BRIGHAM YOUNG

UNIVERSITY

LVES - BUILD RESTROOMS AT CHAMPIONS TERRACE
UNIVERSITY SPECIAL EVENTS

LAVELL EDWARDS STADIUM

SPECIFICATIONS

FACILITIES PLANNING

240 BRWB PROVO, UTAH 84602
PHONE: (801) 422-5504
FAX: (801) 422-0566

BYU WORK ORDER

N4639

DATE OF RECORD: MARCH 28, 2024

CONSTRUCTION DOCUMENTS

BRIGHAM YOUNG UNIVERSITY

STANDARD CONTRACT REQUIREMENTS

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BRIGHAM YOUNG UNIVERSITY

STANDARD CONTRACT REQUIREMENTS

20 March 2024

(Attached is a list of bidders invited to bid.)

Re: Invitation to Bid – LVES Build Restrooms at Champions Terrace University Special Events
W.O. N4639

To Whom It May Concern:

You are invited to bid on the above-referenced project. This project consists of installing partition wall to enclose Champion's Terrace Fan Room. Install men's and women's restrooms inside Champion's Terrace. The completion date for this project is 28 June 2024.

Plans will be available at the mandatory pre-bid which has been scheduled for 28 March 2024 at 3PM in Room 113 BRWB. Bids will be opened and read aloud on 11 April 2024 at 2PM in Room 113 of the Brewster Physical Facilities Building at Brigham Young University. A performance bond and a labor and materials payment bond for 100% of the contract will be required for this project and must be included in your bid.

We hope that you will be able to bid this project.

Sincerely,

Anthony Burdette

ARB/mh
Attachment

NOTICE TO BIDDERS

SECTION l--PROJECT: LVES Build Restrooms at Champion's Terrace University Special Events

WORK ORDER NUMBER: N4639

SECTION 2--LOCATION: Brigham Young University

SECTION 3--OWNER: Brigham Young University

SECTION 4--DESIGNER: Brigham Young University

SECTION 5--STANDARD CONTRACT REQUIREMENTS:

The Bidder is directed to the Brigham Young University Standard Contract Requirements (revised October 2017). This volume is an integral part of the contract documents and is hereby made a part of the contract.

SECTION 6--DATES:

A. Start Date: Time is of the essence

B. Completion Date: 28 June 2024

SECTION 7--PREBID CONFERENCE

A. Prebid Conference will be:

Date: 28 March 2024

Time: 3PM

Place: Room 113, Brewster Building

SECTION 8--RECEIPT AND OPENING OF BIDS:

A. Bids will be received:

Date: 11 April 2024

Time: 2PM

Place: Room 113, Brewster Building

By: Ole M. Smith

B. The Owner reserves the exclusive right to release all publicity relating to the proposals and the project.

SECTION 9--DEPOSIT FOR CONTRACT DOCUMENTS:

A. A deposit of $0.00 will be required for each set of contract documents (plans and specifications) taken.

SECTION 10--GENERAL CONTRACTORS

A. Bidding by General Contractors will be by invitation only.

BRIGHAM YOUNG UNIVERSITY

FORM OF PROPOSAL

NAME OF PROJECT LVES Build Restrooms at Champion's Terrace University Special Events

WORK ORDER NUMBER N4639

NAME OF CONTRACTOR _____

DATE OF PROPOSAL _____

The undersigned, hereinafter referred to as the Bidder, certifies that the following facts and/or circumstances have occurred or exist relating to the proposed work: LVES Build Restrooms at Champion's Terrace University Special Events prepared by _____.

1. That Bidder has received the contract documents for the above entitled project.

2. That Bidder has received Brigham Young University General Conditions Requirements, revised October 26, 2017.

3. That Bidder is familiar with such documents, has examined the site of the proposed work, including availability of access, utilities, and other similar items relating to performance of the work and is thoroughly familiar with all general and local conditions which could in any way affect this work.

4. That no verbal agreements or representations with or by any officer, agent, or employee of the Owner exist or have been made to the Bidder and the Bidder in submitting this proposal is in no way relying thereon.

5. That if this proposal is accepted, Bidder will enter into a contract with the Owner in substantially the form contained in the contract documents, and will provide the bonds, insurance coverage and all other items required by the contract documents.

6. The term "base bid" shall be understood to include all work contained in the contract documents excluding any substitutes or alternates. The Owner will have the right to accept Alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid and Alternates accepted.

Bidder hereby proposes to furnish all materials, labor, equipment, tools, transportation, services, licenses and permits necessary for the completion of all the work set forth in the contract documents for the sum of:

Base Bid* ($)

Alt. #1 - Extend Side Walls to Deck ($)

*Base bid to include the cost of a Performance Bond and a Labor/Materials Payment Bond and Builder's Risk. See General and Supplementary Conditions.

1. The bidder agrees to complete the work on or before 28 June 2024

2. The bidder acknowledges receipt of addenda No.(s)_____

3. The Bidder's Utah contractor's license number is_____

4. Is your bonding capacity adequate for this job? Yes No

5. For verification call_____

6. Telephone number_____

PROPOSED SUBSTITUTE MATERIALS

The total sum of the Bidder's proposal shall include the furnishing and installing of all materials, equipment, and labor as called for in the contract documents as a base bid.

Hereafter give the total amount to be added or deducted for a complete installation of equipment or materials other than those specified and those approved by addendum are submitted for the Owner's consideration. All materials and equipment proposed for substitution shall be listed below and must meet the requirements of the contract documents. During the time of consideration of the proposals, complete information shall be submitted immediately to the Architect and Owner's Representative. The Contractor is referred to Page 3 of the Instructions to Bidders, Section 9, prior approvals and substitutions for requirements relative to proposed substitutions.

Proposed Substitute	Manufacturer and Catalog Numbers	$ Add	$ Deduct

TYPE OF BIDDER'S ORGANIZATION:

Official Name of Organization

Corporation, Co-partnership, Individual, or Other

Address

Name of individual Members of Firm:

Name of President of Corporation:

Name of Secretary of Corporation:

Corporation is organized under the laws of the State of:

Signature

( )
)Seal(
( )

Title or Office

Legal Address

BIDDER'S LIST OF SUBCONTRACT BIDS USED IN PROPOSAL

(LIST OF SUBCONTRACTORS)

PROJECT NAME LVES Build Restrooms at Champion's Terrace University Special Events

WORK ORDER NUMBER N4639

OWNER'S NAME Brigham Young University

DIVISION	SUBCONTRACT CLASSIFICATIONS	SUBCONTRACTOR USED	AMOUNT

INSTRUCTIONS TO BIDDERS

SECTION 1 -- BIDDING BY INVITATION

A. Bidding shall be by written invitation only. Those wanting to be considered for such invitation shall apply to:

Assistant Administration Vice President
Physical Facilities
202 Brewster Building
Provo, UT 84602

B. The Owner reserves the right to accept or reject any or all bids.

SECTION 2 -- CONTRACT DOCUMENTS

A. The Contract documents may be obtained by contractors from:

Construction Department
Physical Plant
240 Brewster Building
Provo, UT 84602

B. Subcontractors and suppliers who want to obtain Contract documents (plans and specifications) may do so by requesting the documents and paying the printing costs.

C. All Contract documents must be returned within ten (10) days after the bid opening, or the deposit will be forfeited. Those documents purchased outright by the Bidders are exempted.

D. The Contract documents (plans and specifications) may be deposited with local Bid Depositories. Bidders may contact the Invited General Contractors for locations. The Contract documents may be examined free at:

Construction Department
Physical Plant
240 Brewster Building
Provo, UT 84602

SECTION 3 -- CONTRACT METHOD

A. All work specified is to be done under one general contract. Bids will be accepted by the Owner from prime contractors only.

SECTION 4 -- INTERPRETATION OF CONTRACT DOCUMENTS

A. If any Bidder doubts the true meaning of any of the Contract documents, or finds errors, discrepancies or omissions, he shall request a clarification from the Architect in writing. Any interpretations or corrections will be made only by written addenda duly issued by the Owner. All addenda will be mailed, faxed or otherwise delivered to each person receiving a set of the Contract documents. Requests for clarifications must be submitted to the Architect at least five (5) days before bid opening. Unwritten instructions or interpretations will have no validity.

B. Should discrepancies appear in the Contract documents that are not resolved by an addendum, it is expressly understood that the Contractor has used the most expensive method and/or material in the bid.

SECTION 5 -- REQUIREMENTS BEFORE SUBMITTING BIDS

A. The Contractor shall become thoroughly familiar with the site and structures located there (if any). The Contractor shall thoroughly examine all Contract documents in relation to all conditions that might directly or indirectly affect the contract work. The bid amount shall reflect all such conditions.

SECTION 6 -- PREPARING AND SUBMITTING BIDS

A. To receive consideration, a bid must be made according to the following instructions:

1. Bids shall be prepared on BYU bid forms.
2. Bids shall have all items or blanks filled. Numbers shall be stated both in writing and in figures. If there is a discrepancy between the two, the written number shall govern.
3. Bids shall be without interlineations, alterations or erasures.
4. Signatures shall be by those authorized to execute the Contract.
5. The Bidder's legal name, business address and telephone number shall be stated.
6. Neither oral bids nor modifications shall be considered.
7. You may email your bid to the Construction Department Secretary, but it is not official until it is printed, inserted into an envelope, and delivered to the designated person opening the bids prior to the appointed bid opening time. It is suggested that the bidder call in advance to make these arrangements. We do not accept responsibility for email, printing, delivery, or other problems.
8. It is the Bidder's sole responsibility to see that the bid is received at the proper time. Any bid received after the scheduled bid opening time will be returned unopened to the Bidder.
9. Bidders shall accept proposals from only those subcontractors who are approved by the Owner or those who have shown to the Bidder's satisfaction that they are financially capable of handling the work. Furthermore, subcontractors must have the technical ability, personnel, plant, experience and reputation to carry out their portions of the work. It will be assumed that the question of bonding subcontractors, where considered desirable or necessary by the Contractor, including the cost of such bonds, has been resolved before bids have been submitted.
10. In order for the bid to be considered valid, two or more Bidders bidding as a "joint venture" must have the written approval of the Owner before submitting a bid. All members of a joint venture shall sign the bid and an official representative of the joint venture shall be designated in the proposal.
11. The term "base bid" shall be understood to include all work contained in the Contract, excluding any alternates or substitutes. The Owner shall have the right to accept alternates in any order or combination, and to determine the low Bidder based on the sum of the base bid and alternates accepted.
12. Substitutes or alternates accepted by the Owner may be included in the Contract or added by Change Order. In determining the low Bidder, the Owner will not consider substitutes.
13. Bids may be withdrawn by the Bidder, either in person or by a written request before bid opening. Once opened, the Bidders will have 24 hours to review and withdraw their bids. After the 24-hour period, the bids may not be withdrawn and must remain fixed as submitted for 45 days after opening. Envelopes must contain nothing but the proposal and bid breakdown forms if required. Envelopes shall be opaque, sealed and bear the Bidder's name.

SECTION 7 -- APPROVAL OF CONTRACTORS AND SUBCONTRACTORS

A. As soon after the bid opening as is practicable, the Owner will interview the apparent low Bidder and if deemed advisable, the second or third low Bidders. Within two hours of the bid opening, the low Bidder and the second or third low Bidders will provide to the Owner a list of subcontractors and their dollar amounts that were used in formulating their bid. The list of subcontractors will be examined by the Owner as soon as possible. The Owner reserves the right to accept or reject any subcontract proposal.

B. Provide Unit Prices within 24 hours of Bid Opening if requested in Form of Proposal.

C. If a Bidder doubts the correctness or acceptability of any subcontract proposal, the Bidder may submit the names and amount of other competing subcontractors for consideration, making sure that he clearly states which one he has used in formulating his proposal.

SECTION 8 -- FACTORS AFFECTING AWARD OR REJECTION OF BID

A. The Bidder's and subcontractor's past performance, organization, equipment and ability to perform and complete their contract as specified will be vital elements, as well as the amount of their bids, in the award of the Contract.

B. The Owner reserves the right to reject any or all bids, or to waive any irregularities or informalities in bids received. The

Owner reserves the right to accept the bid that will, in the Owner's opinion, best serve the interests of the Owner.

C. If a schedule is requested on form of proposal - The Owner reserves the right to reject a bid that provides a date that is past the requested substantial completion. Further, the Owner reserves the right to award the project based on proposed substantial completion regardless of whether such bid is the lowest.

SECTION 9 -- PRIOR APPROVALS AND SUBSTITUTIONS

A. Several acceptable brands of equipment, manufactured articles or methods of construction may have been identified in the Contract. It is not intended to close the Contract against other brands, articles, or methods that may warrant consideration. However, unspecified materials must have prior approval by the Owner to be considered.

B. Prior Approvals: Requests for approval of unspecified materials must be made to the Architect at least five days before bid opening. The requests for prior approval shall be considered by the Architect if time permits and if properly documented. The Architect is not bound to consider these items despite their apparent validity.

C. Fully detailed technical data, references and other information shall be furnished simultaneously with the requests for prior approval items.

D. Such requests shall be reviewed by the Architect and the Owner. If accepted, the approved requests will be included in an addendum.

E. The Contractor's "base bid" shall include the furnishing of only those items that are explicitly specified or which have received prior approval by addendum.

F. Substitutions: Besides the "base bid," any equipment or material supplier and any contractor or subcontractor may, at his option, submit a substitute price and product for any item specified which he feels warrants consideration by the Owner. This proposed substitution is to be listed where indicated on the bid form.

G. Any proposed substitute submitted by a Bidder shall include the amount by which the "base bid" would be increased or decreased.

H. The Owner may accept or reject any substitute proposed. In determining the low Bidder, the Owner will not consider substitutes.

I. If requested, the Contractor shall furnish information or data concerning the substitute. The Owner may request the Contractor, at his own expense, to have the substitute tested by an approved testing laboratory.

SECTION 10 -- FORM OF CONTRACT

A. Copies of the form of the Contract that the successful Bidder will be required to execute are included in this specification.

SECTION 11 -- ADDENDA

A. All addenda issued before bid opening shall be included in the bid and shall be a part of the Contract.

SECTION 12 -- REQUIREMENTS IMMEDIATELY AFTER SIGNING THE CONTRACT

A. Immediately after signing the Contract, the Contractor shall furnish the following to the Owner:
   1. Executed performance, labor and material payment bonds, each in an amount equal to 100 percent of the contract sum as specified in the General Conditions.
   2. Insurance certificates as specified in the General Conditions.
   3. A cost breakdown of the work that may, as approved by the Owner, serve as a basis for making monthly payments to the Contractor.
   4. A project schedule as to how he intends to construct the project. This must be, in the opinion of the Owner, a realistic method of analyzing and scheduling each component of the work. It must show when all trades or crafts start and finish their work. This schedule must be reviewed weekly in the OAC meeting and updated as

required. A critical path method of scheduling is preferred. If the Contractor cannot produce and maintain such a schedule, this service must be obtained from an outside consultant. The schedule must be approved by the Owner's Representative before the Contractor submits the first payment request.

B. The Contractor shall issue subcontracts as mutually agreed between the Owner and the Contractor. A complete list of subcontractors and major suppliers including names, addresses and telephone numbers are required within fourteen (14) days of the Owner=s subcontractor review.

SECTION 13 -- DISQUALIFICATION

A. If the above requirements are not satisfied, the bid may be disqualified at the discretion of the Owner.

CONTRACT

Project Name

AT

BRIGHAM YOUNG UNIVERSITY

LONG FORM CONTRACT NO.
Project No.:
(Work Order No.:)

THIS CONTRACT, made and executed as of the day day of month, year, by and between BRIGHAM YOUNG UNIVERSITY, a non-profit Utah corporation of Provo, Utah (hereinafter referred to as "Owner"), and Contractor Name (hereinafter referred to as "Contractor").

WITNESSETH:

That for and in consideration of the payments hereinafter specified to be paid by the Owner to the Contractor and the covenants and agreement herein contained to be kept and performed by the parties hereto, the Contractor agrees to build and construct the proposed Project Name at Brigham Young University in Provo, Utah (hereinafter referred to as the "Project") and to furnish and deliver all materials, and perform and supervise all services (hereinafter, the “Work”) as required herein and by the contract documents hereinafter identified, all of which shall collectively constitute the contract, and shall hereinafter be referred to collectively as the "Contract".

ARTICLE I. THE IDENTIFICATION OF CONTRACT DOCUMENTS

A. The Plans entitled "Name on plans" were prepared by Brigham Young University, reviewed by Richard or Ray or whomever, Title of Reviewer, and approved by Ole Smith, Assistant Administration Vice-President of Brigham Young University, on date.

B. The Specifications entitled "Name on Specs" were prepared by Brigham Young University, reviewed by Richard or Ray or whomever, Title of Reviewer, and approved by Ole Smith, Assistant Administration Vice-President of Brigham Young University, on date.

C. Addendum Number One, dated Month Day, Year.

D. Addendum Number Two, dated .

E. The Brigham Young University General Conditions are a part of this Contract.

ARTICLE II. THE CONTRACT SUM

The Owner agrees to pay to the Contractor, in accordance with the terms hereof, the following:

Base Bid	$
Total	**$**

The Contractor agrees to accept a total of written dollar amount (check instructions for guidelines) Dollars ($) as full compensation for performing his obligation under the contract.

ARTICLE III. DATE OF COMPLETION

The Contractor agrees to complete the work required by the Contract on or before midnight, date (Month Day, Year). Time is hereby expressly declared to be of the essence of the Contract.

ARTICLE IV. THE CONTRACTOR'S REPRESENTATIVE

The Contractor's Representative is Name of the Contractor.

ARTICLE V. THE OWNER'S REPRESENTATIVE

The Owner's Representative is Ole M. Smith.

IN WITNESS WHEREOF, the Owner has caused this instrument to be signed by its President, attested by its Secretary, and its corporate seal to be hereunto affixed, and the Contractor has hereunto affixed his signature as of the day and year above written.

ACKNOWLEDGED: BRIGHAM YOUNG UNIVERSITY	CONTRACTOR
Ole M. Smith Assistant Administration Vice President	contractor rep contractor company
Steve Hafen Administration Vice President	Date
Shane Reese President	

BRIGHAM YOUNG UNIVERSITY

(Tax Exempt No. 11691946-003-STC)

SALES TAX EXEMPTION CERTIFICATE

In Lieu of Form TC-721

TO: contractor name _____

Pursuant to Utah State Tax Commission Rule R865-19S-58, Brigham Young University is exempt from sales/use tax on purchases of all Construction Materials (as defined by the above Rule). You and your subcontractors are hereby authorized to purchase Construction Materials free of Utah sales tax for the Project listed below pursuant to the agreement between you and Brigham Young University dated _____.

PROJECT: _____

OWNER'S REPRESENTATIVE: _____

Assistant Administration Vice-President Date
202 BRWB, Provo, UT 84602-8100
(801) 422-5500

CONTRACTOR'S (OR SUB'S) AFFIDAVIT

TO (Name of Vendor): _____

I certify that the purchases of Construction Materials from the Vendor above are made in behalf of Brigham Young University for the above referenced Project *only*. I further certify that the Construction Materials purchased will be installed or converted into real property owned by Brigham Young University.

NAME OF CONTRACTOR/SUB: _____

Street Address: _____ **Phone:** _____
Address City State/Zip

By: _____ **Title:** _____ _____
Authorized Representative Position or Job Title Date

NOTE: Vendor must keep this certificate on file for audit review. Contractor or Sub must keep a copy of this certificate on file and must notify vendors of cancellation, modification, or limitation of the exemption claimed. Contractor or Sub is liable for sales tax on any Construction Materials purchased which are not used on the Project above or which do not otherwise qualify for exemption.

GENERAL CONDITIONS

SECTION 1 - DEFINITIONS

A. OWNER - Brigham Young University, Provo, UT, referred to as the "Owner."

B. OWNER'S REPRESENTATIVE - The Assistant Administration Vice President - Physical Facilities, 202 Brewster Building, Brigham Young University, Provo, UT 84602.

C. ARCHITECT - The Architect is a licensed architect, engineer, or organization so designated in the Contract. The term "Architect" means the Architect or his authorized representative.

D. CONTRACTOR - The Contractor is the person or organization identified as such in the Contract and referred to throughout the Contract as if singular in number and masculine in gender. The term "Contractor" means General Contractor or his authorized representative.

E. SUBCONTRACTOR - The person, firm or corporation supplying direct or indirect labor and/or materials at the site of the Project and under separate contract or agreement with the Contractor.

F. PROJECT MANAGER - The BYU personnel who acts as liaison between the Owner and the Contractor for the Project. [CITY INSPECTOR ISSUE]

G. THE WORK - The work includes all labor necessary to produce the construction, demolition, or other delivery of goods and services required by the Contract and all materials and equipment incorporated or to be incorporated in such work.

H. THE PROJECT - The Project is the total construction designed by the Architect. The Work performed under the Contract may be the whole or a part of the work required to be performed under the Project.

I. WRITTEN NOTICE - Written notice shall have been duly served if delivered in person to the Project Manager or the Contractor's designated representative. Written notice is also served by a registered or certified mailing to the last known address of the corporation, if delivered to the direction of the Project Manager or the Contractor's designated representative.

J. CONTRACT - The Contract consists of the Brigham Young University short or long form contract; the Instructions to Bidders; the Supplementary Conditions; the General Conditions; the Drawings; the Specifications; Addenda; and Change Orders describing the Work and signed or acknowledged between the Owner and Contractor.

SECTION 2 - THE CONTRACT DOCUMENTS

A. The Contract represents the entire agreement between the parties and supersedes all prior negotiations, representations or agreements, either written or oral, including the bidding documents. After written execution of the Contract, the Contract shall be amended or modified only by a Change Order.

B. Words that have well-known technical or trade meanings are used herein by such recognized meanings.

C. Within the Contract there shall be the following order of precedence, (1) being the highest precedent:
   1. The BYU Short Form or Long Form Contract takes precedence over all other documents.
   2. Supplementary General Conditions take precedence over General Conditions.
   3. General Conditions take precedence over Drawings and Specifications.
   4. Addenda or modifications of any nature, to the Drawings and Specifications, take precedence over the original.

5. Specifications take precedence over Drawings.
6. Within the Working Drawings, the larger scale takes precedence over smaller, figured dimensions over scaled and noted materials over graphic indications.

SECTION 3 - DISCREPANCIES IN THE CONTRACT

A. Should any question arise regarding the Contract, the Contractor shall request written interpretation and clarification from the Architect before proceeding. Without such request and written authorization, the Contractor proceeds at his own risk.

SECTION 4 - ADDITIONAL DRAWINGS & INSTRUCTIONS

A. The Architect shall promptly furnish any additional instructions or clarification necessary for proper execution of the Work specified in the Contract.

SECTION 5 - OWNERSHIP AND MAINTENANCE OF DRAWINGS

A. All drawings and specifications furnished to the Contractor, including electronic file versions, are the property of the Owner. They are not to be used on other work and must be returned to the Owner if so requested. One copy may be retained by the Contractor, but may not be used for any third-party work without the express written consent of the Owner.

B. The Owner shall furnish, free of charge to the Contractor, all copies of drawings and specifications reasonably necessary for the execution of the Work. The Contractor shall maintain in good order on the Project one copy of drawings, addenda and specifications that shall be readily available to the Architect and the Project Manager.

SECTION 6 - PROGRESS MEETINGS

A. Contractor shall be required to attend weekly Owner, Architect, and Contractor (OAC) meetings. The agenda and meeting minutes will be prepared by the Architect. The Architect shall distribute meeting minutes within seven days of the meeting. The Contractor shall attend such meetings and shall require subcontractors to attend as necessary. These meetings are to:
    1. Insure that all activities are being coordinated properly on the Project.
    2. Review the schedule.
    3. Check the status of:
        a. Submittals, including shop drawings and samples.
        b. Change Orders and Proposal Requests.
        c. Payment requests.
        d. Any other matters that may need to be reviewed.

SECTION 7 - PROJECT SCHEDULE

A. Before the first payment request, the Contractor shall prepare and submit for review an estimated Project schedule for the Work. The Project schedule shall be in sufficient detail to include, but not be limited to:
    1. Significant elements of the Work.
    2. Period for each element of Work with a beginning and ending date.
    3. Percentage of progress of Work completed or to be completed in a monthly period.
    4. Early start anticipated schedule of all Owner Provided/Contractor Installed (OP/CI) mechanical controls.

B. The Project schedule shall be updated monthly and submitted with each payment request and shall show the original Project schedule or revised Project schedule, one entry for each item of work, as follows:
    1. All Work already completed and paid for by Owner.

2. Work during current period for which payment is being requested.
3. Remaining Work to be done, itemized in the Schedule of Values.

SECTION 8 - EMERGENCIES

A. In case of an emergency endangering life or threatening the safety of the structure or of adjoining property, the Contractor may, without waiting for specific authorization from the Architect or Owner, act at his own discretion to safeguard life or property. Compensation and time shall be allowed the Contractor for such emergency work. The amount of both shall be decided between the Contractor, the Architect, and the Owner.

B. The Contractor shall notify the Project Manager immediately and shall make a full written report of such emergency action to the Project Coordinator within seven days of the event.

SECTION 9 - SUBMITTALS, SHOP DRAWINGS, AND SAMPLES

A. General:
1. The Contractor shall deliver submittals, shop drawings or samples to the Owner and Architect as indicated below. Furthermore, the Contractor shall accompany each submittal with a transmittal letter indicating the title of the Project, the name of the Contractor, the title of the submittal and the specification section number.

B. Submittal Schedule:
1. The Contractor shall, within twenty-one (21) calendar days after receipt of the signed contract, furnish a submittal schedule listing all items that the Contract requires for review. This schedule shall include shop drawings, manufacturers' literature, certificates of compliance, material samples, material colors, guarantees, etc.
2. The schedule shall show the type of item, the Contract requirement reference, the Contractor's scheduled dates for submitting the items and the projected need dates for review by the Architect. The schedule shall show a minimum of fourteen (14) calendar days for review by the Architect. If resubmittal is required, an additional seven (7) days will be allowed. The Contractor shall revise and update this schedule as appropriate and submit it with each payment request until all items have been submitted and reviewed.
3. The Contractor shall coordinate the submittal schedule with the Project schedule for all the work. The Contractor shall revise and update the submittal schedule to insure consistency with the Project schedule. The Contractor shall promptly provide such revised submittal schedules to the Owner.
4. Furnishing of the submittal schedule or subsequent revisions shall not be interpreted as relieving the Contractor of the obligation to comply with all Contract requirements for items on the schedule.

C. Definitions:
1. Shop drawings are drawings, diagrams, illustrations, electronic files, schedules, performance charts, brochures and other data prepared by the Contractor or subcontractor, manufacturer, supplier, or distributor. Shop drawings illustrate some portion of the work and confirm dimensions and conformance to the Contract.
2. Samples are physical examples furnished by the Contractor to illustrate materials, equipment, color, or construction and to help establish standards by which the work will be judged.

D. Procedure:
1. The Contractor shall review and stamp his certification that the products and methods meet the requirements specified in the Contract. The Contractor shall submit one (1) electronic copy of shop drawings to the Architect and one (1) electronic copy to the Owner, with reasonable promptness and in orderly sequence. Shop drawings and samples not required by the Contract

but requested by the Contractor, or supplied by those under contract to him, need not be submitted to the Architect and Owner for approval. These shop drawings shall meet all specified shop drawing requirements, except those relating to submission to the Architect and Owner.

2. The Contractor shall reject shop drawings not in conformance with the Contract.
3. Shop drawings shall be complete and detailed. If reviewed by the Architect, each copy of the shop drawings shall be stamped and dated by the Architect. If review "with exception" or "as noted" by the Architect is so identified, stamped and dated, the Contractor shall comply with notations shown. If the Architect requires resubmission of submittals, the Contractor shall make any corrections at the Contractor's expense. The Contractor shall not copy Project drawings and use those drawings as submittals.
    a. Any shop drawing which does not conform to the Contract shall be explicitly noted on the drawings and in the transmittal letter. This shall not be construed as approval to proceed with performing or providing the changed work until specifically approved by the Owner and a Change Order accordingly issued. If shop drawings show variations from Contract requirements because of standard shop practice, or for any other reason, such variations shall be explicitly noted in the transmittal letter. Shop drawing review shall be general. It shall not relieve the Contractor of responsibility for accuracy of such shop drawings, nor for proper fitting, construction of work, furnishing of materials or work required by Contract and not shown on shop drawings.
    b. All transmittal of shop drawings may be by email or other electronic means.

E. By approving shop drawings and samples, the Contractor determines and certifies that all field measurements, field construction criteria, materials, catalog numbers and similar data conform to the Contract. The Contractor determines and certifies that he has checked and coordinated each shop drawing and sample with requirements of the Contract.

F. No work requiring a shop drawing or sample submission shall be commenced until submission has been approved in writing by the Architect.

G. Samples:
1. Where specified or required, the Contractor shall submit samples to the Architect with specification material, affidavits, and other documentation as required by the Architect or the Owner.
2. It is the Contractor's specific responsibility to ascertain that samples have been checked and approved before being submitted.
3. Cost of samples, including transportation, delivery and any other costs, shall be paid by the Contractor. Unless specified otherwise, samples shall be submitted in triplicate for the Architect, the Owner and the Contractor. The Contractor shall keep his samples on the jobsite. Where samples are specifically required to be submitted for approval, no work involving the sampled materials shall proceed until written approval has been obtained from the Architect.

H. Review by the Architect and the Owner:
1. Review of shop drawings by the Architect and the Owner shall not be construed as a complete check, but will show only that the general method of construction and detailing is satisfactory. Review of such drawings will not relieve the Contractor of responsibility for any error that may exist in the submittals.

SECTION 10 - ROYALTIES & PATENTS

A. The Contractor shall pay all royalties and license fees. The Contractor shall defend and hold the Owner harmless from all suits or claims for infringement of any patent rights.

SECTION 11 - CONTRACTOR'S LIABILITY INSURANCE AND BONDS

A. Insurance:

1. The Contractor shall not commence work under this Contract until he has obtained the insurance required and evidence of such insurance has been submitted to and approved by the Owner. The submittal of said evidence to the Owner shall not relieve or decrease the liability of the contractor.
    a. Workers' Compensation & Employers' Liability Insurance as required by statute.
    b. Commercial General Liability Insurance – the current version of ISO Form CG 00 01 or equivalent, Occurrence Policy, with -
        (1) Limits of not less than -

(a)	General Aggregate	$ 2,000,000.00
(b)	Products - Comp/OPS Aggregate	$ 2,000,000.00
(c)	Personal and Advertising Injury	$ 1,000,000.00
(d)	Each Occurrence	$ 1,000,000.00
(e)	Fire Damage (any one fire)	$ 50,000.00
(f)	Medical Expense (any one person)	$ 5,000.00

        (2) Endorsements attached thereto including the following or their equivalent -
            (a) The current version of ISO Form CG 25 03, Amendment of Limits of Insurance (Designated Project or Premises), describing the subject Contract and specifying the limits as shown above.
            (b) The current version of ISO Form CG 20 10, Additional Insured -- Owners, Lessees, or Contractors (Form B), naming the Owner as an additional insured and containing the following statement - "This endorsement also constitutes primary coverage in the event of any occurrence, claim, or suit."
    c. Automobile Liability Insurance, with -
        (1) Limits of not less than $1,000,000.00 Combined Single Limit per accident.
        (2) Coverage applying to any auto.

B. Certificate of Insurance, on the current version of ACORD 25-S Form, or equivalent, filed with the Owner identifying:
    1. Owner, as defined in the Construction Contract, as Certificate Holder and Additional Insured.
    2. Endorsements, as listed above. (Note: If forms other than ISO forms are used, copies of the non-ISO forms are to be attached to this certificate).
    3. Project as defined in the Construction Contract.
    4. Cancellation clause of the certificate amended to read, "Should any of the above described policies be canceled before the expiration thereof, the issuing company will mail a notice within thirty (30) days to the certificate holder named."
    5. Insurance companies providing coverage - All companies listed must be rated "A-" or better in the Standard and Poor's Solvency Review Guide Property & Casualty (current edition.)
    6. The Name, Address, and Telephone Number of The "Producer" - The certificate is to bear an original signature of the Authorized Representative of the Producer. Facsimile or mechanically reproduced signatures will not be accepted.

C. Performance Bond and Labor & Material Payment Bond:
    1. The Contractor shall furnish the Owner a performance bond, and a labor and a material payment bond each in an amount equal to 100 percent of the Contract amount as security for all obligations arising under the Contract. Such bonds shall –
        a. Be written on Form AIA Document A312. Where the laws of the state in which the project is located mandate a statutory payment bond form, such mandated payment bond form shall be used but is to be accompanied by the AIA Document A312 Performance Bond.
        b. Be issued by a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under applicable federal insurance law as acceptable sureties or reinsurance companies on federal bonds. The penal sum

obligation assumed by each surety, shall not exceed the maximum amount permitted by law.

c. Be accompanied by a certified copy of the Power of Attorney stating the authority of the Attorney-in-fact executing the bonds on behalf of the Surety.

D. The Owner reserves the right to reject any insurance company, policy, endorsement, certificate of insurance, surety company, performance bond, or labor and material payment bond with or without cause.

E. The cost of such insurance and such bonds as required above shall be the obligation of the Contractor.

SECTION 12 - HOLD HARMLESS AGREEMENT

A. Besides obtaining insurance coverage as required above, the Contractor shall indemnify and save the Owner, the Architect, and their agents and employees harmless from and against any liability, demands, causes of action or claims thereof, whether well founded or otherwise, including the cost of defending the same, for bodily injury to any person whosoever (including the employees of the Owner or the Architect) or damage to property of any person during construction because of the negligence of the Contractor, their subcontractors or material suppliers, their agents or employees.

B. The Contractor shall defend the Owner and Architect in any lawsuit filed by any of their subcontractors or material suppliers. Where liens have been filed against the Owner's property, this shall require the Contractor or his bonding company to obtain lien releases and record them in the appropriate county or local jurisdiction so as to unencumber and provide the Owner with a title free and clear from any liens.

C. No subcontract shall relieve the Contractor of any of his liability or obligation under the Contract. The Contractor agrees that he is fully responsible to the Owner for acts or omissions of his subcontractors and their material suppliers and of persons either directly or indirectly employed by them.

SECTION 13 - BUILDERS RISK LOSSES

A. The Owner will provide Builder's Risk Insurance or reimburse the Contractor for losses to the Project, described herein, to the extent to which such losses are or would be covered by the Owner's Policy Form of F.M. Global's "All Risk" insurance policy covering Builders Risk Insurance. 1. Deductible Clause - All claims for loss or expense arising out of one occurrence shall be adjusted as one claim, and from the amount of such adjusted claim, there shall be deducted the sum of:

a. $2,500.00 on all Projects. The deductible amount is the responsibility of the Contractor or Subcontractor.

2. Loss Reporting Procedure - All losses requiring reimbursement under this Section shall be reported to the Project Coordinator as soon as practical and always before the beginning of repairs so that details of the loss can be obtained and verified to simplify a prompt loss adjustment.

B. Copies of the insurance forms are available from the Owner at the Brigham Young University Physical Facilities, Construction Section offices.

SECTION 14 - PERMITS, INSPECTIONS, CERTIFICATES, AND REGULATIONS

A. Permits:

1. The Contractor shall obtain, and the Owner shall pay cost of, permits necessary for completion of this work. "Permits," as used in this paragraph includes any permits necessary for the Contractor to complete the Work, including but not limited to: excavation, footing, and foundation permits; building permits; hot work permits; elevator permits; fire sprinkler permits; boiler permits; demolition permits; specialty permits from the State of Utah or other federal or state

governmental entities, such as Health Department permits; etc. The responsibility for obtaining, and any resulting liability for failing to obtain, such permits shall rest with the Contractor.

2. The Contractor shall schedule and coordinate all necessary inspections and shall notify the Project Manager and the Authority Having Jurisdiction of all inspections. The Contractor shall be responsible for securing a certificate of occupancy that may be required by Authorities Having Jurisdiction over the Work. The Contractor shall deliver these certificates to the Project Manager before execution of the Certificate of Substantial Completion.
3. The Contractor will be required to notify the Utah Division of Air Quality of any demolition projects and obtain all permits required by the State, County, and/or Provo City. The Contractor shall include all demolition permit fees in his bid.
4. The Contractor shall hold harmless, defend, and indemnify Owner from and against any and all claims, demands, allegations, fines, and damages associated with or arising from the Contractor's failure to obtain required permits.

B. Regulations:

1. The Contractor and others working under his jurisdiction, supervision, or control shall do all work according to laws, regulations, and ordinances required by governmental authority or other agencies having jurisdiction over this work.
2. If the Contractor observes that the Contract is in variance with any laws, regulations or ordinances, he shall notify the Project Manager and shall not proceed unless necessary changes required for compliance with said laws, regulations and ordinances have been made as provided in the General Conditions, Section 24. The Contractor shall be fully responsible for any work knowingly done contrary to laws, regulations and ordinances. The Contractor shall fully indemnify the Owner against loss and bear all costs and penalties arising from those violations.
3. The Contractor shall hold harmless, defend, and indemnify Owner from and against any and all claims, demands, allegations, fines, and damages associated with or arising from the Contractor's failure to follow applicable regulations.

SECTION 15 - MEASUREMENTS, SURVEYS, BUILDING LAYOUT & SITE EXAMINATION

A. The Contractor shall be responsible for:

1. Establishing lot lines and bench marks.
2. Laying out the work on the building site.
3. The proper observance of property lines and set back requirements.
4. The location and layout of buildings as noted in the drawings with respect to the position on the property and elevation in relation to the grade.

B. If existing conditions shown in the Contract documents differ materially from those the Contractor encounters in the performance of the work, the Contractor shall immediately notify the Architect and the Owner in writing.

C. The Architect and the Owner shall promptly investigate the reported conditions. If they find that such conditions do materially differ and cause an increase or decrease in the Contractor's cost or the time required for performance of any part of the work, the Owner shall make an equitable adjustment by Change Order.

D. As the work progresses, the Contractor shall lay out on the forms, or floors, the exact locations of all partitions as a guide to all trades. Subcontractors providing work that is to be placed in connection with walls and/or partitions shall check such locations and immediately notify the Contractor of any conflicts in structure or changes necessary to adapt services, utility lines or equipment required by the Contract. Subcontractors and others failing to make such checks and give notice as outlined above shall be required to assume any costs resulting from their failure to do so.

E. Before ordering materials or doing work, the Contractor shall verify all measurements to properly size or fit

the work. No extra charge or compensation will be allowed by the Owner resulting from the Contractor's failure to comply with this requirement.

SECTION 16 - INSPECTION OF WORK

A. The Architect, Owner, and other inspectors or government officials as appropriate shall always have full access to all phases of the work. The Contractor shall provide adequate means to simplify inspection.

1. The Contractor shall notify the Project Manager and local authorities twenty-four (24) hours before doing work that covers or otherwise makes it difficult to inspect structural, plumbing, mechanical, electrical, or other work.
2. Should any of the work be covered before it is inspected by Project Manager and local authorities, the Contractor shall uncover that work for inspection at his own expense.
3. The Contractor shall schedule the work so an inspection team may inspect the mechanical, electrical, and plumbing work before it is covered up. This inspection team will furnish a list of items that must be completed before the work is concealed.

SECTION 17 - SUPERVISION & CONSTRUCTION PROCEDURES

A. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the work under the Contract. The Contractor shall not change project managers or superintendents without the written consent of the Owner.

SECTION 18 - ARCHITECT'S STATUS AND DECISIONS

A. The Architect shall assist the Project Manager during the construction period.

1. The Architect will make frequent visits to the site to familiarize himself with the progress and quality of the work and to determine if the work is proceeding according to the Contract and schedule. During periodic visits the Architect may condemn work that fails to conform to the Contract.
2. The Architect shall interpret the conditions of the Contract and be the judge of its performance. He shall use his powers under the Contract to enforce its faithful performance by the Contractor. The Architect will review shop drawings and prepare Proposal Requests. The Architect will conduct inspections with the Project Manager to determine the dates of substantial completion and final completion.
3. In general, the Architect shall work with and coordinate with the Project Manager and the Contractor for the accomplishment of the Work. However, in the event that the Architect and Project Manager disagree on how a work should be accomplished, the Contractor shall take final direction from the Project Manager.
4. Neither the Owner nor the Architect will be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs concerning the Work. Neither the Owner nor the Architect will be responsible for failure of the Contractor, subcontractor, material supplier or their employees to carry out the Work according to the Contract.

SECTION 19 - MATERIAL & EQUIPMENT

A. DELIVERY, STORAGE, & HANDLING

1. Materials shall be delivered to the site in original packaging with labels and trademarks intact, and such labels and trademarks shall remain intact until used. Structural steel, piping and fittings shall be manufactured in the United States of America.
2. The Contractor shall confine his apparatus, storage of materials, and operations of his workers to limits indicated by law, ordinances and permits. The Contractor shall arrange and maintain storage of materials within contract limit lines in an orderly manner leaving all walks, driveways, roads and entrances unencumbered. The Contractor and the Contractor’s employees shall park

only in the areas designated by Owner.

3. All new and existing equipment on the site shall be protected from physical damage and from the elements by measures satisfactory to the Architect and the Project Coordinator. All rotating equipment shall be rotated four turns weekly during construction.
4. If any material is found not conforming to the Contract, the Contractor shall remove such nonconforming materials at his expense.

B. PRODUCT OPTIONS & SUBSTITUTIONS

1. When several materials are specified in the Contract by name for one use, the Contractor may select any one of those so specified. The mixing of different products specified by name for one use is prohibited.
2. Items and material not specified in the Contract shall be removed and replaced by specified items and material at no additional cost to the Owner. No additional time will be added to the Contract for removal or replacement.
3. Wherever words "approved by," "satisfactory to," "submitted to," "inspected by," or similar phrases are used in this specification, they shall be understood to mean that the material or item referred to shall be approved by, be satisfactory to, submitted to, or inspected by the Architect and the Project Manager.

SECTION 20 - TEMPORARY CONSTRUCTION FACILITIES

A. TEMPORARY ELECTRICITY

1. The Contractor shall arrange with the proper authority (State, County, City, Owner, etc.) for all power required by the Contractor during the construction period until the Certificate of Substantial Completion is issued. If the power is coming from a BYU owned source, it will be paid for by BYU with the exception of the installation cost of equipment, conduit, wire, etc. BYU may provide transformer(s) and meter(s) at their discretion. Contractor to coordinate with BYU Construction Project Manager prior to bid. If no coordination takes place prior to bid, contractor is to provide transformer and meter at no additional cost to the owner after bid. Contractor shall bare the cost of any damages to owner provided equipment due to contractor's negligence. The method of metering, connections, etc., must have the written approval of the authority furnishing the utility to the Contractor. The Contractor shall be responsible for all utilities needed for his use during the entire construction period.
2. The Contractor shall provide all temporary wiring, outlets, metering (if the source of power is other than a BYU source), and associated materials. The temporary electrical system shall comply with local codes and the current, adopted version of the National Electrical Code.
3. The Contractor shall provide electrical power to distribution centers only.
4. If utility service is available from the Owner's permanent utilities, the Contractor may, by arranging with the Owner, use these permanent utilities. The Owner assumes no responsibility for damage caused by the Contractor using any of the Owner's utilities due to interruption of services by the Owner, whatever the cause.

5 The contractor may not use BYU provided power for welding equipment or other major equipment without written approval of BYU. Anything needing power other than for small tools, temporary lighting and project start up and function of permanent equipment (for example: elevator and mechanical equipment) shall be approved in writing by the BYU project Manager.

B. TEMPORARY LIGHTING

1. The Contractor shall provide wiring, outlets and fixtures for temporary lighting.
2. The Contractor shall provide pigtails and other lights for all areas within and around the building, sufficient to meet OSHA regulations, or to provide the following intensities, whichever is greater:

a. All working areas	3 foot candles
b. Stairs, landings, ramps	5 foot candles
c. Outdoor floodlighting within contract limit lines	3 foot candles
d. All areas involving finish work	30 foot candles

C. TEMPORARY HEATING, COOLING & VENTILATING

1. All temporary heating and cooling shall be arranged and paid for by the Contractor. Heating and cooling from the central plant will be charged at $12.00 per million BTUs, if available and payable monthly to the Owner. BYU will provide the meter and contractor will install.
2. New Additions and New Buildings:
    a. The Contractor shall be responsible for installation and operation of temporary heating, cooling, and ventilating units including fuel, temporary piping, fittings, wiring, and connections in new additions and new buildings as necessary.
    b. The Contractor shall be responsible for damage to building and contents caused by cold, heat, and dampness.
    c. The Contractor shall maintain safe conditions for use of temporary heating, cooling, and ventilating systems including, but not limited to, the following:
        (1) Operate equipment following the manufacturer's instructions.
        (2) Provide fresh air ventilation required by the equipment manufacturer.
        (3) Keep temperature of fuel containers stabilized.
        (4) Secure fuel containers from overturning.
        (5) Operate equipment away from combustible materials.
        (6) Provide adequate fire extinguishers.
3. Existing Building:
    a. Where practicable and unless otherwise specified, existing facilities may be used, at the Owner's expense, to maintain minimum heating and cooling requirements. Normal setback temperature patterns shall not be interfered with except as specifically required to meet construction requirements. The existing system shall be protected by the Contractor from contamination, construction dust and debris. Filters shall be maintained in a clean condition and replaced with new filters at the completion of construction.
4. Specific heating requirements, unless otherwise specified by industry or manufacturer specifications, include but are not limited to:
    a. Gypsum Plaster – Uniform minimum temperature of 55 deg F for a week before application of plaster, during plastering operations, and until plaster is dry.
    b. Gypsum Board - 55 degrees F minimum day and night during entire joint treatment operation and until execution of Certificate of Substantial Completion.
    c. Ceramic Tile - 50 deg F minimum during preparation of mortar bed, laying of the tile, and for 72 hours after completion of the tile work.
    d. Acoustical Tile - 70 deg F minimum during setting of the tile.
    e. Resilient Flooring - 70 deg F minimum during application.
    f. Painting - 55 deg F minimum during painting operations and until dry.
5. When temporary heating, cooling, or ventilating is no longer required, the Contractor shall dismantle the temporary system and remove it at his own expense. The Contractor shall return permanent mechanical equipment to 'like-new' condition for the Substantial Completion Inspection. All warranties will begin at substantial completion regardless of when the equipment was started.

D. TEMPORARY WATER

1. The Owner will allow the Contractor usage of existing water facilities required for construction, at the Contractor’s expense. If additional water is needed which cannot be supplied by existing facilities, the Contractor is to pay for installation of all valves, piping and metering, and arrange with the proper authority for connection of the additional water. BYU will provide the meter and contractor will install.

E. TEMPORARY SANITARY FACILITIES

1. The Contractor shall provide and maintain sanitary, temporary toilets.
2. The Contractor shall at all times maintain such facilities clean, neat and sanitary.
3. Temporary outside toilets shall be removed at completion of the job.

F. SCAFFOLDING AND PLATFORMS

1. The Contractor or his subcontractors shall furnish and maintain all equipment such as temporary stairs, ladders, ramps, platforms, scaffolds, hoists, runways, derricks, chutes, elevators, etc., as required for proper execution of the Work.
2. All apparatus, equipment, and construction shall meet all requirements of labor laws, safety regulations and other applicable Federal, State or local laws.
3. Temporary stairs shall be built whenever needed. The Contractor shall provide temporary treads, handrails and shaft protection as needed or as required by governing codes.

H. TREE & PLANT PROTECTION

1. Before commencing site work, the Owner shall build and maintain protective fencing around existing trees and vegetation as identified on the Project drawings.
    a. Individual trees shall have protective fencing built beyond the drip line and to the satisfaction of the Project Manager.
    b. Groups of trees and other vegetation shall have protective fencing built around the entire group to the satisfaction of the Project Manager.
    c. Areas within protective fencing shall remain undisturbed and shall not be used for any purpose.
2. The Contractor shall protect all other trees, shrubs, lawns and all landscape work from damage and shall provide appropriate guards and covering. If normal sprinkling system is disrupted, the Contractor shall coordinate with BYU grounds to make sure the trees are watered by BYU or the Contractor.
3. Vegetation designated on drawings to be protected that has died or has been damaged beyond repair shall be removed and replaced by the Owner and back charged to the Contractor.

I. TEMPORARY ENCLOSURES

1. When walls and roof are in place, the Contractor shall provide temporary, weather tight enclosures for all exterior openings to protect all work. Openings into existing structure shall be made weatherproof.

J. PROTECTION FROM SNOW & ICE

1. The Contractor shall remove all snow and ice as may be required for the proper safety, protection and execution of the Work.

K. BRACING, SHORING, & SHEATHING

1. The Contractor shall design, furnish, install, and maintain all shoring, bracing, and sheathing as required for safety and proper execution of the Work and have the same removed if required when the Work is completed.

L. PROTECTION OF PERSONS

1. The Contractor shall provide, install, and maintain all necessary precautions to protect all persons on the site, including the public. Such measures shall include:
    a. Posting of appropriate warning signs in hazardous areas.
    b. Providing guardrails, fencing and barricades of adequate heights around all openings in floors or roofs, and around all excavations. All guardrails shall meet all applicable codes.
    c. Providing warning lights around obstructions, pits, trenches, or similar areas on-site or in adjacent streets, roads, sidewalks, or in the structure itself.
    d. When use or storage of hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel, and shall perform the work in accordance with all applicable codes or regulations.

M. PROTECTION FROM WEATHER

1. The Contractor shall provide protection against weather and protect all work, materials, apparatus, and fixtures. At the end of the day all work that might be damaged shall be covered.

2. If low temperatures or other weather conditions make it impossible to continue operations safely in spite of precautions, the Contractor shall cease work and notify the Project Manager.

N. PROTECTION OF EXISTING WORK
1. The Contractor shall protect all streets, private roads, and sidewalks, including overhead protection where required, and shall make all necessary repairs to damaged Work at his own expense.
2. The Contractor shall provide proper protection of all existing Work, furnishings, and fixtures likely to be damaged. When exterior openings are made in existing Work, they shall be covered with weather tight protection at the end of the day.
3. Before commencing work, the Contractor shall survey the site, and shall photograph and note any damage to existing structures including walks, curbs and utilities and shall provide copies of the photographs to the Project Manager before proceeding with work. Any damage not noted by the Contractor will be repaired or replaced by the Contractor.
4. Any Work damaged by failure to provide protection shall be removed and replaced at Contractor's expense.

O. FIRE PROTECTION
1. The Contractor shall provide at least one approved fire extinguisher in plain sight on each floor at each usable stairway prior to introduction of any combustible materials into the building.
2. Fires shall not be built on the premises.
3. In existing buildings with fire alarm/detection devices, the Contractor shall cover all smoke detectors within the work area each morning before work begins and remove dust covers at the end of the day. Fire detection devices must be functioning in the work area when the Contractor is not on the site.

P. PROTECTION OF ADJACENT PROPERTY
1. The Contractor shall provide all necessary protection and support of adjacent property.

Q. CONSTRUCTION CLEANING
1. The Contractor shall keep premises broom clean during progress of the work.
2. The Contractor shall remove waste materials and rubbish left by employees, subcontractors, and material suppliers. Roads inside and outside the Project shall be cleaned daily when hauling.
3. Before and during painting and varnishing, the Contractor shall clear the area of all debris, rubbish, and building materials that may cause dust. Sweep floors as required and take all possible steps to keep area dust free.

R. SURFACE WATER CONTROL
1. The Contractor shall protect the excavation, trenches and building from water damage by:
   a. Providing pumps, equipment and enclosures necessary for such protection.
   b. Constructing and maintaining temporary drainage and pumping as necessary to keep the site free of water.
2. The cost of water control shall be borne by the Contractor. The Owner may, if promptly notified of adverse underground water conditions, negotiate reasonable financial relief for the Contractor where such conditions could not have been learned from the Soils Engineer's Report, the Contract, or by commonly known local conditions.

S. OFFICES
1. The Contractor shall provide and maintain a weather tight office at the construction site. This building is to be located outside of, and detached from the building under construction. Connection of utilities and monthly utility costs shall be paid by the Contractor. This building shall be the property of the Contractor and shall be removed upon completion of the Project.

T. SHEDS AND TRAILERS

The Contractor shall provide and maintain neat, weather-tight storage sheds or trailers for storage of all materials that might be damaged or affected by weather or moisture. These sheds or trailers shall

have wood floors raised above the ground and will be outside of and detached from the building under construction. They shall be property of the Contractor and shall be removed upon completion of the work.

U. CODE OF CONDUCT

Contractor recognizes that BYU is an affiliate of the Church of Jesus Christ of Latter-day Saints, and that students and employees at BYU expect to work and learn in an environment consistent with the principles of the Church. Contractor agrees that all of Contractor's employees will A) Refrain from consuming alcohol, tobacco, or other illegal drugs on BYU campus, except that smoking may be permitted in designated, outdoor, areas; B) Refrain from using profanity; C) Observe modest standards of dress and behavior; D) be courteous and respectful to all members of the BYU campus community. Violations of these expectations may be grounds for terminating the Contractor's engagement or for asking the Contractor to dismiss a particular, offending employee from the Project.

SECTION 21 - TESTING

A. Testing companies will be selected by the Owner.

B. The Owner and/or the Architect reserve the right to have tests taken at any time.

C. Tests not specified as part of a trade section shall be paid by the Owner.

D. Should tests reveal a failure of the Work to meet Contract requirements, subsequent tests related to the failure shall be paid by the Contractor.

E. Tests shall be made according to recognized standards by a competent, independent testing laboratory.

F. Materials found defective or not in conformance with the Contract shall be promptly replaced or repaired at the expense of the Contractor.

G. Samples required for testing shall be furnished by the Contractor and selected as directed by the Architect or Project Manager.

SECTION 22 - EXISTING UTILITIES

A. Prior to execution of the Work the Contractor is to locate all existing vaults, manholes, valves, meters, etc. Contractor is to photograph, GPS, measure from existing structures and facilities that are to remain and keep this information readily available at the site/construction trailer. Contractor is also to mark the above utilities by staking and maintaining stakes for fast and accurate locating of all existing utilities in case of emergencies.

B. BYU will initially provide all on campus blue staking information. It is the Contractor's responsibility to maintain the blue staking locations and information by staking, painting, keeping GPS coordinates or any alternative ways that the Contractor can keep current, accurate information.

SECTION 23 - CUTTING AND PATCHING

A. The Contractor shall coordinate all cutting, fitting, or patching of the Work (including but not limited to cutting or patching of floorings; ceilings; roofs; walls; mechanical, electrical and plumbing; and all other surfaces and structures) that may be required to make the several parts of the Work come together properly. The Contractor shall coordinate all portions of the Work so as to receive or to be received by other portions of the Work, whether previously existing or newly created. The Contractor shall make proper repair or

closure of the Work as needed or as directed by the Architect or the Project Manager.

B. The Contractor shall refrain from cutting or digging in a manner that is harmful to the Owner's premises. Contractor agrees that Contractor will not cut or alter any section of the Owner's premises except as indicated on the plans and specifications without prior consent of the Architect and the Project Manager. The Contractor shall give 48-hour Blue Stake notice to the Project Manager and local Blue Stakes location center.

C. In the event that Contractor shall cause damage to the Owner's premises while cutting or digging, Contractor shall cause the damage to be repaired at the Contractor's expense.

D. All concrete slabs whether suspended or on-grade shall be scanned by the general contractor and/or verified by BYU before demoing, drilling, coring or cutting. It is the responsibility of the general contractor to repair or replace the slab, it's reinforcements and other parts, utilities in the slab and adjacent surfaces as a result of failure to scan the slab.

SECTION 24 - CONDEMNATION OF WORK

A. The Owner or the Architect shall have the right to condemn and require removal of the following at the Contractor's expense:
   1. Any portions of the Work that do not meet the requirements of the Contract either in substance or installation.
   2. Any portions of the work damaged or rendered unsuitable during installation or resulting from the Contractor's failure to properly protect the work.

SECTION 25 - CHANGES IN THE WORK

A. The Owner may make changes within the general scope of the Contract, including but not limited to changes:
1. In the Contract.
2. In the method or manner of performance of the Work.
3. In the Owner-furnished facilities, equipment, materials, or site.
4. In directing acceleration of the Work.

B. Any written order from the Owner or Architect which changes the scope of the work shall be a Change Order.

C. The Architect is authorized to order minor changes during the Work that will not involve significant extra cost or time. The price of such minor changes will be mutually agreed upon between the Project Manager and the Contractor. The Contractor will proceed with the changed work immediately. These minor field changes will subsequently be included in a Change Order.

D. Proposal Requests may be issued which ask the Contractor to submit a price for proposed changes in the scope of the Work. The Contractor is to promptly provide costs associated with the prospective changes, including credits for deleting any unnecessary Work. Cost breakdowns are to be submitted in sufficient detail to verify that the complete scope of the Work is understood by the Contractor, Architect, and Project Manager.

E. Change Orders -
   1. Except for emergencies as covered in Section 8, and to avoid delays, no changes in the work shall be made without a written Change Order. The Contractor's proposal shall be the basis of negotiation for the Change Order price and/or time adjustments.
   2. If the Owner decides it is necessary to proceed with changed work to avoid delay before prices or times have been negotiated, he may order the Contractor to proceed on a time and materials basis or on a mutually agreed not-to-exceed price and time extension. This notice to proceed shall be issued by the Owner's Representative. Upon receipt of such order, the Contractor shall immediately perform the changed work. The Owner and the Contractor will then negotiate the price and/or time when practicable, and a Change Order will be issued.

3. When submitting proposals for Change Orders, the Contractor shall furnish a price breakdown itemizing costs as required by the Owner. Unless otherwise directed, the breakdown shall be in sufficient detail to allow an analysis of all material, labor, equipment, overhead costs and profit, and shall cover all Work involved in the change, whether such Work was deleted or added. Any amount claimed for subcontractors shall be supported by a similar price breakdown. In addition, if the proposal includes a time extension, a justification shall be furnished. The proposal, with the price breakdown and time extension justification, shall be furnished within fourteen (14) days of the date that the first request was made by the Owner's Representative. In such proposals, profit and overhead shall be computed as follows:

a. The Subcontractor's profit and overhead shall not exceed 15% of total direct costs.
b. The Contractor's profit and overhead on work done by his own crews shall not exceed 15% of total direct costs.
c. The Contractor's profit and overhead on work performed by subcontractors shall not exceed 5% of total direct costs or in the case of a CMGC Contract the Contractor's profit and overhead fee on change orders shall not exceed the pre-contract negotiated fee.
d. The subcontractor's profit and overhead on work performed by any of his subcontractors shall not exceed 5% of total direct costs. Contractor's profit and overhead will not exceed 5% of total direct costs.
e. On credit changes, profit and overhead on the originally estimated work will not have to be returned to the Owner.
f. No supervision costs, office managerial costs, or office expenses can be added to Change Orders.
g. Upon signing a Change Order, the Contractor releases the Owner from any further claim for money or time because of the changed work.

SECTION 26 - CLAIMS FOR EXTRA COST

A. If the Contractor intends to assert any additional claim for equitable adjustment of cost or time, he must, within fourteen (14) calendar days of the events or circumstances giving rise to the change, submit to the Architect and the Owner a written statement of the nature and monetary extent of such claim. If a mutually acceptable settlement of the claim cannot be reached within a reasonable time, the parties to the Contract shall handle the matter as a dispute under Section 27 "DISPUTES."

SECTION 27 - DELAYS AND EXTENSION OF TIME

A. All time limits stated in the Contract are of the essence. Contractor agrees to carry out the Work according to the time durations and limits as specified in the Contract.

B. If the Contractor is delayed any time during the progress of the work because of labor disputes, abnormal weather, unusual delays in transportation, or any other causes beyond the Contractor's control, the Contractor may be given additional time to complete the work by Change Order.
   1. All requests for time extensions shall be made in writing to the Project Manager.
      a. Claims for time extension due to abnormal weather shall be made within fourteen (14) days of the abnormal weather.
      b. Claims made beyond these time limits shall not be considered by the Owner.
   2. Requests for time extensions shall be fully documented by including copies of daily logs, letters, shipping orders, delivery tickets and other supporting information.
   3. In case of a continuing cause of delay only one claim is necessary.

SECTION 28 - DISPUTES

A. Except as otherwise provided in the Contract, any dispute concerning a question of fact arising under this Contract that is not disposed of by agreement shall be decided by the Owner's Representative (as represented by the Assistant Administration Vice President/Physical Facilities of Brigham Young University). The decision shall be rendered in writing and mailed or otherwise given to the Contractor. If

the decision is not agreeable to the Contractor, the Contractor will, within fourteen (14) days of the decision, mail or otherwise furnish to the Owner's Representative a written appeal addressed to the Owner.

SECTION 29 - CORRECTION & WARRANTY OF WORK

A. The Contractor shall promptly correct any work that fails to conform to the requirements of the Contract during the progress of the Work. The Contractor shall remedy any defects due to faulty materials, equipment or construction that appear within one year from substantial completion of the Contract or within such longer periods as may be prescribed by law or by the terms of any applicable extended guarantee required by the Contract. The Contractor shall promptly correct all faulty work or pay all costs of correcting the faulty work.

SECTION 30 - OWNER'S RIGHT TO DO WORK

A. If the Contractor defaults or neglects to carry out the Work according to the Contract or fails to perform any provision of the Contract, the Owner may, upon approval of the Architect, after providing seven days written notice to the Contractor and without prejudice to any other remedy Owner may have, make good such deficiencies. In such case, an appropriate Change Order will be issued deducting the cost of correcting such deficiencies, including the cost of the Architect's additional services made necessary by such default, neglect or failure. If the payments due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. .

SECTION 31 - CONTRACTOR'S PAY REQUEST

A. The Contractor shall submit to the Project Manager a monthly payment request based on the estimated value of the work completed and materials on the site as of that date. The payment request shall be on the form provided in this document, or on the then-current AIA G702 Application and Certification for Payment (or equivalent) Form. Such payment request shall be based on the schedule of values submitted by the Contractor. The Contractor warrants that title to all work, materials and equipment covered by the payment request, whether incorporated in the Project or not, will pass to the Owner upon the receipt of such payment by the Contractor, free and clear of all liens, claims, security interests or encumbrances. The Project Manager may audit Contractor payments to subcontractors or suppliers anytime.

SECTION 32 - PAYMENTS TO CONTRACTOR

A. Upon approval of the Contractor's monthly payment request, the Owner will, within fourteen (14) days after receipt of said certification, mail to the Contractor a sum equal to 95% of the amount requested, less previous payment thereon. The retention that is withheld by the Owner will be placed in an interest-bearing account and paid to the Contractor after the project is completed and accepted by the Owner.

B. Upon receipt of a payment by the Owner, the Contractor shall pay each subcontractor within fourteen (14) calendar days, the amount allowed to the Contractor for the subcontractor's work.

C. The Contractor's monthly payment request, which shall show the amount paid under the subcontract, shall be made available to the Project Manager for examination. Full and final payment of the Contract amount shall be made within thirty (30) days of the completion of the following requirements:

1. The Architect's and Owner's written acceptance of the work.
2. Payment of all labor and material bills, and receipt of all final lien waivers or lien releases from all subcontractors, mechanics and suppliers.
3. No payment made under this Contract shall be construed to be an acceptance of defective or improper materials or construction.

D. A schedule of dollar values shall be submitted to the Architect and the Owner before the Contractor’s first

payment request will be processed.

E. The schedule of values shall be submitted on the Owner's standard payment request form.
   1. This breakdown shall follow the trade divisions of the specification. Each item shall include its pro rata part of overhead and profit so that the sum of the items will equal the Contract price.
   2. The breakdown will correspond exactly to items of work in the Project schedule including work of subcontractors.

F. The Contractor shall make arrangements to receive all payments from the Owner by direct deposit.

SECTION 33 - PAYMENTS WITHHELD

A. Payments may be withheld from the Contractor by the Owner to protect the Owner from loss due to:
   1. Defective work not remedied.
   2. Liens or claims filed or reasonable evidence of probable filing.
   3. The Contractor's failure to promptly pay subcontractors for labor and materials accepted by the Contractor.
   4. The Architect's or the Project Manager's reasonable doubt that the Project can be completed for the unpaid balance of the Contract price.
   5. Damage to another contractor.
   6. Failure to maintain scheduled progress.

B. Upon satisfactory correction of the above conditions, withheld payments will be made.

SECTION 34 - CONTRACTOR RESPONSIBILITIES

A. The Contractor is fully responsible for the Project and all materials and work until the Owner has accepted the completed Project in writing. The Contractor shall replace or repair, at his own expense, any materials or work damaged or stolen even if the Contractor has received payment for the work or materials.

B. By executing the Contract, the Contractor represents that he has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract.

C. The Contractor shall employ a competent superintendent satisfactory to the Architect and the Owner. The superintendent shall be present at the Project site during the progress of the Work. This superintendent shall not be changed except with the prior consent of the Project Manager or unless the superintendent ceases to be in the Contractor's employment. The replacement superintendent shall also be subject to these conditions. The superintendent shall represent the Contractor, and all communications given to the superintendent shall be as binding as if given to the Contractor.

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

E. In the event that the Contractor receives purported directions regarding the Work from anyone other than the Project Manager, the Contractor shall forward/direct all communications to the Project Manager.

F. Unless otherwise directed, the Contractor shall, within two (2) hours after the bid opening, furnish the Architect and the Owner a list of the proposed subcontractors who will be working on the Project. The Owner will notify the Contractor in writing if any of the subcontractors are unacceptable.

G. The Contractor shall not contract with any subcontractor who has been rejected by the Owner or the Architect. The Contractor will not be required to contract with any subcontractor, person or organization

against whom he has a reasonable objection if such objection is made before the bid opening. The Contractor is not to use or accept any bid from a subcontractor unless the Contractor is willing and able to work with that subcontractor.

H. If the Owner or the Architect requires a change of any proposed subcontractor or person or organization previously accepted by them, the Contract amount shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued.

I. The Contractor shall not make any substitution of a subcontractor who has been accepted by the Owner and the Architect unless the substitution is accepted in writing by the Owner and the Architect. Any increase in cost shall paid by the Contractor.

J. All damage or loss to any property caused in whole or in part by the Contractor, any subcontractor, or by either of their agents, shall be remedied by the Contractor at no cost to the Owner.

K. The Contractor shall be solely responsible for initiating and supervising all safety programs including, but not limited to:
   1. The protection of all persons on the site, including the public.
   2. All conditions specified in this contract.
   3. All conditions required by codes and/or governmental regulations including OSHA.
   4. The protection of all property on the site or affected by the Work.
   5. The Contractor shall designate a responsible member of its organization at the site whose duty will be the prevention of accidents. This person will be Contractor's onsite representative unless otherwise designated in writing by Contractor to Owner and Architect.

L. The Contractor shall be responsible for:
   1. Limiting all Work at the site to Monday through Saturday, between the hours of 7:00 A.M. to 10:00 P.M. No Sunday work is to be performed. Any exceptions to the working hours or days must be made by prior written authorization by the Owner.
   2. Requiring all personnel on site to be appropriately dressed. This includes protective clothing and equipment as needed. Shirts are to be worn at all times.
   3. Limiting all Work at the site according to local noise ordinances or other ordinances.

M. The Contractor's employees shall not be allowed to use radios, boom boxes, etc., are on the site.

N. Renderings representing the Work are the property of the Owner. All photographs of the Work, whether taken during construction or at completion, are the property of the Owner. The Owner reserves all rights including copyrights to renderings and photographs of the Work. Buildings shall not be photographed, and no renderings or photographs shall be taken, obtained, used, or distributed without the prior written consent of the Owner.

O. All information regarding the cost of the Project shall be considered confidential and shall not be disclosed by the Contractor to any third party without the prior written consent of the Owner.

SECTION 35 - SUBCONTRACTORS

A. The Contractor's responsibility for this Project includes the work of all subcontractors and material suppliers, including those recommended or approved by the Owner. The Contractor shall be held responsible to the Owner for proper completion and guarantee of all construction and materials under subcontracts and for the acts and omissions of his subcontractors or their employees. Any warranties required for such work shall be obtained by the Contractor in favor of the Owner and delivered to the Owner. It is expressly agreed that there is no contractual relationship between the Owner and any subcontractor, and under no circumstances shall the Owner be responsible for the nonperformance or financial failure of any subcontractor.

B. The Contractor shall require each subcontractor to agree:
   1. To be bound by terms of the Contract as far as applicable to the subcontractor's work.
   2. To assume toward the Contractor the same obligations the Contractor has assumed toward the Owner, including the prompt payment of his employees and material suppliers affected by this work.
   3. To submit his applications for payment to the Contractor in time to allow the Contractor to make timely application to the Owner.
   4. To execute claim or lien releases or lien waivers as requested by the Contractor for payments made by the Contractor.
   5. To make all claims for extra work or for extensions of time to the Contractor in the same manner the Contractor is to make this type of claim to the Owner.

C. The Contractor agrees in his relationship with the subcontractors:
   1. To bind himself to the subcontractors by all the obligations that the Owner assumes to the Contractor.
   2. To pay the subcontractors within fourteen (14) calendar days upon receipt of payment from the Owner that portion of the funds received as represents the subcontractor's portion of the Work completed to the Contractor's satisfaction for which payment was made by the Owner.

SECTION 36 - LOCKOUT/TAGOUT, CONFINED SPACE, HAZARD COMMUNICATION PROGRAMS, HOT WORK and EXCAVATION PERMIT PROGRAMS

A. The Contractor and the subcontractors will have a written "Lockout/Tagout" program. A copy of this program will be submitted to the Project Manager.

B. The Contractor and subcontractors shall evaluate all work places to determine if any spaces are permit-required confined spaces in accordance with any applicable OSHA regulations. If the workplace contains permit spaces, the Contractor shall inform exposed employees by posting danger signs in compliance with OSHA regulations. If the Contractor decides that its employees will enter permit spaces, the Contractor shall implement a written confined space program. The written program shall be made available to all persons (whether employees of the Contractor or not) and submitted to the Project Manager. The confined space program shall inform the persons that the workplace contains confined spaces that require a permit to enter those spaces. The Contractor shall identify the hazards that may be encountered in the confined space. The Contractor shall specify any precautions or procedures required for the protection of persons in or near confined spaces.

C. Besides complying with the confined space requirements that apply to all employers, the Contractor shall:
   1. Obtain any available information regarding permit space hazards and entry operations.
   2. Coordinate entry operations when both contractor and subcontractor personnel will be working in or near permit spaces.

D. The Contractor shall inform the Project Manager of the methods the Contractor will use to inform all employees on the site of any precautionary measures that need to be taken for protection during the workplace's normal and emergency operating conditions. The Contractor will specify the methods to inform the employees of the labeling system for hazardous materials. The Contractor may rely on an existing hazard communication program to comply with these requirements if it is current with OSHA regulations.

E. The Contractor shall make the written hazard communication program available to all personnel working on the Project and to the Project Manager.

H. In addition to the Hot Work permit required under Section 14, above, the Contractor shall have and implement a Hot Work permitting program that complies with all OSHA regulations. This program must be

communicated to all those who might be involved with Hot Work. Copies of this program shall be made available to the Project Manager upon request.

I. The Contractor shall have and implement a written excavation permitting program that complies with all OSHA regulations. This program must be communicated to all those who might be involved with related work. Pre-task planning and job hazards must be assessed prior to any excavations on the Project. Existing utilities must be identified and procedures put in place to avoid damage or interruptions to existing buildings or operations. Copies of this program shall be made available to the Project Manager upon request.

SECTION 37 - OWNER'S RIGHT TO CANCEL CONTRACT

A. The Contractor shall give the Owner at least twenty-one (21) days written notice before filing any petition for bankruptcy. The Contractor shall be in material breach of the Contract if the Contractor fails to give this notice.

B. Should the Contractor make a general assignment for the benefit of his creditors, or if he should persistently refuse or fail to apply enough properly-skilled workers or proper materials to correctly execute the Work, or if he should fail to make prompt payment to the subcontractors or material suppliers for accepted material or labor, or constantly disregard laws, ordinances or instructions of the Architect and the Owner, or otherwise be guilty of substantial violation of any provision of the Contract, then the Owner may, without any prejudice to any other right or remedy and after giving the Contractor seven (7) days written notice, terminate employment of the Contractor and take possession of the premises and all materials, tools and appliances, and finish the Work by whatever method the Owner deems expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract price exceeds the expense of finishing the Work, including compensation for additional administrative services, such excess shall be paid to the Contractor. If such expense shall exceed the unpaid balance, the Contractor shall pay the difference to the Owner.

SECTION 38 - CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE CONTRACT

A. If the Work should be stopped under court order, or other public authority for thirty (30) days, or the Owner shall fail to pay the Contractor within thirty (30) days of receipt of a properly prepared and completed payment request, then the Contractor may, on seven (7) days written notice to the Owner and the Architect, terminate this Contract and recover from the Owner the percentage of the Contract price represented by the work completed as of the date of termination with any loss sustained which can be established.

SECTION 39 - SEPARATE CONTRACTS

A. The Owner reserves the right to award separate contracts concerning other portions of the Project under these or similar conditions of the Contract to other contractors.

B. The Contractor shall afford separate contractors reasonable opportunity for the introduction and storage of their materials and equipment and the execution of their work, and shall properly connect and coordinate his work with theirs.

C. If any part of the Contractor's work depends upon the work of another separate contractor, the Contractor shall inspect and promptly report to the Project Manager any apparent discrepancies or defects in such work that render it unsuitable for proper execution and results. Failure of the Contractor to inspect the work is an acceptance of the work of the separate contractor unless defects develop in the other separate contractor's work after the execution of the Contractor's work.

SECTION 40 - ASSIGNMENT

A. The Contractor shall not assign or sublet this Contract or any part of it or any monies due him without prior written consent of the Owner.

SECTION 41 - LIQUIDATED DAMAGES

A. For each calendar day that the Work or any portion of the Work remains incomplete after the expiration of the time limit set in the Contract or by Change Order, the amount per calendar day shown in the Supplementary Conditions will be deducted from the money due or to become due to the Contractor. This deduction is not a penalty, but is liquidated damages and may include additional expenses such as administrative and inspection costs.

B. At the time of substantial completion, and after the meeting to certify substantial completion, the Owner, Architect and Contractor shall agree upon the time that will be allowed for the Contractor to complete the remaining Work on the Project. If the Contractor does not complete the Work within the agreed time, the liquidated damages will continue at a reduced amount as stated in the Supplementary Conditions. The liquidated damages shall be in full force and effect, not as a penalty but as liquidated damages for each additional calendar day it takes to complete the Project. If liquidated damages are required, they shall be accrued and deducted from the money due the Contractor.

SECTION 42 - ACCELERATION OF WORK

A. If, in the judgment of the Architect or the Owner, it becomes necessary at any time to accelerate the Work or part of it, the Contractor shall deploy the workers in such portions of the Project to enable others to properly engage and carry on their work. If circumstances require that the entire Work or a portion of it be completed at a date earlier than the Contract completion date as adjusted by Change Orders, the Contractor shall increase his forces, equipment, hours of work, or number of shifts, and shall speed delivery of materials to meet the altered completion date or dates ordered or directed. Any increase in cost to the Contractor according to such orders or directives will be adjusted by Change Order.

B. If the Work is behind schedule and the rate of placement of work is inadequate to regain scheduled progress, the Contractor shall immediately take action to ensure timely completion of the Work.
   1. This shall be accomplished by any one or a combination of the following or other suitable measures:
      a. An increase in working forces.
      b. An increase in equipment or tools.
      c. An increase in hours of work or number of shifts.
      d. Expediting delivery of materials.
   2. The Contractor shall notify the Project Manager of specific measures taken or planned to increase the rate of progress with an estimate of when scheduled progress will be regained.
   3. Acceleration of work will continue until scheduled progress is regained. Scheduled progress shall be established from the latest revised and approved Project schedule for the job.
   4. Timely completion will be understood as the Contract completion date as revised by all time extensions.
   5. The Contractor shall not be entitled to additional compensation for efforts to regain scheduled progress.

SECTION 43 - CONTRACTOR'S QUALITY CONTROL

A. MATERIAL QUALITY
   1. Materials incorporated into the Project shall be new except as otherwise indicated in the specifications. Materials shall be of specified quality and furnished in sufficient quantity to simplify proper and timely execution of the Work.
   2. The Contractor shall furnish evidence of the quality of materials incorporated into the Project as required by the Contract or at request of the Architect or the Project Manager.
   3. Materials not meeting requirements of the Contract shall be removed from the Project and replaced with materials meeting the Contract requirements by the Contractor at no additional expense to the Owner.

B. ASBESTOS

1. The Contract has been prepared following generally accepted professional architectural and engineering practices. Accordingly, no asbestos or products containing asbestos have been knowingly specified for this Project. The Contractor agrees to notify the Project Manager immediately for instructions if:
   a. Materials containing asbestos are brought to the site for inclusion in the Work.
   b. Asbestos materials are encountered in any existing structures upon which work is being done.
2. At the Architect's direction and with the Owner's approval, an independent testing laboratory will perform testing procedures on suspect materials at Owner's expense.
3. The Contractor shall certify, based upon his best knowledge, information, inspection and belief, that no building materials containing asbestos were used in the construction of the Project. The Contractor will submit certification on form provided by the Owner.

SECTION 44 - TEMPORARY OR TRIAL USAGE OF ANY MECHANICAL DEVICES

A. Temporary or trial usage by the Owner of mechanical devices, machinery, apparatus, elevators, equipment or other work or materials supplied under this Contract before written acceptance by the Owner shall not be construed as evidence of the Owner's acceptance.

SECTION 45 - PROJECT CLOSEOUT

A. FINAL CLEANING

1. Upon completion of the Work, the Contractor shall remove all tools, scaffolding, surplus materials and all rubbish from under and about the building. The Contractor shall leave the building clean and habitable, having thoroughly swept or vacuumed floors, cleaned windows and dusted flat surfaces such as cabinet tops and window sills.
2. Besides general cleaning noted above, the Contractor shall do the following special cleaning for all trades at the completion of the work:
   a. Remove putty or caulking stains from glass. Wash and polish inside and outside, exercising care not to scratch glass.
   b. Remove marks, stains, fingerprints, other soil and dirt from painted, decorated and stained work.
   c. Clean and polish woodwork.
   d. Clean and polish hardware for all trades. This shall include removal of stains, dust, dirt, paint and other similar materials.
   e. Remove spots, soil and paint. Wash tile work.
   f. Clean fixtures and equipment, and remove stains, paint, dirt and dust.
   g. Remove temporary floor protection and clean floors. Spray and buff resilient flooring.
   h. Clean exterior and interior metal surfaces, including doors and windows, required to have polished finishes. Remove oils, stains, dust, and dirt. Polish surfaces, leaving them without fingerprints or other blemishes.
3. If the Contractor fails to clean up, the Owner may do so and the cost will be withheld from the Contractor's final payment.

B. PROJECT RECORD DOCUMENTS

The Contractor shall deliver to the Architect before the substantial completion inspection:

1. Accurate Project "record" drawings, including redline drawings.
2. Certificates of occupancy that may be required by Authorities Having Jurisdiction over the work.

C. OPERATING & MAINTENANCE DATA

Before execution of the certificate of substantial completion, the Contractor shall furnish the operating instructions and maintenance manuals as called for in the Contract.

D. WARRANTIES & GUARANTEES

1. When written guarantees beyond one year after substantial completion are required of any section of the Work, the Contractor shall secure such guarantees properly addressed and signed and in favor

of the Owner. These documents shall be delivered to the Project Manager upon substantial completion of the Contractor's work and before execution of the certificate of substantial completion.

2. Delivery of guarantees and warranties shall not relieve the Contractor from any obligation assumed under any other provisions of his Contract.
3. Nothing within the Contract intends or implies that guarantees shall apply to work abused or neglected by the Owner.

E. PRE-SUBSTANTIAL, SUBSTANTIAL, & FINAL COMPLETION INSPECTIONS

1. Pre-Substantial Completion Inspection:
   a. Upon the Contractor's request and if the request is accompanied by a punch list prepared by the Contractor, the Project Manager and the Architect will make inspections and furnish a list of additional items to be corrected or completed by the Contractor.
   b. The Contractor shall notify the Project Manager when items have been corrected or completed. Upon the Project Manager's verification of correction, the Project Manager will arrange a substantial completion inspection to include the Owner, Architect, engineers and college representatives.

2. Substantial Completion Inspection:
   a. At the substantial completion inspection, unless the Work is rejected, the Architect may execute a certificate of substantial completion (to be signed by the Architect, Owner and Contractor) that states the dates for:
      (1) User occupancy,
      (2) Commencement of warranties,
      (3) Final completion inspection,
      (4) Modifications to the amount assessed for liquidated damages.
   b. After inspection, the Architect will furnish a final list of items to be corrected.
   c. The Owner, Architect and Contractor will decide how much time is to be allowed for completion of the items.
3. Final Completion Inspection:
   a. Final Completion Inspection will ensure that all deficiencies noted at the substantial completion inspection have been corrected.
   b. When all items have been corrected, the Project Manager will process the final payment and send a final completion letter indicating the final completion date to the Contractor.
   c. If all items have not been corrected as agreed, the Owner may elect to complete the work under provisions of Section 29 of the General Conditions.
   d. All lien waivers and releases are to be submitted before final payment can be made.
   e. A copy of the final payment consent form will be obtained from the surety/bonding company.

SECTION 46 - OWNER-PURCHASED MATERIALS AND EQUIPMENT

A. The Owner desires to purchase certain materials which will be utilized in the Work. Contractor's duties with respect to Owner-purchased materials are:

1. Scheduling:
   a. The Contractor shall furnish the Owner with a schedule of dates on which the Contractor requires delivery of Owner-purchased materials. The Owner will arrange for the materials to be delivered to the construction site on or before the specified dates. If delivery dates are changed, rescheduled, or otherwise varied from the original schedule, the Contractor shall notify the Owner in writing of delivery date rescheduling and the Contractor shall coordinate the delivery of the Owner-purchased materials directly with the supplier.
2. Pre-Installation Inspection:
   a. The Contractor shall be responsible for receiving, inspecting and storing all Owner-purchased materials until the materials are needed for installation by the Contractor. Regardless of any inspection performed by the Owner of the Owner-purchased materials, the Contractor shall be responsible for inspecting the Owner-purchased materials to determine suitability, quality and conformance with specifications before installation or at such other

time as the Contractor may desire in order to avoid interruptions and delays in the progress of the Project. The Contractor shall reject any material which does not meet specifications or which appears to have any defect which may make the material unsuitable for use in the Project. The Contractor shall notify the Owner and the manufacturer or supplier of all defects and assist the Owner in arranging for the repair, replacement or correction of the defective condition. The Contractor shall not be entitled to an extension of any deadline or completion date which results from failure to discover defects which the Contractor should have discovered through an inspection.

3. Defective Materials:
   a. The Contractor acknowledges that use of improper or defective material may result in costs and damages to the Owner in excess of the value of the materials; that after use in the Project it may be difficult or impossible to inspect the material to determine the cause of any failure; and that in the event of the failure of material there may be a question as to the cause of the failure. Because the Contractor's employees will be the last to handle and inspect material prior to incorporation into the Project, the Contractor will be liable to the Owner for damages resulting from failure of Owner-purchased materials during the Contractor's warranty period specified herein from any cause whatsoever unless the Contractor provides clear and convincing proof that (1) the entire loss from a failure is covered by a valid manufacturer's or supplier's warranty, or (2) the Contractor could not have prevented the failure by complying with the requirements of this Section concerning Owner-purchased materials.

4. Claims:
   a. The Contractor agrees to assist the Owner to present claims to manufacturers and suppliers for defects in Owner-purchased materials. Where there is any question as to the division of liability between the Contractor and a manufacturer or vendor, the Contractor shall provide all relevant information in the Contractor's possession which may aid the Owner in determining the division of responsibility. The Owner shall have final approval of any proposed adjustment or settlement of warranty claims.
5. Implied Warranties:
   The benefit of contractual and implied warranties with respect to Owner-purchased materials shall run to the Owner and not to the Contractor.
6. Unloading:
   Except as otherwise provided herein, the Contractor shall be responsible for unloading all Owner-purchased materials and verifying delivery amounts to the Owner.
7. Custody and Security:
   The Contractor shall use reasonable care in protecting Owner-purchased materials from loss, deterioration, damage, theft, vandalism or destruction.
8. Reports:
   At Owner's request, the Contractor shall furnish reports to the Project Manager demonstrating the Contractor's compliance with this Section.
9. Retained Ownership:
   All materials purchased by the Owner which remain after completion of the Project shall be the property of the Owner. If the Owner does not wish to retain or dispose of surplus Owner-purchased materials, the Contractor shall remove and dispose of them.

10. Rights of Ownership:
    None of the foregoing duties of the Contractor with respect to Owner-purchased materials shall prevent the Owner from exercising any prerogative of ownership of the materials.

SECTION 47 - OWNER'S SALES TAX EXEMPT STATUS

A. Contractor and subcontractors are authorized to purchase Construction Materials on behalf of Brigham Young University free of Utah sales tax, as defined by applicable Utah State Tax Rule. The grant of this contractual right is conditioned upon and made subject to the following:
    1. The construction materials must be installed or converted into real property owned by Brigham Young University and may not be used for any purpose other than constructing the Project.
    2. All construction materials purchased without sales tax must be clearly identified and segregated at all times between the time of purchase and time of installation into the Project.
    3. Contractor and subcontractors will comply with such instructions and guidance as Brigham Young University may issue from time to time to implement Tax Commission requirements for the sales tax exemption on construction materials.

B. Brigham Young University will provide the Contractor with the Sales Tax Exemption Certificate.

SECTION 48 – FOREIGN PRODUCTS AND CURRENCY

A. All foreign product costs shall be negotiated in U.S. dollars. Owner will not assume any risk for currency fluctuations after bidding. Contractor assumes all responsibility for any change in costs due to foreign currency fluctuations if the Contractor chooses to negotiate product costs in a foreign currency.

SUPPLEMENTARY CONDITIONS

SECTION 1--COMMENCEMENT, PROSECUTION & COMPLETION OF THE WORK

A. The Contractor shall be required to commence work after receipt of the contract from the Owner.

B. The Contractor shall prosecute the work diligently so as to complete it within the time limit allowed in this document.

C. The Contractor agrees to complete this work required by the Contract on or before midnight 28 June 2024.

D. Time is hereby expressly declared to be of the essence of the Contract.

SECTION 2--LIQUIDATED DAMAGES

A. The amount agreed upon and established as liquidated damages up to substantial completion is $1000 per calendar day.

B. At the time of substantial completion the Owner and the Contractor will agree on how much time will be allowed for the Contractor to complete the remaining work. If the Contractor exceeds the time allowed, liquidated damages will continue at one third (1/3) of the amount of the original liquidated damages or $1000 per calendar day.

SECTION 3--FIRE/SMOKE ALARMS

A. The Contractor shall be charged $1,000.00 for any fire alarm or smoke alarm that is caused by the Contractor and disrupts the building occupants. BYU fire alarm technicians are available to answer any questions concerning the alarm systems. The Contractor is to contact the Project Manager to coordinate alarm technicians.

SECTION 4—EXISTING UTILITIES

A. Prior to execution of the work the contractor is to locate all existing vaults, manholes, valves, meters, etc. Contractor is to photograph, GPS, measure from existing structures and facilities that are to remain and keep this information readily available at the site/construction trailer. Contractor is also to mark the above utilities by staking and maintaining stakes for fast and accurate locating of all existing utilities in case of emergencies.

B. BYU will initially provide all on campus blue staking information. It is the contractor's responsibility to maintain the blue staking locations and information by staking, painting, keeping GPS coordinated or any alternative ways that the contractor can keep current, accurate information.

SECTION 5—CONTRACTOR WORKING HOURS

A. No work will be performed between the hours of 10:00 p.m. and 7 a.m. without prior written authorization or in case of emergency situation approved by BYU Project Manager. No work is allowed on Sunday.

SECTION 6—BUILDER'S RISK INSURANCE

Section 13 of the General Conditions is deleted in its entirety and replaced with the following:

SECTION 13—BUILDERS RISK LOSSES

A. If the Contract Sum is over $100,000, prior to performing any work, Contractor will obtain and maintain during the term of this Agreement All-Risk Builders Risk Insurance Policy – ISO Form CP 00 20 (10/12), Builders' Risk Coverage (or equivalent) and ISO Form CP 10 30 (10/12), Causes of Loss Special Form, including coverage for flood, or equivalent insurance forms, with Limits of Insurance in the amount of the Contract Sum. An installation floater may be used, if approved in writing by Owner. The Policy will:

a. cover materials stored at temporary storage locations and materials in transit;
b. include Owner and all Subcontractors as additional named insureds;
c. be subject to a deductible payable by Contractor of not less than $2,500 per occurrence of any loss, which will be the responsibility of Contractor and will not be included in the Cost of the Work or be a reimbursable expense; and
d. provide that such insurance is primary, non-contributory and not excess coverage.

B. Contractor will provide evidence of this insurance coverage to Owner by providing, if applicable, a Certificate of Insurance on ACORD 27, Evidence of Property Insurance, for the Builder's Risk Insurance Policy, identifying the Project as defined in the Contract, submitted to Owner, attaching the endorsement giving evidence that the Owner and all Subcontractors are listed as named insureds on the Builder's Risk Policy.

Contact the BYU Construction Department (construction@byu.edu) for an electronic Excel version of this form.

Brigham Young University

Physical Facilities -- Construction Department

MONTHLY PAYMENT REQUEST

Date _____
Request No. _____
Period From _____ to _____
TAX ID# _____

Payable To:
Contractor _____
Address _____
City, State, Zip _____

Project Name _____
Project No. _____
Contract No. _____
Contract Date _____

APPLICATION FOR PAYMENT

HOLD FOR PICKUP ☐

1. ORIGINAL CONTRACT AMOUNT		$ -
2. NET CHANGE BY CHANGE ORDERS		$ -
3. CONTRACT AMOUNT TO DATE (line 1 plus line 2)		$ -
4. TOTAL EARNED (work completed and materials stored to date)		$ -
5. **AMOUNT THIS REQUEST**		$ -
6a. RETAINAGE HELD THIS REQUEST (5% of line 5)	$ -	
6b. RETAINAGE RELEASED THIS REQUEST	$ -	
6c. RETAINAGE RELEASED TO DATE (total of line 6b above plus previous pay app line 6c)	$ -	
6d. TOTAL HELD RETAINAGE TO DATE (5% of line 4 minus line 6c)		$ -
7. TOTAL EARNED LESS RETAINAGE HELD TO DATE (line 4 minus line 6d)		$ -
8. LESS PREVIOUS PAYMENTS (line 7 from previous pay app)		$ -
9. **CURRENT PAYMENT DUE** (line 7 minus line 8) (to check take line 5 minus line 6a plus line 6b)		$ -
10. BALANCE TO FINISH, Including Retainage (line 3 minus Line 4 plus Line 6d)	$ -	

Contractor's Representative _____
Date _____

Owner's Representative _____
Date _____

Project Manager _____ Date _____
Director of Construction _____
Director of Planning _____
Accounting _____
Architect _____

Legend
data input

SCHEDULE of VALUES

Project Name _____ **Contractor** _____

Item NO.	DESCRIPTION	Subcontractor or Supplier	% Item of Total	CONTRACT Amount	% THIS ESTIMATE	AMOUNT THIS ESTIMATE	% TO DATE	AMOUNT TO DATE	% of Rentention	Retention Withheld
1										
2										
3										
4										
5										
6										
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28										
29										
30										
31										
32										
TOTALS										

ARCHITECTURAL - TABLE OF CONTENTS

SECTION 000103

PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Identification of project team members and their contact information.

1.02 OWNER:

A. Name: Brigham Young University
   1. Address: Provo, Utah 84602
   2. Telephone: (801) 422-5406

B. Primary Contact: All correspondence from the Contractor to the Architect will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Name: Keith Austin (Construction Project Manager)
   2. Email: keith_austin@byu.edu
   3. Telephone: (801) 404-1531

1.03 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Company Name: BYU Facilities Planning
   2. Primary Contact: Keith Martin
      a. Email: keith_martin@byu.edu
      b. Telephone: (801) 623-8894

B. Interior Designer:
   1. Company Name: BYU Facilities Planning
   2. Primary Contact: Corinne Priest
      a. Email: corinne_priest@byu.edu
      b. Telephone: (801) 422-5640

C. Mechanical Engineering:
   1. Company Name: BYU Facilities Planning
   2. Primary Contact: Barry Holman
      a. Email: barry_holman@byu.edu
      b. Telephone: (801) 921-0919

D. Electrical Engineering:
   1. Company Name: BYU Facilities Planning
   2. Primary Contact: Steve Griffiths
      a. Email: steve_griffiths@byu.edu
      b. Telephone: (801) 376-5238

D. Structural Engineering:
   1. Company Name: Reaveley Engineers
   2. Primary Contact: Mark Harris
      a. Email: mharris@reaveley.com
      b. Telephone: (801) 652-7958

END OF SECTION

SECTION 024100

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Selective demolition of building elements for alteration purposes.

C. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 003100 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.

B. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and

D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

1.03 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.

1.04 SUBMITTALS

A. See Section 9 of General Conditions013000 - Administrative Requirements for submittal procedures.

B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 5 years of experience.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.01 SCOPE

A. Remove and legally dispose of all materials, being demolished, indicated on plans..

B. Remove other items indicated, for salvage, relocation, recycling, and reinstallation.

3.02 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. Comply with applicable requirements of NFPA 241.
   3. Use of explosives is not permitted.
   4. Provide, erect, and maintain temporary barriers and security devices.
   5. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.

6. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
7. 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.
8. 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. Do not begin removal until built elements to be salvaged or relocated have been removed.

D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.

E. Protect existing 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.

F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

G. 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.

H. Perform demolition in a manner that maximizes salvage and recycling of materials.
1. Dismantle existing construction and separate materials.
2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

3.03 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 disrupt public utilities without permit from authority having jurisdiction.

D. 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.

E. 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.

F. 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.

G. Use concrete to plug and cap all open ends of abandoned underground utilities which are to remain in place. Some pipelines and conduits will require flowable fill to be placed in pipe see plans for specific areas. Provo City Standards apply to Provo City Utilities review City requirements and permit for specific direction.

H. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

I. Prepare demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 ABANDONED UTILITIES

A. GPS/Survey of Abandoned and New Utilities.
   1. Coordinate with BYU Construction Project Manager to request BYU Civil Engineer to GPS/Survey abandoned and new utilities that have been installed, capped/plugged and/or abandoned in place before burying the utility.
   2. Provide at least a 24-hour notice.
   3. Utilities include but are not limited to the following: Water, storm & sewer pipelines, valves, hydrants, manholes, catch basins, clean outs, conduits, duct banks, etc.
   4. Contractor will be responsible at their expense to uncover abandoned utilities that have not been properly GPS or surveyed by BYU.

3.05 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 and BYU Construction Project Manager 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 indicated on drawings in locations indicated on drawings.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, 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.

E. 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.

3.06 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; dispose of these materials in a lawful manner.

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 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials

B. Fire retardant treated wood materials

C. Concealed wood blocking, nailers, and supports

D. Miscellaneous wood nailers, furring, and grounds

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

D. PS 1 - Structural Plywood; 2009.

E. PS 20 - American Softwood Lumber Standard; 2015.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.05 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.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir, #2, unless otherwise indicated.
   2. 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.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 0.5 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Other Locations: PS 1, C-D Plugged or better.
   3. Wood structural panels when used in non-combustible type construction shall be fire rated and installed in accordance with the adopted IBC code.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length to achieve full penetration of sheathing substrate.

2.05 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. 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. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. 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.

PART 3 EXECUTION

3.01 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.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific 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.
   10. Flat-panel displays, and media projectors..
   11. Communications and electrical room mounting boards.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.
   4. Size: 48 by 96 inches, installed horizontally at ceiling height.

3.05 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Surface Flatness of Floor: 1/8 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

C. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.06 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Leave carpentry wood work of this section open and accessible for required inspections before covering. The inspections will be executed by the BYU Construction PM.

3.07 CLEANING

A. Waste Disposal: Comply with the requirements of Section 017419 - 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, buried in fill, or in interstitial building spaces.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

D. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

C. Section 064216 - Wood-Veneer Paneling: Shop fabricated custom paneling.

D. Section 081416 - Flush Wood Doors.

E. Section 099123 - Interior Painting: Painting and finishing of finish carpentry items.

F. Section 099300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

C. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2016).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2016, with Errata (2017).

F. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

G. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.

H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

I. PS 1 - Structural Plywood; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.
   2. Provide instructions for attachment hardware and finish hardware.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   2. Include certification program label.

D. Samples: Submit three samples of finish plywood, 12 by 12 inch in size illustrating wood grain and specified finish.

E. Samples: Submit three samples of wood trim 12 inch long.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
   2. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
   3. Provide designated labels on shop drawings as required by certification program.
   4. Provide designated labels on installed products as required by certification program.
   5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect work from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, chair rails, and Miscellaneous Trim: As indicated on drawings.
   2. Valance Work: Clear fir; prepare for paint finish.

2.02 LUMBER MATERIALS

A. Hardwood Lumber: red oak, cherry, maple, walnut species as shown on drawings, Sawn as indicated on drawings, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.03 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.04 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Adhesive for factory-fabricated units: Manufacturer's recommended adhesive for application.

C. Fasteners of size and type to suit application.

D. Fasteners for Exterior Applications: Hot-dipped galvanized steel complying with ASTM A153/A153M; length required to penetrate wood substrate 1-1/2 inch minimum.

E. Concealed Joint Fasteners: Threaded steel.

2.05 ACCESSORIES

A. Lumber for Shimming and Blocking: Softwood lumber of Douglas Fir species.

B. Primer: As specified in Section 099000.

C. Wood Filler: Water base, tinted to match surface finish color.

2.06 HARDWARE

A. Hardware: Comply with BHMA A156.9.

B. Shelf Standards: KV 85 Series style, Anochrome finish; Double Slotted Standards manufactured by Knape and Vogt, KV.

C. Shelf Brackets: KV 185 style, Anochrome finish; Extra Duty Bracket manufactured by Knape and Vogt, KV.

2.07 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.08 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

E. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

C. See Section 061000 for installation of recessed wood blocking.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS
Kingspan Insulated Panels
QuadCore® Optimo® Insulated Wall Panel System

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Steel faced, QuadCore® (polyisocyanurate) metal wall panels.

B. Accessories including fasteners and perimeter trim.

1.2 REFERENCES

A. American Architectural Manufacturers Association (AAMA)

1. AAMA 501.1: Standard Test Method for Metal Curtain Walls for water penetration using Dynamic Pressure.
2. AAMA 501.2: Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls and Sloped Glazing Systems.

B. American Society of Civil Engineers (ASCE)

1. ASCE 7: Minimum Design Loads for Buildings and Other Structures.

C. ASTM International

1. ASTM A480: Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
2. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
3. ASTM A755: Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
4. ASTM A792: Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot–Dip Process
5. ASTM A924: Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
6. ASTM B117: Standard Practice for Operating Salt Spray (Fog) Apparatus

7. ASTM B209: Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
8. ASTM C209: Standard Test Methods for Cellulosic Fiber Insulating Board
9. ASTM C273: Standard Test Method for Shear Properties of Sandwich Core Materials.
10. ASTM C518: Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
11. ASTM C920: Standard Specification for Elastomeric Joint Sealants
12. ASTM D224; Standard Specification for Smooth-Surfaced Asphalt Roll
13. ASTM D522: Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
14. ASTM D523: Standard Test Method for Specular Gloss
15. ASTM D714: Standard Test Method for Evaluating Degree of Blistering of Paints
16. ASTM D968: Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
17. ASTM D1308: Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
18. ASTM D1621: Standard Test Method for Compressive Properties of Rigid Cellular Plastics
19. ASTM D1622: Standard Test Method for Apparent Density of Rigid Cellular Plastics
20. ASTM D1623: Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics
21. ASTM D1654: Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
22. ASTM D1929: Standard Test Method for Determining Ignition Temperature of Plastics
23. ASTM D2126: Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
24. ASTM D2244: Standard practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
25. ASTM D2247: Standard Practice for Testing Water Resistance of Coatings in 100 percent Relative Humidity
26. ASTM D2794: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
27. ASTM D3273: Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
28. ASTM D3359: Standard Test Methods for Measuring Adhesion by Tape Test
29. ASTM D3363: Standard Test Method for Film Hardness by Pencil Test
30. ASTM D4145: Standard Test Method for Coating Flexibility of Prepainted Sheet
31. ASTM D4214: Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films
32. ASTM D5894: Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a UV Condensation Cabinet)

33. ASTM D6226: Standard Test Method for Open Cell Content of Rigid Cellular Plastics.
34. ASTM E72: Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
35. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials
36. ASTM E90: Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
37. ASTM E283: Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
38. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
39. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
40. ASTM G153: Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials
41. ASTM G154: Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials

D. FM Global (FM)

1. Approval Standard 4880; Class 1 Fire Rating of Insulated Wall or Wall and Roof/Ceiling Panels, Interior Finish Materials or Coatings, and Exterior Wall Systems.
2. Approval Standard 4881; Class 1 Exterior Wall Systems.
3. Approval Standard 4882; Class 1 Interior Wall and Ceiling Materials or Systems for Smoke Sensitive Occupancies

E. International Building Code (IBC): current edition

F. National Fire Protection Agency (NFPA)

1. NFPA 259: Standard Test Method for Potential Heat of Building Materials.
2. NFPA 268: Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
3. NFPA 285: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

G. International Organization for Standardization (ISO)

1. ISO 14025: Environmental Labels and Declarations

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation meeting: Conduct a pre-installation meeting at the job site attended by Owner, Architect, Manufacturer's Technical Representative, Panel Installer, and Contractors of related trades. Coordinate structural support requirements in relation to insulated wall panel system, installation of any separate air/water barriers, treatment of fenestration, and other requirements specific to the project.

1.4 SUBMITTALS

A. Refer to Section [01 33 00 Submittal Procedures] [insert section number and title].

B. Product Data: Submit manufacturer current technical literature for each type of product.

C. Shop Drawings: Submit detailed drawings and panel analysis showing:

1. Profile
2. Gauge of both exterior and interior sheet
3. Location, layout and dimensions of panels
4. Location and type of fasteners
5. Shape and method of attachment of all trim
6. Locations and type of sealants
7. Installation sequence
8. Coordination Drawings: Provide elevation drawings and building sections which show panels in relationship to required locations for structural support. Include panel details and details showing attachment to structural support.
9. Other details as may be required for a weathertight installation

D. Panel Analysis: Provide panel calculations to verify panels will withstand the design wind loads indicated without detrimental effects or deflection exceeding L/180. Include effects of thermal differential between the exterior and interior panel facings and resistance to fastener pullout.

E. Samples: Provide nominal 3 x 5 inch of each color indicated.

F. Miscellaneous Certifications:

1. Submit documentation that products have been certified in accordance with ISO 14025.

G. Quality Assurance Submittals

1. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with requirements.

2. Manufacturer Erection Instructions: Provide manufacturer's written installation instructions including proper material storage, material handling, installation sequence, panel location(s), and attachment methods, details and required trim and accessories.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer shall have a minimum of five (5) years experience in the production of insulated wall panels. Manufacturer shall demonstrate past experience with examples of projects of similar type and exposure.
2. Manufacturer to be registered with a Program Operator with a Certified, Environmental Product Declaration, in conformance with ISO 14025, for Insulated Metal Panels.

B. Installer Qualifications: Authorized by the manufacturer and the work shall be supervised by a person having a minimum of five (5) years experience installing insulated wall panels on similar type and size projects.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver panel materials and components in manufacturer's original, unopened, undamaged packaging with identification labels intact.

B. Store wall panel materials on dry, level, firm, and clean surface. Stack no more than two bundles high. Elevate one end of bundle to allow moisture run-off, cover and ventilate to allow air to circulate and moisture to escape.

1.7 WARRANTY

A. Limited Warranty: Standard form in which manufacturer agrees to repair or replace items that fail in materials or workmanship within specified warranty period. The items covered by the warranty include structural performance including bond integrity, deflection and buckling.

1. Warranty Period: Two (2) years from date of Substantial Completion, or 2 years and 6 months from the date of shipment from manufacturer's plant, whichever occurs first.

B. Finish Warranty: Submit Manufacturer's limited warranty on the exterior paint finish for adhesion to the metal substrate and limited warranty on the exterior paint finish for chalk and fade.

C. Thermal Warranty: Standard form in which manufacturer agrees to repair or replace panels that exhibit greater than 10% reduction from published material R-value at time of manufacture as measured in accordance with ASTM C518 within specified warranty period.

1. Warranty Period: Thirty (30) years from date of Substantial Completion or 30 years and 3 months from date of shipment from manufacturer's plant, whichever occurs first.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Kingspan Insulated Panels Ltd. 12557 Coleraine Drive, Caledon, ON L7E 3B5 (866-442-3594); 5202-272nd Street, Langley, B.C. V4W 1S3 (866-442-3594) (www.kingspanpanels.ca);

B. Kingspan Insulated Panels, Inc., 726 Summerhill Drive, Deland, FL 32724 (888-882-5862); 2000 Morgan Road, Modesto, CA 95358 (800-377-5110) (www.kingspanpanels.us)

C. Basis of Design: Kingspan QuadCore® Optimo® wall panel.

2.2 EXTERIOR WALL PANELS

A. Performance Criteria:

1. Structural Test: Structural performance shall be verifiable by witnessed structural testing for simulated wind loads in accordance with ASTM E72 and E330.
2. Freeze / Heat Cycling Test: Panels shall exhibit no delamination, surface blisters, permanent bowing or deformation when subjected to cyclic temperature extremes of minus 36 deg. F to plus 180 deg. F temperatures for twenty one, eight-hour cycles.
3. Water Penetration: There shall be no uncontrolled water penetration through the panel joints at a pressure differential of 20 psf, when tested in accordance with ASTM E331.
4. Dynamic Water Penetration: There shall be no uncontrolled water penetration through the panel assembly at a pressure difference of 15 psf, when tested in accordance with AAMA 501.1.
5. Air Infiltration: Air infiltration through the panel shall not exceed 0.01 cfm/sf at 6.24 psf air pressure differential when tested in accordance with ASTM E283.

6. Humidity Test: Panels shall exhibit no delamination or metal interface corrosion when subjected to plus 140 deg. F temperature and 100 percent relative humidity for a total of 1500 hours (62 days).
7. Autoclave Test: Panels shall exhibit no delamination or shrinkage/melting of the foam core from the metal skins after being subjected in an autoclave to a pressure of 2psig (13.8kPa) at a temperature of plus 218 deg. F (plus 103 deg. C) for a period of 2 1/2 hours.
8. Seismic Performance: Comply with ASCE 7, Section 13, "Seismic Design Requirements for Non-Structural Components". Panels shall be hard-fastened to structure along one edge only such that lateral slippage between panels can occur in the event of seismic activity.
9. Fire Test Response Characteristics: Steel-faced panels with polyisocyanurate (ISO) core shall fully comply with Chapter 26 of International Building Code regarding the use of Foam Plastic.
    a. Flame Spread and Smoke Developed Tests on exposed Insulating Core:
        1) ASTM E84 Flame spread and smoke developed indices:
            a) Flame Spread: 25 or less.
            b) Smoke Developed: 90 or less.
    b. FM 4880: Class I rated per FM Global, panels are approved for use without a thermal barrier and do not create a requirement for automatic sprinkler protection.
    c. FM 4882: Class I rated per FM Global for smoke sensitive occupancies
    d. NFPA 259 Potential Heat Content; established for foam core.
    e. NFPA 268 Ignitability of Exterior Wall Assemblies Using a Radiant Heat Source; successfully passed acceptance criteria.
    f. NFPA 285 Intermediate Scale Multi-story Fire Evaluation; successfully passed acceptance criteria when installed per listed details.
    g. UL 263 Fire Resistive Rating; classified as a component of a fire-rated wall assembly for 1-hour and 2-hour rating Design No. U053 (rated assemblies include appropriate layers of fire-rated Type X Gypsum board).
    h. CAN/ULC S101 Standard Methods of Fire Endurance Tests of Building Construction Materials
        1) Fire Endurance Test – 10 minutes: 3 inch or greater Panels remained in place without joint stitch fastening
        2) Fire Endurance Test – 10 minutes: Less than 3 inch Panels remained in place with joint stitch fastening
    i. ASTM D1929 Minimum Flash and Self Ignition; established for foam core.
    j. S101, S102, S127, S134, S138 UL Canada fire test standards; successfully passed.

10. Windborne Debris rating for Wall Panel:

    a. Meet requirements for high velocity hurricane zone with large missile impact when tested in accordance with FM Standard 4881.

11. Insulating Core: QuadCore® Polyisocyanurate (POLYISO) core, ASTM C591 Type IV, CFC and HCFC free, compliant with Montreal Protocol and Clean Air Act, with the following minimum physical properties:

    a. Core is 95 percent closed cell when tested in accordance with ASTM D6226
    b. Panel shall provide a nominal R-values of 8.0 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 75°F mean temperature and 9.0 [hr·ft2·°F/Btu] per inch thickness when tested in accordance with ASTM C 518 at 35°F mean temperature.
    c. Foam has a density of 2.2 to 2.8 pounds per cubic foot when tested in accordance with ASTM D1622
    d. Compressive Stress: Panels shall have a compressive stress of 24 psi. when tested according to ASTM D1621
    e. Shear Stress: 22 psi when tested in accordance with ASTM C273
    f. Tensile Stress: 24 psi when tested in accordance with ASTM D1623
    g. Oven Aging at 212 degrees F:
        1) 14 days: minus 0.6 percent volume change
        2) Tested according to ASTM D2126
    h. Low Temperature Aging at minus 40 degrees F:
        1) 14 days: minus 0.2 percent volume change
        2) Tested according to ASTM D2126

B. Paint Finish Characteristics:

1. Gloss: 15 ± 5 measured at 60 degree angle tested in accordance with ASTM D523.
2. Pencil Hardness: HB-H minimum tested in accordance with ASTM D3363.
3. Flexibility, T-Bend: 1-2T bend with no adhesion loss when tested in accordance with ASTM D4145.
4. Flexibility, Mandrel: No cracking when bent 180° around a 1/8 mandrel as tested in accordance with ASTM D522.
5. Adhesion: No adhesion loss tested in accordance with ASTM D3359.
6. Reverse Impact: No cracking or adhesion loss when impacted 3000 by inches of metal thickness (lb-in), tested in accordance with ASTM D2794.
7. Abrasion Resistance: Nominal 65 liters of falling sand to expose 5/32 inch diameter of metal substrate when tested in accordance with ASTM D968.
8. Graffiti Resistance: Minimal effect.
9. Acid Pollutant Resistance: No effect when subjected to 30 percent sulfuric acid for 18 hours, or 10 percent muriatic acid for 15 minutes when tested in accordance with ASTM D1308.
10. Salt Fog Resistance: Passes 1000 hours, when tested in accordance with ASTM B117 (5 percent salt fog at 95 deg. F).
11. Cyclic Salt Fog and UV Exposure: Passes 2016 hours when tested in accordance with ASTM D5894.

12. Humidity Resistance: Passes 1500 hours at 100 percent relative humidity and 95 deg. F, with a test rating of 10 when tested in accordance with ASTM D2247, and D714.
13. Color Retention: Passes 5000 hours when tested in accordance with ASTM G153 and G154.
14. Chalk Resistance: Maximum chalk is a rating of 8 when tested in accordance with ASTM D4214, Method A.
15. Color Tolerances: Maximum of 5ΔE Hunter units on panels when tested in accordance with ASTM D2244.

C. Panel Assembly:

1. Panel thickness: [2 inches] thick.
2. Panel width: 40 inches
3. Panel Lengths: [As indicated on Drawings].
4. Panel Attachment: Shall consist of fasteners and stainless steel attachment clip completely concealed within the panel side joint.
5. Horizontal Panel Joint Reveals: [1/8 inch]

6. Vertical Joint Treatments (for horizontal panels):

    a. Panel trimless ends with black gasket insert
    b. Surface mounted aluminum extrusion with reveal and [Flush] [Recessed] aluminum insert
    c. Surface mounted top hat metal flashing

7. Vertical Panel Joint Reveals: 1/8 inch
8. Exterior Face of Panel:

    a. Material:

        1) Steel coil material shall be in accordance with ASTM A755: [AZ50 Galvalume®/ Zincalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792].
        2) Gauge: 22 gauge

    b. Profile: Flat (unprofiled)
    c. Texture: [Smooth]
    d. Exterior Paint Finish Color:

        1) Bright Silver
        2) Finish System:

            a) [1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat.]

b) [1.0 mil. Fluropolymer (PVDF) Two Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) MICA color coat.]
c) [1.5 mil. Fluropolymer (PVDF) Three Coat system: 0.2 mil primer with 0.8 mil Kynar 500 (70 percent) METALLIC color coat and .5 mil clear coat.]
d) [2.4 mil. Fluropolymer (PVDF) Three Coat system: 0.8 mil primer with 0.8 mil Kynar 500 (70 percent) SOLID color coat and 0.8 mil clear coat.]

9. Interior Face of Panel:

a. Material:

1) Steel coil material shall be in accordance with ASTM A755: [AZ50 Galvalume®/ Zincalume® (55 percent aluminum, 45 percent zinc) in accordance with ASTM A792].

b. Profile: Shadowline [Flat (unprofiled)].

1) Shadowline Profile description: Linear striations nominal 0.0625 inch deep by 3/4 inches wide at 3 inches on center.

c. Texture: [Non-directional stucco embossed] [Smooth].
d. Gauge: 26 gauge [24 gauge] [22 gauge].
e. Interior Finish: [modified polyester, dry film thickness of 1.0 mil including primer.]

1) Color: [USDA Imperial White]

2.3 ACCESSORIES

A. Fasteners:

1. Self drilling fasteners shall be corrosion resistant plated steel with neoprene washer, as recommended by manufacturer.
2. Material: Hex-head type with steel and neoprene washer and 12 gauge stainless steel clip supplied by the manufacturer.
3. Size: As recommended by manufacturer.

B. Perimeter Trim:

1. Fabricated perimeter trim and metal flashing: Shall be same gauge, material and coating color as exterior face of insulated metal wall panel.
2. Extruded perimeter trim: Shall be extruded aluminum 6063-T5 alloy with spray applied PVF coating in same color as exterior face of insulated metal wall panel.

C. Sealants: Butyl, non-skinning/curing type as recommended by manufacturer.

D. Butyl Tape: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Provide field measurements to manufacturer as required to achieve proper fit of the preformed wall panel envelope. Measurements shall be provided in a timely manner so that there is no impact to construction or manufacturing schedule.

B. Supporting Steel: All structural supports required for installation of panels shall be by others. Support members shall be installed within the following tolerances:

1. Plus or minus 1/8 inch in 5 feet in any direction along plane of framing.
2. Plus or minus 1/4 inch cumulative in 20 feet in any direction along plane of framing.
3. Plus or minus 1/2 inch from framing plane on any elevation.
4. Plumb or level within 1/8 inch at all changes of transverse for pre-formed corner panel applications.
5. Verify that bearing support has been provided behind vertical joints of horizontal panel systems and horizontal joints of vertical panel systems. Width of support shall be as recommended by manufacturer.

C. Examine individual panels upon removing from the bundle; notify manufacturer of panel defects. Do not install defective panels.

3.2 PANEL INSTALLATION

A. Installation shall be in accordance with manufacturer's installation guidelines and recommendations.

B. Install panels plumb, level, and true-to-line to dimensions and layout indicated on approved shop drawings.

C. Cut panels prior to installing, where indicated on shop drawings, using a power circular saw with fine tooth carbide tip blade per manufacturer's instructions. Personnel should wear respiratory and eye protection devices.

D. Butyl Weather Barrier Sealant:

1. Apply non-skinning butyl sealant as shown on shop drawings and manufacturer's installation instructions as necessary to establish the vapor barrier for the panels.

2. Use non-skinning butyl tube sealant only for tight metal-to-metal contact.
3. Do not use non-skinning butyl tube sealant to bridge gaps.

E. Place panel fasteners through pre-punched holes in attachment clips, concealed within the joint of the panel. Secure units to the structural supports. Space clips as recommended by manufacturer or otherwise indicated on the approved shop drawings.

F. TRIM INSTALLATION

1. Place trim and trim fasteners only as indicated per details on the approved shop drawings.
2. Field drill weep holes where appropriate in horizontal trim; minimum 1/4 inch diameter at 24 inches on center.
3. Place a continuous strip of butyl tube sealant between the inside back face of closure trims and interior panel faces for proper vapor seal.

G. SEALANT INSTALLATION FOR EXPOSED JOINTS

1. Clean and prime surfaces to receive exterior exposed sealants in accordance with sealant manufacturer's recommendations.
2. Follow sealant manufacturer's recommendations for joint width-to-depth ratio, application temperature range, size and type of backer rod, and compatibility of materials for adhesion.
3. Direct contact between butyl and silicone sealants shall not be permitted.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: General Contractor shall engage an independent testing and inspection agency acceptable to the architect to perform field tests and inspections and to prepare reports of findings.

B. Field Water Test: After completing portion of metal wall panel assembly including accessories and trim, test a 2-bay area selected by the architect for water penetration in accordance with AAMA 501.2.

3.4 CLEANING AND PROTECTION

A. Remove protective film immediately after installation.

B. Touch-up, repair or replace metal panels and trim that have been damaged.

C. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

END OF SECTION

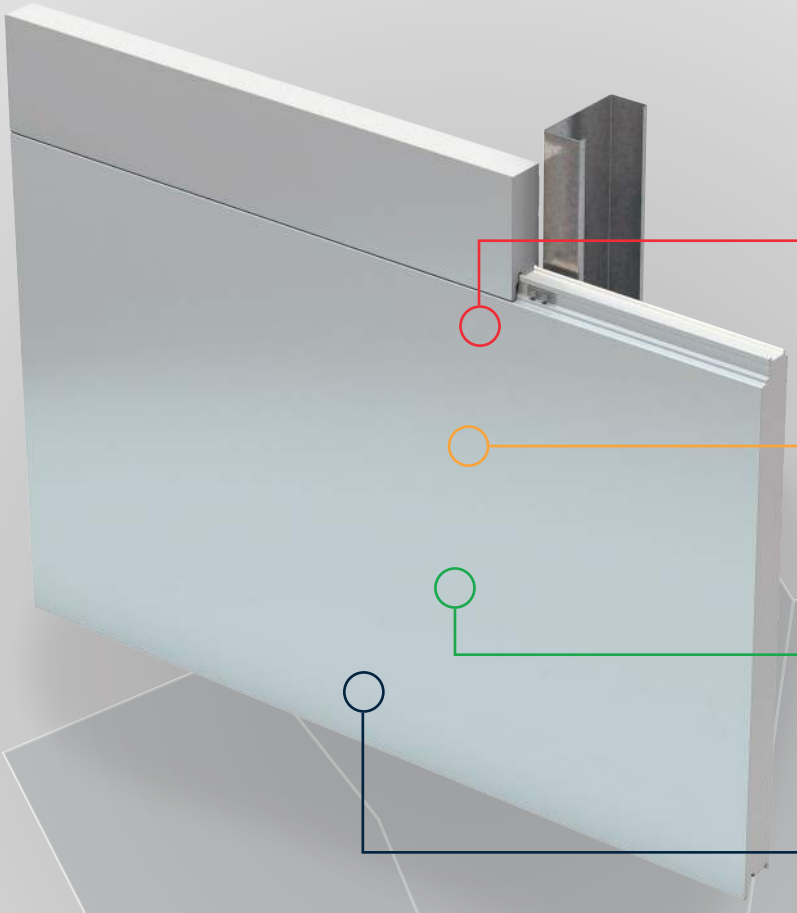
DISCLAIMER:

Kingspan Insulated Panels Guide Specifications have been written as an aid to the professionally qualified Specifier and Design Professional. The use of this Guideline Specification requires the sole professional judgment and expertise of the qualified Specifier and Design Professional to adapt the information to the specific needs for the Building Owner and the Project, to coordinate with their Construction Document Process, and to meet all the applicable building codes, regulations and laws. KINGSPAN INSULATED PANELS EXPRESSLY DISCLAIMS ANY WARRANTY, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE OF THIS PRODUCT FOR THE PROJECT.

Insulated Panels
North America

Protected by Kingspan WARRANTY

QuadCore®
Optimo® Wall Series
Data Sheet



1 Superior **FIRE** Protection

2 Unrivaled **THERMAL** Efficiency

3 Unmatched **HEALTH & WELLNESS** Certification

4 30-Year Thermal **PERFORMANCE** Warranty

POWERED BY QuadCore® TECHNOLOGY

Kingspan®

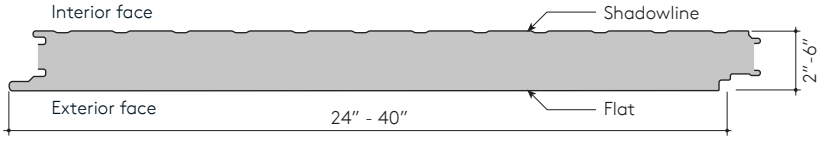
QuadCore® Optimo® Data Sheet

Insulated Wall Panel System

Class-leading performance **in thermal, fire resistance and health & wellness**

Product Specification

Insulation Core:	QuadCore® Technology
Profile:	Exterior: Flat Interior: Shadowline or flat
Embossing:	Exterior: Stucco or non-embossed Interior: Stucco or non-embossed
Gauge:	Exterior: 22 ga Interior: 26, 24, 22 ga
Width:	24″, 30″, 36″, 40″
Thickness:	2″, 2.5″, 3″, 4″, 5″, 6″
Length:	Embossed: 8′ - 32′ Non-embossed: 8′ - 20′
Reveal option:	1/8″, 3/8″, 1″, 2″
Orientation:	Vertical or horizontal
Post fabrication (optional):	Trimless ends, folded corners, transverse bends (Manufacturing limitations apply. Please contact us for detailed information)
R-value:	≈ 8 per inch per ASTM C518 @ 75°F mean temperature ≈ 9 per inch per ASTM C518 @ 35°F mean temperature



Applications

KS Optimo® with QuadCore® delivers a flat appearance with a soft non-directional embossed stucco or smooth texture. KS Optimo® with QuadCore® horizontally or vertically applied, uses a patented double seal integrated joint. Standard reveals are 1/8″ for vertical applications, and 3/8″ for horizontal applications.

KS Optimo® with QuadCore® is suitable for new and retrofit applications across the cold storage, commercial and industrial market sectors.

Design Features

The foamed-in-place manufacturing process produces superior panels of consistent high quality that arrive to site ready for quick and easy installation, saving up to 50% in on-site construction time.

Panels are available with optional factory-caulked side joints to save erection labor (not available for cold storage applications).

Customer Options

Kingspan offers a full spectrum of vibrant colors for every color scheme. The high performance coatings provide long-life protection, color and gloss retention. Custom color matching is available to meet individual building designs and creative freedom.

QuadCore® Optimo® Data Sheet

Insulated Wall Panel System

Performance Testing and Approvals

Kingspan insulated panels featuring QuadCore® Technology meet specific building envelope performance criteria and requirements stipulated by US and Canadian building codes.

Test	Procedure	Results
Fire	FM 4880	Passed: Class 1 Fire Rating of Building Panels or Interior Finish Materials*
	FM 4882	Passed: Smoke Sensitive Occupancies Interior and Exterior Use*
	ASTM E84	Flame Spread: 25 or Less / Smoke Developed: 90 or Less
	CAN/ULC-S101	Fire Endurance Tests: 10 min (Fastener conditions vary depending on product thickness. Please contact technical.NA@kingspanpanels.com for detailed information.)"
	CAN/ULC-S102	Flame Spread: 20, Smoke Developed: 45 for panel insulation core
	CAN/ULC-S138	Passed: Fire growth of foamed plastic insulated building panels in a full scale room configuration
	CAN/ULC-S134	Passed: Standard method of test for fire of exterior wall assemblies
	NFPA 259	Tested for potential heat of building materials
	NFPA 285	Passed: Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components
Structural	FM 4881	Passed. For complete wind pressure ratings please contact Kingspan Technical Services or refer to ApprovalGuide.com*
	ASTM E72	Vacuum chamber tested. Panel load / span and deflection tables are available
Thermal Transmission	ASTM C518	**Thermal Performance at 35°F mean temperature** / **Thermal Performance at 75°F mean temperature**

Thermal Performance at 35°F mean temperature		Thermal Performance at 75°F mean temperature	
Thickness	**R-Value**	**Thickness**	**R-Value**
2	18	2	16
2.5	22.5	2.5	20
3	27	3	24
4	36	4	32
5	45	5	40
6	54	6	48

Air Infiltration	ASTM E283	0.003 CFM/ft^2 of Panel Area at 6.24 psf
Water	ASTM E331	No uncontrolled water penetration at 20 psf differential pressure
	AAMA 501.1	Dynamic water pressure testing – no sign of water leakage at 15 psf
Bond Strength	ASTM D1623	Panels tested for tensile bond strength of metal to foam
		Sample placed in an autoclave device and pressurized to 2 PSI at 218°F for 2½ hours
Skin Delamination		No skin delamination with direct pull off pressure up to 1188 psf

*Thickness: 2"-6", Width: 24"-42", Min. panel length: 8', Min. gauge: Exterior 26 ga, Interior 26 ga.
For FM compliance, systems must be installed in accordance with FM installation specifications as detailed on ApprovalGuide.com.
Please contact technical.NA@kingspanpanels.com for detailed information or refer to ApprovalGuide.com.

FM APPROVED

Contact Details

DeLand, FL: 877-638-3266
Modesto, CA: 800-377-5110
www.kingspanpanels.us

Caledon, ON: 866-442-3594
Langley, BC: 877-937-6562
www.kingspanpanels.ca

For the product offering in other markets please contact your local sales representative or visit www.kingspanpanels.com
To ensure you are viewing the most recent and accurate product information, please visit www.kingspanpanels.com

Issue 8.1: 05/2022

SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-sag gun-able joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

D. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

B. Section 071300 - Sheet Waterproofing: Sealing cracks and joints in waterproofing substrate surfaces using materials specified in this section.

C. Section 072500 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.

D. Section 078400 - Firestopping: Firestopping sealants.

E. Section 079513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.

F. Section 087100 - Door Hardware: Setting exterior door thresholds in sealant.

G. Section 092116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

H. Section 092216 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

I. Section 093000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

J. Section 233100 - HVAC Ducts and Casings: Duct sealants.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C834 - Standard Specification for Latex Sealants; 2014.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

E. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015.

J. SWRI (VAL) - SWR Institute Validated Products Directory; Current Listings at www.swrionline.org.

1.04 SUBMITTALS

A. See Section 013000 - 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. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   7. Sample product warranty.
   8. Certification by manufacturer indicating that product complies with specification requirements.
   9. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Owner and Architect and submit at least two physical samples for verification of color of each required sealant.

F. Installation Plan: Submit at least four weeks prior to start of installation.

G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

H. Installation Log: Submit filled out log for each length or instance of sealant installed.

I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Installation Plan: Include schedule of sealed joints, including the following.
   1. Approximate date of installation, for evaluation of thermal movement influence.

E. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Destructive field adhesion testing of sealant joints, except interior sealant joints.
      a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
      b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.
   1. Dow Chemical Company; _____: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Sika Corporation; _____: www.usa-sika.com/#sle.
   3. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.

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. Dow Chemical Company; _____: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
   2. Sika Corporation; _____: www.usa-sika.com/#sle.
   3. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.

2.02 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: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
         2) Exception: Open-, membrane-, and 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.

C. Interior Joints: Use non-sag polyurethane sealant, paintable, unless otherwise indicated.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with levels of volatile organic compound (VOC) content as indicated in Section 016116.

B. Colors: As indicated on drawings.

2.04 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Color: To be selected by Architect from manufacturer's standard range.
   2. Manufacturers:
      a. Dow Chemical Company; 790 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Dow Chemical Company; 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      c. Sika Corporation; Sikasil WS-290: www.usa-sika.com/#sle.
      d. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
      e. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
      f. Tremco Commercial Sealants & Waterproofing; Spectrem 2: www.tremcosealants.com/#sle.
      g. Substitutions: See Section 016000 - Product Requirements.

B. Type ___ - Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 35 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.
   3. Manufacturers:
      a. Substitutions: See Section 016000 - Product Requirements.

C. 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 25 percent, minimum.
   2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Manufacturers:
      a. Sherwin-Williams Company; Stampede-1/-TX Polyurethane Sealant: www.sherwin-williams.com/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.

2.05 SELF-LEVELING SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single-component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
   2. Hardness Range: 0 to 15, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Service Temperature Range: Minus 40 to 180 degrees F.
   5. Manufacturers:
      a. Sika Corporation; Sikasil 728SL: www.usa-sika.com/#sle.
      b. Tremco Commercial Sealants & Waterproofing; Spectrem 900SL: www.tremcosealants.com/#sle.

2.06 ACCESSORIES

A. Backer Rod: Cylindrical open cellular foam rod compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Open Cell: 40 to 50 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

E. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 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.

3.02 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.

3.03 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 sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. 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.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

H. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 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.

END OF SECTION

SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL UPDATED MAY 2022

1.01 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. Sound-rated hollow metal doors and frames.

F. Hollow metal borrowed lites glazing frames.

G. Accessories, including glazing, louvers, and matching panels.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lites.

C. Section 099113 - Exterior Painting: Field painting.

D. Section 099123 - Interior Painting: Field painting.

1.03 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.

1.04 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 A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. 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; 2016.

G. 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; 2015.

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

I. ASTM E413 - Classification for Rating Sound Insulation; 2016.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

K. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

L. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

N. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

P. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

Q. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

R. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

S. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - 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.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Manufacturer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company; _____: www.assaabloydss.com
   2. Curries, an Assa Abloy Group company; _____: www.assaabloydss.com
   3. Steelcraft, an Allegion brand; ____: www.allegion.com
   4. All hardware locations to be per CECO standard locations.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel

conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush.
5. 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. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. 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.

2.03 HOLLOW METAL DOORS

A. Door Finish: Architect to confirm finish with BYU.

B. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.
4. Weatherstripping: Refer to Section 087100.

C. 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 gage, 0.042 inch, minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.

D. 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 gage, 0.042 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (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 inch, nominal.

E. Sound-Rated Interior 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 gage, 0.042 inch, minimum.
   2. Sound Transmission Class (STC) Rating of Door and Frame Assembly: STC of 35, minimum, calculated in accordance with ASTM E413, and tested in accordance with ASTM E90.
   3. Door Thickness: 1-3/4 inch.
   4. Opening Force of Sound-Rated Doors, Non-Fire Rated: 5 lbs., maximum, in compliance with ADA Standards.

2.04 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: Same as hollow metal door.

C. Exterior Door Frames: Face welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. **Frame Metal Thickness: 14 gage, 0.067 inch, minimum. Updated May 2022**
   3. Weatherstripping: Separate, see Section 087100.

D. Interior Door Frames, Non-Fire Rated: Face welded type.
   1. **Frame Metal Thickness: 16 gage, 0.053 inch, minimum. Updated May 2022**
   2. Knock-down door frames are allowed in remodeling applications but not in new construction.

E. Door Frames, Fire-Rated: Face welded type.
   1. Fire Rating: Same as door, labeled.
   2. **Frame Metal Thickness: 16 gage, 0.053 inch, minimum. Updated May 2022**

F. Sound-Rated Door Frames: Face welded type.
   1. **Frame Metal Thickness: 16 gage, 0.053 inch, minimum. Updated May 2022**

G. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

H. Mullions for Pairs of Doors: Fixed, except where removable is indicated, with profile similar to jambs.

I. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

K. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

L. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 088000, factory installed.

B. Astragals for Double Doors: Specified in Section 087100.

C. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.

D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 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.

3.02 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 087100.

F. Comply with glazing installation requirements of Section 088000.

G. Coordinate installation of electrical connections to electrical hardware items.

H. Touch up damaged factory finishes in accordance with the painting sections of this specification.

3.03 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.

3.04 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

3.05 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

SECTION 084313

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of metal and glass.

C. Aluminum doors and frames.

D. Weatherstripping.

E. Door hardware.

1.02 RELATED REQUIREMENTS

A. Section 072500 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.

B. Section 078400 - Firestopping: Firestop at system junction with structure.

C. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 084229 - Automatic Entrances.

E. Section 087100 - Door Hardware: Hardware items other than specified in this section.

F. Section 088000 - Glazing: Glass and glazing accessories.

G. Section 122400 - Window Shades: Attachments to framing members.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

J. 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.

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

L. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2010).

M. 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.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting two weeks before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, 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. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

G. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

H. Report of field testing for water leakage.

I. Designer Qualifications Statement.

J. Manufacturer Qualifications Statement.

K. Installer Qualifications Statement.

L. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 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 Utah.

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.

1.07 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.

1.08 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.

1.09 WARRANTY

A. See Section 017800 - 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 five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer.
   2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Center-Set Style:
   1. Basis of Design: Kawneer.
   2. Vertical Mullion Dimensions: 1-3/4 inches wide by 4-1/2 inches deep (Interior); 2 inches wide by 4-1/2" inches deep, thermally broken (exterior)

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Monolithic Glazing:
   1. Basis of Design: Kawneer.
   2. Thickness: 2 inches. Heavy Wall.

B. Wide Stile, Insulating Glazing, Thermally-Broken:
   1. Basis of Design: Kawneer.
   2. Thickness: 2 inches. Heavy wall.

2.04 MANUFACTURERS

A. Aluminum-Framed Storefront and Doors:
   1. Kawneer North America; _____: www.kawneer.com

2.05 STOREFRONT

A. Aluminum-Framed Exterior Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch insulating glazing.
   2. Glazing Rabbet: For 1/4 inch monolithic glazing.
   3. Glazing Position: Centered (front to back).
   4. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   5. Finish: Class I natural anodized.
   6. Aluminum-Framed Storefront Door Framing Package: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
      a. Glazing Rabbet: For 1 inch insulating glazing.
      b. Glazing Rabbet: For 1/4 inch monolithic glazing.
      c. Glazing Position: Centered (front to back).
      d. Vertical and Horizontal Mullion Dimensions: 2 inches wide by 4-1/2 inches deep. Heavy wall heavy.
      e. Finish: Class I natural anodized.
   7. Finish Requirements:
      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.
   8. Finish Color: As indicated on the drawings.

9. 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.
10. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
11. 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.
12. 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.
13. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
14. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
15. 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.
16. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

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 flexure limit of glass in any direction, with full recovery of glazing materials.
2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf pressure difference.

2.06 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Applied.

B. Glazing: As specified in Section 088000.
1. For Exterior Framing: Type Solarband 70XL #2 surfaced, fully tempered.
2. For Interior Framing: Type 1/4" tempered glass.
3. Glass Spandrel Panels: Type 1/4" tempered glass.

C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
1. Finish: Same as storefront.

D. Swing Doors: Glazed aluminum.
1. Thickness: 2 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Beveled.
6. Finish: Same as storefront.

2.07 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.08 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils thick.

B. Color: As indicated on drawings.

2.09 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all exterior doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all exterior doors.

D. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all exterior doors.

E. Hinges: Geared type, heavy duty, concealed leaf; continuous.

F. Push/Pull Set: Standard configuration push/pull handles.

G. Exit Devices: Panic type.

H. Door Closers: Exposed overhead.

I. Automatic Door Operators and Actuators: As specified in Section 084229.

PART 3 EXECUTION

3.01 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.

3.02 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. Set thresholds in bed of sealant and secure.

J. Install hardware using templates provided.
   1. See Section 087100 for hardware installation requirements.
   2. See Section 084229 for operator and actuator installation requirements.

K. Install glass and infill panels in accordance with Section 088000, using glazing method required to achieve performance criteria.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for independent testing and inspection requirements. Inspection will monitor quality of installation and glazing.

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.
   4. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf.
      a. Maximum allowable rate of air leakage is 0.09 cfm/sq ft.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.06 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. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 088000

GLAZING

PART 1 GENERAL **UPDATED 2/21**

1.01 SECTION INCLUDES **SEE CHANGES IN BOLD**

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

D. Mirrors

1.02 RELATED REQUIREMENTS

A. Section 064100 - Architectural Wood Casework: Cabinets with requirements for glass shelves.

C. Section 084313 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (SM) - GANA Sealant Manual; 2008.

N. **ICC (IBC) - International Building Code; 2018** **Updated 2/21**

O. IGMA TB-3001 - Guidelines for Sloped Glazing; 2001.

P. ITS (DIR) - Directory of Listed Products; current edition.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

R. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2017.

S. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2017.

T. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014, with Errata (2017).

U. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

V. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

W. UL 9 - Standard for Fire Tests of Window Assemblies; Current Edition, Including All Revisions.

X. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Y. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Z. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting two weeks before starting work of this section; require attendance by each of the affected installers.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.08 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.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, inter-pane 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

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. Oldcastle Glass . (obe.com)
   2. Northwestern Industries Inc, NWI (nwiglass.com)

B. Float Glass Manufacturers:
   1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
   2. Guardian Glass, LLC: www.guardianglass.com/#sle.
   3. Pilkington North America Inc: www.pilkington.com/na/#sle.
   4. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

C. Plastic Films Manufacturers:
   1. 3M Window Film; _____: www.3m.com/#sle.
   2. Substitutions: Refer to Section 016000 - Product Requirements.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. **Annealed Type: Not approved for use on Campus. Updated 2/21**
   2. Kind FT - Fully Tempered Type: Complies with ASTM C1048.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.

4. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.06 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" or 1/2" inch, nominal, depending on size of pane and application.
   5. Glazing Method: Dry glazing method, gasket glazing.

2.07 GLAZING COMPOUNDS

A. Type GC-5 - 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; Standard color as selected by Architect.

B. Manufacturers:
   1. Dow Corning Corporation; 795: www.dowcorning.com/construction.
   2. **No Substitutions.** **Updated 2/21**

2.08 ACCESSORIES

A. Setting Blocks: Neoprene, 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 x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: EPDM, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.
   3. Spacer Rod Diameter: As required for application.

D. Glazing Gaskets: Resilient polyvinyl chloride extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 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 the minimum required face and edge clearances are being provided.

C. 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.

D. Verify that sealing between joints of glass framing members has been completed effectively.

E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 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.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. 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-protection spray, plastering, mortar droppings, etc.

G. **Prevent spandrel glazing from contact with batt insulation.** **Updated 2/21**

3.04 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.

3.05 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.06 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.

3.07 PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES UPDATED OCTOBER 2022 AND FEB 2024

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2016.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. UL (FRD) - Fire Resistance Directory; current edition.

1.04 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.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on suspension system components.

C. Samples: Submit two samples 4x4 inch in size illustrating material and finish of acoustical units.

D. Samples: Submit two samples each, 12 inches long, of suspension system main runner.

E. Manufacturer's Installation Instructions: Indicate special procedures. Include information relative to compliance with seismic requirements contained in the International Building Code (IBC).

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 1 percent of total installed, not less than 100 sf.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by 1 for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 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

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. USG: www.usg.com.

B. Suspension Systems:
   1. Same as for acoustical units.
   2. Armstrong World Industries, Inc; Prelude XL: www.armstrong.com.
   3. USG; DONN DX/DL: www.usg.com.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. Units for Installation in Fire-Rated Suspension System: Listed and classified for the fire-resistive assembly as part of suspension system.
   2. VOC Content: Certified as Low Emission by one of the following:

B. **Acoustical Panels Type ACT-2:**
   1. **Size: 24 by 24 inches,**
   2. **Panel Edge: Tegular.**
   3. **Surface Pattern: Perforated.**
   4. **Surface Color: White.**
   5. **Suspension System: Exposed grid.**
   6. **Products:**
      a. **USG Frost 490.** **Updated Feb 2024**
      b. **Armstrong Ultima High NRC 1941A.**

2.03 SUSPENSION SYSTEM(S)

A. 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 Suspension System: Formed steel, commercial quality cold rolled; heavy-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White Painted.

C. Fire-Rated Exposed Steel Suspension System: Formed steel, commercial quality cold rolled; light-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Fire Rating: Listed and classified for use in a 1 hour fire-resistive assembly.
   4. Finish: White painted.

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. 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.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers **and compression struts** will not interfere with other work.

Updated Oct 2022.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with manufacturer's instructions and as supplemented in this section. The installed system must comply with the International Building Code including the seismic requirements of the code and ASTM 580.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to the reflected ceiling plan. Any changes to the ceiling layout must be approved by the owner and architect.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers **and compression struts** with other work. The suspension system must attach to structure and not to the work of any other trades. **Updated Oct 2022**

E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. 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.

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. Refer to manufacture engineering requirements for limitations.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently. Fixtures and equipment exceeding 56 pounds shall be supported to the structure by hangers approved by the ceiling manufacturer.

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.

L. Install USG ACM-7 seismic clips or Armstrong BERC seismic clips in accordance with manufacture recommendations on all perimeter material less than 2". Install seismic clips strategically on wall side versus soffit site when grid terminates in perimeter molding at a soffit line.

M. Each grid member that comes into the perimeter shall be supported by suspension wire connected to structure within 8" of the perimeter. The angle of the wire shall be less than 1 in 6. See ASTM 580/580M.

N. Perimeter moldings shall be attached to studs or backing unless approved otherwise by owner and architect.

O. Partition walls that connect to the ceiling grid below shall also be braced to the structure above using stud kickers @ 8'-0" o.c..

P. Leave all ceiling grid work open and accessible as required for inspection by the BYU Construction PM before proceeding to place the ceiling tile in the grid.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

G. Where round obstructions occur, provide preformed closures to match perimeter molding.

H. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

I. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 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 099113

EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Exposed surfaces of steel lintels and ledge angles.
   3. 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. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
   7. Marble, granite, slate, and other natural stones.
   8. Floors, unless specifically indicated.
   9. Ceramic and other types of tiles.
   10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   11. Exterior insulation and finish system (EIFS).
   12. Glass.
   13. Concrete masonry units in utility, mechanical, and electrical spaces.
   14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 055000 - Metal Fabrications: Shop-primed items.

C. Section 055100 - Metal Stairs: Shop-primed items.

D. Section 099123 - Interior Painting.

E. Section 099600 - High-Performance Coatings.

F. Section 210553 - Identification for Fire Suppression Piping and Equipment: Color coding scheme for items to be painted under this section.

G. Section 220553 - Identification for Plumbing Piping and Equipment: Color coding scheme for items to be painted under this section.

H. Section 230553 - Identification for HVAC Piping and Equipment: Color coding scheme for items to be painted under this section.

I. Section 260553 - Identification for Electrical Systems: Color coding scheme for items to be painted under this section.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 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 2012).

D. ASTM D4259 - Standard Practice for Abrading Concrete; 1988 (Reapproved 2012).

E. ASTM D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete; 2005 (Reapproved 2012).

F. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

H. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

I. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.

J. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.

K. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.

L. SSPC-SP 1 - Solvent Cleaning; 2015.

M. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

N. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

O. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

P. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.05 SUBMITTALS

A. See Section 013000 - 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. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   3. Manufacturer's installation instructions.
   4. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

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 and Owner 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, factory finished metals, and wood doors, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 5% of amount of product used (min 1 gallon, max 20 gallons) of each color, type, surface texture, and sheen; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 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 documented experience and approved by manufacturer. Individuals applicating products with experience in performing the type of work specified with 5 years' experience or working under direct on-site supervision of an individual meeting this requirement.

1.07 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet long by 4 feet wide, illustrating paint color, texture, and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.08 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. Container Label with date purchased indicated.

D. 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.

1.09 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. Minimum Application Temperature for Varnish Finishes: 65 degrees F for exterior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect and owner is obtained using the specified procedures for substitutions.
   2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. Paints:
   1. Manufacturers as listed below for the paint systems and substrates.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 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. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Non flat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
         4) Varnishes: 350 g/L, maximum.
      c. Architectural coatings VOC limits of Utah.
   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 and owner from the manufacturer's full line.

E. Colors: As indicated on drawings. Where color not indicated comply with the following:
   1. Selection to be made by Architect and owner after award of contract.

2. Allow for minimum of four colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Wood, Opaque, Latex, 3 Coat:
   1. Option 1: Benjamin Moore:
      a. One coat of primer sealer. BM 023 Fresh Start Acrylic
      b. Two coats: BM N448 Ultra Spec Exterior Acrylic, Satin
   2. Option 2: PPG
      a. One coat of primer sealer. PPG Exterior Gripper
      b. Two coats: PPG Manor Hall Egg Shell
   3. Option 3: Sherwin Williams
      a. One coat of primer sealer. SW ProBlock B51W620
      b. Two coats: SW A100 Satin

B. Masonry/Concrete, Opaque, Latex, 3 Coat:
   1. Option 1: Benjamin Moore
      a. One coat of block filler. BM Ultra Spec 571.
      b. Finish Coats: Two coats. BM N448 Ultra Spec Exterior 100% Acrylic. Satin
   2. Option 2: PPG
      a. One coat of block filler. PPG 6-7, Speedhide.
      b. Finish Coats: Two coats. PPG Manor Hall. Eggshell.
   3. Option 3: Sherwin Williams
      a. One coat of block filler. SW B25W25 Prep Rite Interior/Exterior Block Filler
      b. Finish Coats: Two coats. SW A100A82W00151. Satin

C. Paint ME-OP-3A - Ferrous Metals, Primed and Unprimed, Alkyd, 3 Coat:
   1. See BYU High Performance System shown below.

D. Galvanized Metals, Railings, metal stairways, Alkyd, 3 Coat:
   1. Prepare as required in Part 3.
   2. See BYU High Performance System shown below.

E. Paint MaE-OP-3A - Aluminum, Unprimed, Alkyd, 3 Coat:
   1. See BYU High Performance System shown below.

F. BYU High Performance System
   1. Primer: PPG Amerlock 400
   2. Finish Coats: Two coats. PPG Pitthane Ultra. Semi-Gloss.

2.04 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: Paint manufacturer-approved filler.

C. Fastener Head Cover Material: Paint manufacturer-approved filler.

PART 3 EXECUTION

3.01 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 and owner of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. 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. Fiber Cement Siding: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
   4. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 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 tri-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 1500 to 4000 psi at 6 to 12 inches. Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.

I. 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.

J. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

K. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

L. Galvanized Surfaces:
   1. Allow for galvanized metal to age as long as possible, minimum 30 days from galvanizing.
   2. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

M. 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 methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 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. Sand metal surfaces lightly between coats to achieve required finish.

H. Vacuum or blow clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing. Prior to reinstall, allow surface to dry thoroughly a minimum of 24 hours or as required by manufacturer.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection and testing.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099123

INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints, stains, and varnishes.

C. Materials for backpriming woodwork.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Surfaces inside cabinets.
   4. Prime surfaces to receive wall coverings.
   5. 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.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. 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 except prime surfaces to receive wall coverings.
   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. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Concrete masonry units in utility, mechanical, and electrical spaces.
   12. Acoustical materials.
   13. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 055000 - Metal Fabrications: Shop-primed items.

C. Section 055100 - Metal Stairs: Shop-primed items.

D. Section 099113 - Exterior Painting.

E. Section 099600 - High-Performance Coatings.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 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 2012).

D. ASTM D4259 - Standard Practice for Abrading Concrete; 1988 (Reapproved 2012).

E. ASTM D4260 - Standard Practice for Liquid and Gelled Acid Etching of Concrete; 2005 (Reapproved 2012).

F. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2015.

G. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.

H. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition, www.paintinfo.com.

I. SCAQMD 1113 - South Coast Air Quality Management District Rule No.1113; current edition.

J. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; Fourth Edition.

K. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; Fourth Edition.

L. SSPC-SP 1 - Solvent Cleaning; 2015.

M. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

N. SSPC-SP 3 - Power Tool Cleaning; 1982 (Ed. 2004).

O. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

P. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015); 2003.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. MPI product number (e.g. MPI #47).
   3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
   4. Manufacturer's installation instructions.
   5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

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 and owner before preparing samples, to eliminate sheens definitely not required.
   3. Allow 30 days for approval process, after receipt of complete samples by Architect.

4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - 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.

1.06 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. Individuals applicating products with experience in performing the type of work specified with 5 years' experience or working under direct on-site supervision of an individual meeting this requirement.

1.07 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Locate where directed by Architect.

C. Mock-up may remain as part of the work.

1.08 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. Container Label with date purchased indicated.

D. 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.

1.09 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. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior, unless required otherwise by manufacturer's instructions.

F. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect and owner is obtained using the specified procedures for substitutions.
   2. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.

B. Paints:
   1. PPG Paints: www.ppgpaints.com
   2. Sherwin-Williams Company: www.sherwin-williams.com
   3. Benjamin Moore: www.benjaminmoore.com.
   4. Manufacturers as listed below for the paint systems and substrates.

C. Transparent Finishes:
   1. PPG Paints Deft Interior Clears/Polyurethanes: www.ppgpaints.com
   2. Sherwin-Williams Company: www.sherwin-williams.com
   3. [Benjamin Moore: www.benjaminmoore.com].

D. Stains:
   1. PPG Paints Deft Interior Stains: www.ppgpaints.com
   2. Sherwin-Williams Company: www.sherwin-williams.com
   3. [Benjamin Moore: www.benjaminmoore.com].

E. Primer Sealers: Same manufacturer as top coats.

F. Substitutions: See Section 016000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. 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. SCAQMD 1113 Rule.
      c. CARB (SCM).
      d. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Non flat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
         4) Varnishes: 350 g/L, maximum.

e. Architectural coatings VOC limits of Utah.

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 and owner from the manufacturer's full line.

E. Colors: As indicated on drawings.
1. Allow for minimum of four 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.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 PAINT SYSTEMS - INTERIOR

A. Interior gypsum board surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.

B. Paint I-OP-GB - Interior gypsum board surfaces to be painted, Unless Otherwise Indicated. Normal spaces not requiring special systems for specific spaces and uses included below.
1. Primer: One coat, BM N534 UltraSpec
a. Finish coats: Two coats, BM 550 Regal Select Interior Pearl
2. Option 2: PPG
a. Primer: One coat, PPG 1000 High Hiding Interior Primer Sealer
b. Finish Coats: Two coats, PPG Diamond 350 Semi-Gloss
3. Option 3: Sherwin Williams
a. Primer: One coat, SW Contractors 152 Pro Primer White
b. Finish coats: Two coats, SW ProMar 200 Zero VOC Interior Latex Semi-Gloss Extra
c. Two top coats and one coat primer.

C. Special use area - Animal or Chemical Laboratory Rooms surfaces to be painted, Unless Otherwise Indicated.
1. Special use areas include all painted surfaces such as gypsum board, ceilings, doors, door frames, railings, handrails, guardrails, and balustrades in Animal or Chemical Laboratory Rooms.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Epoxy-Modified Latex.
a. Products:
1) PPG PSX 700 Gloss two coats with PPG Amerlock 400 primer coat.
2) PPG Aquapon WB 98-1 Series with PPG primer per manufacturer recommendations.

D. Ferrous metals except handrails, guardrails and metal stairways.
1. Products: Metal Doors and Frames:
a. Option 1: Primer: one coat BM HP04 ultra spec acrylic metal primer Finish Coats: BM P29 Ultra spec HP Acrylic DTM Semi-gloss.
b. Option 2: Rust oleum Primer Metalmax Finish Coats: Two coats Rust oleum Beyond S-38 Satin
c. Option 3: Primer SW Pro Industrial Procryl Universal Primer. Two Finish Coats: SW 6509-62822 Multi surface acrylic enamel.

E. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.

1. Shop primer by others.
2. One top coat _____.
3. Top Coat: Latex Dry Fall.
    a. Products:
        1) PPG Paints Speedhide Super Tech Water Based Interior Dry-Fog, 6-723XI, Flat.
        2) Sherwin-Williams Waterborne Acrylic Dryfall, Flat.
4. Primer: As recommended by top coat manufacturer for specific substrate.

F. Concrete Floors to be Painted.
1. Two top coats and one coat primer.
2. Top Coat(s): Latex Floor Paint, Gloss.
    a. Products:
        1) PPG Paints Break-Through Interior/Exterior Gloss Water-Borne Acrylic, V71-610 Series.
3. Primer: As recommended by top coat manufacturer for specific substrate.

G. Transparent Finish on Wood.
1. 1 top coat over sanding sealer over stain.
2. Stain: Semi-Transparent Stain for Wood; MPI #90.
    a. Products:
3. Top Coat(s): Clear Water Based Varnish.
    a. Products:
        1) PPG Paints Deft Interior Polyurethane WB Acrylic Satin, DFT 159.
        2) PPG Paints Deft Interior Polyurethane WB Acrylic Semi-Gloss, DFT 158
        3) Sherwin-Williams Wood Classics Waterborne Polyurethane Varnish, Satin.

H. Transparent Finish on Concrete Floors.
1. Sealer: Water Based for Concrete Floors.
    a. Products:
        1) Spartan Straight Seal.

I. Wood, Opaque, Latex, 3 Coat:
1. One coat of latex primer sealer as recommended by top coat paint manufacturer.
2. Semi-gloss: Two coats of latex enamel; PPG Regency, BM Regal Select, PPG Diamond 350.

J. Concrete/Masonry, Opaque, Latex, 3 Coat:
1. One coat of block filler. Follow top coat manufacturers recommendation.
2. Two coats of latex enamel; ____.
    a. Option 1: BM Ultraspec 571 Low Lustre
    b. Option 2: PPG Regency Semi-Gloss
    c. Option 3: Sherwin-Williams ProMar 200 Water based Acrylic, Semi-Gloss

K. Guardrails, Handrails and metal stairways, Galvanized Metals, Unprimed, 3 Coat:
1. One coat of PPG Amerlock 400 Epoxy primer.
2. Two coats; PPG Pitthane Ultra Semi-Gloss.

2.04 PRIMERS

A. Primers: Provide the primer recommended by manufacturer of top coats.

2.05 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

3.01 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. Test shop-applied primer for compatibility with subsequent cover materials.

F. 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. Plaster and Stucco: 12 percent.
   3. Masonry, Concrete, and Concrete Masonry Units : 12 percent.
   4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
   5. Concrete Floors and Traffic Surfaces: 8 percent.

3.02 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 1500 to 4000 psi at 6 to 12 inches. Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.

H. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1500 psi at 6 to 12 inches. Allow to dry.

I. 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.

J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

N. Copper: Remove contamination by steam, high pressure water, or solvent washing.

O. 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.

P. 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 methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

Q. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

R. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

S. Glue-Laminated Beams: Prior to finishing, wash surfaces with solvent, remove grease and dirt.

T. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

U. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 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 in thicknesses specified by manufacturer.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

G. Sand wood and metal surfaces lightly between coats to achieve required finish.

H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

I. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

J. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

PLUMBING & MECHANICAL - TABLE OF CONTENTS

DIVISION 22 – PLUMBING

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

B. Retrofit piping cover system.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

G. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position; 2014.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

J. MFMA-4 - Metal Framing Standards Publication; 2004.

K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

L. NFPA 101 - Life Safety Code; 2015.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

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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 033000.

1.05 SUBMITTALS

A. See Section 013000 - 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.
   1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.

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.

1.06 QUALITY ASSURANCE

A. Comply with current adopted version of IMC and/or ANSI/MSS SP-58.

B. Installer Qualifications for Field-Welding: As specified in Section 055000.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with current adopted version of IMC and or ANSI/MSS SP-58.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor as specified by structural engineer. Include consideration for vibration, equipment operation, and shock loads where applicable.
   5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
   6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
      a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
      b. 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 055000.

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C. 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. Miro Industries_____.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Comply with MFMA-4.
   3. 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.
   4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   5. Minimum Channel Dimensions: 1-5/8 inch width by 1-5/8 inch height.

D. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
   1. Channel Material: Use polyester resin or vinyl ester resin.
   2. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
   3. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: 1/2 inch diameter.
      b. Piping 2" and smaller: 3/8 inch diameter.
      c. Piping 2-1/2" to 4": 1/2 inch diameter.
      d. Piping larger than 4": refer to engineered drawings and/or manufacturer's requirements.
      e. Trapeze Support for Multiple Pipes: refer to engineered drawings and/or manufacturer's requirements.

F. Thermal Insulated Pipe Supports:
   1. General Construction and Requirements:
      a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
      b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with 1 or 1.
      c. Pipe supports to be provided for nominally sized, 2-1/2 inch to 18 inch iron pipes.
      d. Insulation inserts to consist of calcium silicate insulation surrounded by a 90 degree galvanized steel jacketing.
   2. PVC Jacket:
      a. Minimum Service Temperature: Minus 40 degrees F.
      b. Maximum Service Temperature: 180 degrees F.
      c. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 60 mil.
      e. Connections: Brush on welding adhesive.
   3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

G. Pipe Supports:
   1. Liquid Temperatures Up To 140 degrees F:

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a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
b. Support From Below: MSS SP-58 Types 35 through 38.

2. Operating Temperatures from 140 to 446 degrees F:
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.
   b. Roller Support: MSS SP-58 Types 41 or 43 through 46, with appropriate saddle of MSS SP-58 Type 39 for insulated pipe.
   c. Sliding Support: MSS SP-58 Types 35 through 38.

H. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

I. Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

J. Strut Clamps: Two-piece pipe clamp.

K. Strut-Mount Vibration-Damping Routing Clamps (for refrigeration piping).
1. Zinc-plated steel or stainless steel clamp with TPE cushion.
   a. Adjustable metal body with oil and chemical resistant TPE cushion.
   b. Manufacturers:
      1) Hydra-Zorb:
      2) Substitutions: See Section 016000 - Product Requirements.

L. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

M. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

N. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.
1. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
2. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.
3. Pipe Diameter 8 inches: 0.625 inch U-bolt.
4. Pipe Diameter 10 inches: 0.75 inch U-bolt.
5. Pipe Diameter 12 to 16 inches: 0.875 inch U-bolt.
6. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.

O. Pipe Alignment Guides: Galvanized steel.
1. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.
2. Pipe Diameter 10 inches and Larger: Roller type.
3. Pipe Diameter 18 to 30 inches: 1 inch U-bolt.

P. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

Q. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation; _____: www.cooperindustries.com
   b. Unistrut, a brand of Atkore International Inc; _____: www.unistrut.com

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c. Miro Industries.
d. Substitutions: See Section 016000 - Product Requirements.

2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified. Ensure that slip sheet is provided between the pipe support and roofing membrane.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 12 inches under supported component to top of roofing.

R. Pipe Shields for Insulated Piping:
1. General Construction and Requirements:
a. Surface Burning Characteristics: Comply with 1 or 1.
b. Shields Material: 180 degree galvanized steel or aluminum jacketing.
c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
d. Minimum Service Temperature: Minus 40 degrees F.
e. Maximum Service Temperature: 178 degrees F.
f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

S. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow 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.
13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

T. Pipe Installation Accessories:

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1. Copper Pipe Supports: Use pre-manufactured support.
2. PEX Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
3. CPVC Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
4. Thermal Insulated Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
5. Overhead Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
6. Plenum Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
7. Telescoping Pipe Supports: Use pre-manufactured support, except where allowed by Architect.
8. Inserts and Clamps: Use pre-manufactured support, except where allowed by Architect.

2.02 RETROFIT PIPING COVER SYSTEM

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread index/smoke developed index of 20/250, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Materials:
   1. Piping Cover System: Removal-resistant, modular, snap-fit cover units, clips, and anchors for use with CPVC, steel, and copper piping systems.
   2. Cover Units: L-shaped and U-shaped cross-section units of flame retardant resin material, paintable finish.
   3. Unit Length: Per manufacturer.
   4. Provide coupling fittings for joining units end to end and prefabricated inside and outside corner fittings and end caps as required.
   5. Provide mounting clips to secure covers to wall-ceiling per manufacturer requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Field-Welding (where approved by Architect): Comply with Section 055000.

H. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

I. Equipment Support and Attachment:
   1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

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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 4 inch high concrete pad constructed in accordance with Section 033000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

K. Secure fasteners according to manufacturer's recommended torque settings.

L. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL **UPDATED NOV 2021**

1.01 SECTION INCLUDES **THIS COMPLETE SECTION IS UPDATED.**

A. For identification for plumbing piping and equipment comply with Section 230553 - Identification for HVAC Piping and Equipment.

END OF SECTION

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SECTION 220719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glass Fiber insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 099113 - Exterior Painting: Painting insulation jacket.

C. Section 099123 - Interior Painting: Painting insulation jacket.

D. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

E. Section 232113 - Hydronic Piping: Placement of hangers and hanger inserts.

F. Section 232213 - Steam and Steam Condensate Piping: Placement of hangers and hanger inserts.

G. Section 232300 - Refrigerant Piping: Placement of inserts.

1.03 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 C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015a.

E. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

F. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

G. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

H. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

I. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

J. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

K. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.

L. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.

M. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

N. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2016.

O. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).

P. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2017.

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Q. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2016.

R. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

S. ASTM C1410 - Standard Specification for Cellular Melamine Thermal and Sound-Absorbing Insulation; 2014.

T. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2010 (Reapproved 2015).

U. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

V. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

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

Y. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

Z. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

AA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - 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.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

C. Protect from moisture, sun, elements.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

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B. Insulation shall have a 'K' value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

2.02 GLASS FIBER

A. Manufacturers:
   1. CertainTeed Corporation; _____
   2. Johns Manville Corporation; _____
   3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation
   4. Owens Corning Corporation
   5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
   1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
   2. Maximum Service Temperature: 650 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.03 JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation; _____
      b. Substitutions: See Section 016000 - Product Requirements.
   2. Jacket: One piece molded type fitting covers and sheet material, 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 and/or tacks.
   3. Covering Adhesive Mastic: Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth or embossed.
   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; 0.015 inch thick aluminum, or
   6. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

C. Stainless Steel Jacket: ASTM A666, Type 316 stainless steel.
   1. Thickness: 0.010 inch.
   2. Finish: Smooth for interior appications, corrugated for exterior.
   3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

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3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, roof drain bodies, and expansion joints.

E. Install cellular melamine with factory-applied jackets with a manufacturer-approved adhesive along seams, both straight lap joints and circumferential lap joints.
   1. Install seal over seams with factory-approved room temperature vulcanization (RTV) silicone sealant to ensure a positive vapor barrier seal in outdoor and sanitary washdown environments.

F. Glass fiber insulated pipes conveying fluids below ambient temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

I. 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.

J. Inserts and Shields:
   1. Application: Piping 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.

K. **Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.** Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.

L. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish exposed pipe in Mechanical Equipment Rooms with PVC jacket and fitting covers. Finish exposed pipe in Finished Spaces with paper and foil scrim suitable for appication of paint, or PVC jacket and fitting covers. Coordinate with owner.

M. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

N. Minimum pipe insulation thicknesses (in inches):
   1. Cold Piping:

a. Potable cold water piping, chilled domestic water supply and return, roof drain bodies, interior above-ground storm water piping, including roof drain, deck drain and landscape drain piping and plumbing vents within 6 lineal feet of roof or wall outlet.
   1) Glass fiber with jacket, self sealing lap: 1" thickness.
   2) Flexible elastomeric: 1/2" thickness.

2. Hot Piping:
   a. Potable hot water piping, potable hot water recirculating piping and hot drain piping.
      1) Glass fiber with jacket, self sealing lap: 1" thick for pipe sizes up to and including 2"; 1-1/2" thick for pipe sizes over 2".
      2) Flexible elastomeric: 1/2" thick for pipe sizes up to and including 2" (largest size permitted) with contact cement or heat fused joints.

FT (°F)	Insulation Conductivity		Nominal pipe or tube size (inches)				
	Conductivity	TR (°F)	< 1	1 to < 1½	1½ to < 4	4 to < 8	≥ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	50	0.5	1.0	1.0	1.0	1.5

FT = Fluid Operating Temperature Range and Usage

TR = Mean Temperature Rating

Conductivity units are shown in $\frac{btu \cdot in}{h \cdot ft^2 \cdot °F}$

END OF SECTION

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SECTION 221005

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Domestic water.
   3. Flanges, unions, and couplings.
   4. Pipe hangers and supports.
   5. Valves.
   6. Strainers.

1.02 RELATED REQUIREMENTS

A. Section _____: Roof penetrations.

B. Section 078400 - Firestopping.

C. Section 083100 - Access Doors and Panels.

D. Section 099113 - Exterior Painting.

E. Section 099123 - Interior Painting.

F. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.

G. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

H. Section 220553 - Identification for Plumbing Piping and Equipment.

I. Section 220719 - Plumbing Piping Insulation.

J. Section 312316 - Excavation.

K. Section 312323 - Fill.

L. Section 330110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 2015.

B. ANSI Z223.1 - National Fuel Gas Code; 2016.

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 B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.

F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

H. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2016.

I. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

J. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

K. ASME B31.1 - Power Piping; 2016.

L. ASME B31.9 - Building Services Piping; 2014.

M. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2017.

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N. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.

O. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.

P. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

Q. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

R. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.

S. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

T. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

U. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

V. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

W. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

X. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

Y. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

AA. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

AB. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

AC. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

AD. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015a.

AE. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe and (Metric); 2015a.

AF. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2016.

AG. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2016.

AH. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012 (Reapproved 2017).

AI. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011 (Reapproved 2017).

AJ. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

AK. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

AL. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2016).

AM. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012a.

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AN. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

AO. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2017.

AP. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2016a.

AQ. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

AR. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2015.

AS. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

AT. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

AU. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.

AV. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

AW. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2017a.

AX. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.

AY. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.

AZ. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

BA. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2015.

BB. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.

BC. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

BD. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2015.

BE. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.

BF. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014.

BG. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

BH. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core; 2012e2.

BI. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2016.

BJ. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2014).

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BK. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing; 2015a.

BL. ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems; 2011a.

BM. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2011.

BN. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe; 2010.

BO. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.

BP. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

BQ. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

BR. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

BS. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

BT. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

BU. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2013.

BV. AWWA C606 - Grooved and Shouldered Joints; 2015.

BW. AWWA C651 - Disinfecting Water Mains; 2014.

BX. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2016.

BY. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2008.

BZ. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).

CA. 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; 2011 (Revised 2012).

CB. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

CC. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

CD. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

CE. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2016.

CF. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

CG. MSS SP-67 - Butterfly Valves; 2011.

CH. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

CI. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

CJ. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

CK. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

CL. NSF 61 - Drinking Water System Components - Health Effects; 2016.

CM. NSF 372 - Drinking Water System Components - Lead Content; 2016.

CN. PPI TR-4 - PPI Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings For Thermoplastic Piping Materials or Pipe; 2016.

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CO. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Conform to ASME BPVC-IX.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including ASTM material classification, ASTM specification, potable water certification, water pressure rating.

F. All pipe, fittings, and products shall be domestic only.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 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.

B. Steel Pipe: ASTM A53/A53M Schedule 40, galvanized, using one of the following joint types:
   1. Flanged Joints: ASME B16.1 cast iron fittings.
   2. Threaded Joints: ASME B16.4 cast iron fittings.

3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.03 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. Fittings: Cast iron, epoxy coated.
   3. Joints: ASTM B32, alloy Sn95 solder, BCuP copper/silver braze.
   4. Joints: Mechanical Press Sealed Fittings; Pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.
      a. Manufacturers:
         1) Anvil International;
         2) Apollo Valves;
         3) Grinnell Products, a Tyco Business;
         4) Viega LLC; _____:
         5) Substitutions: See Section 016000 - Product Requirements.

2.04 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Ferrous pipe: Class 150 malleable iron threaded unions.
   2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or _____, galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
   6. Manufacturers:
      a. Grinnell Products, a Tyco Business; _____: www.grinnell.com
      b. Substitutions: See Section 016000 - Product Requirements.

D. Mechanical Press Fittings, 1/2" to 4":
   1. Manufacturers:
      a. Viega LLC; [_____]: www.viega.com
      b. Apollo Valves; [_____]: www.apollovalves.com
      c. Nibco.
      d. Substitutions: See Section 016000 - Product Requirements.

E. No-Hub Couplings:
   1. Gasket Material: Neoprene complying with ASTM C564.
   2. Heavy Duty Band Material: Stainless steel.
   3. Eyelet Material: Stainless steel.

F. Dielectric Connections: Nipple type for pipes sizes less than 2". 2" and larger, flange type is permitted.

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2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      a. As per drawings.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Steel pedestal with floor flange; fixture attachment.
   6. Rooftop Supports for Low-Slope Roofs: See section 3.03D. Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density polypropylene.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
      f. Manufacturers:
         1) PHP Systems/Design; _____: www.phpsd.com
         2) Uni-Strut.
         3) Miro Industries.
         4) Substitutions: See Section 016000 - Product Requirements.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable, clevis.
   2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes 2-1/2 and Over: Welded steel bracket and wrought steel clamp.
   4. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
   5. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable, clevis.
   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. Hangers for Hot Pipe Sizes 6 Inches and Over: Carbon steel, adjustable, clevis.
   5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   6. Wall Support for Hot Pipe Sizes 6 Inches and Over: Unistrut supports with cast iron pipe roll.
   7. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and steel support.
   8. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and steel support.
   9. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and steel support.
   10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
   1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
   2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
   3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

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4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Substitutions: See Section 016000 - Product Requirements.

2.06 BALL VALVES

A. Manufacturers:
1. Nibco, Inc; _____: www.nibco.com
2. Viega LLC; _____: www.viega.us
3. Apollo.
4. Watts.
5. Milwaukee.
6. Substitutions: See Section 016000 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel ball and stem, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle, solder, threaded, grooved, or Mechanical Press ends.

2.07 STRAINERS

A. Manufacturers:
1. Watts
2. Armstrong International, Inc; Model _____: www.armstronginternational.com
3. Substitutions: See Section 016000 - Product Requirements.

B. Size 2 inch and Under:
1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
3. Installer to remove plug and install ball valve and male hose thread adaptor in its place.

C. Size 1-1/2 inch to 4 inch:
1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.
2. Installer to remove plug and install ball valve and male hose thread adaptor in its place.

D. Size 5 inch and Larger:
1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.
2. Installer to remove plug and install ball valve and male hose thread adaptor in its place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric nipples or flanges wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Piping is not permitted on roofs unless specifically indicated on drawings.

E. Install piping to maintain headroom, conserve space, and not interfere with use of space.

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F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.

H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
   1. Refer to Section 220719.

I. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 083100, and with architectural plans.

J. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

L. Provide support for utility meters in accordance with requirements of utility companies.

M. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
   1. Painting of interior plumbing systems and components is specified in Section 099123.
   2. Painting of exterior plumbing systems and components is specified in Section 099113.

N. Excavate in accordance with Section 312316.

O. Backfill in accordance with Section 312323.

P. Install bell and spigot pipe with bell end upstream.

Q. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.

R. Install water piping to ASME B31.9.

S. 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. For mechanical press joints, refer to manufacturer's instructions.

T. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

U. Sleeve pipes passing through partitions, walls and floors.

V. Inserts:
   1. Provide inserts for placement in concrete formwork.
   2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
   3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

W. Pipe Hangers and Supports:
   1. Install in accordance with ASME B31.9.
   2. Support horizontal piping as indicated.
   3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
   4. Place hangers within 12 inches of each horizontal elbow.
   5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
   6. Support vertical piping as per plumbing code and local AHJ requirements, and at minimum at every floor. Support riser piping independently of connected horizontal piping.
   7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   8. Provide copper plated hangers and supports for copper piping.
   9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
      a. Painting of interior plumbing systems and components is specified in Section 099123.

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b. Painting of exterior plumbing systems and components is specified in Section 099113.

10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 220548.
11. Support cast iron drainage piping at every joint.

X. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

Y. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install globe valves for throttling, bypass, or manual flow control services.

D. Provide lug end butterfly valves adjacent to equipment when provided to isolate equipment.

E. Provide spring loaded check valves on discharge of water pumps.

F. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope or per plumbing code.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 330110.58.

B. Prior to starting work, verify system is complete, flushed and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual is equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with code approved backflow prevention assembly, water meter with by-pass valves, pressure reducing valve, and sand strainer. If service enters below grade and rises through floor, cast in place. If service enters through wall, provide with link seal between concrete core wall and service pipe, or temporary sleeve which is removed and link seal placed in space between service pipe and concrete. Provide anchor plate support at wall, either cast inside wall or bolted inside building.

END OF SECTION

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SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.
B. Urinals.
C. Lavatories.
D. Under-lavatory pipe supply covers.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Owner-furnished fixtures.
B. Section 064100 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.
C. Section 079200 - Joint Sealants: Sealing joints between fixtures and walls and floors.
D. Section 114000 - Foodservice Equipment: Food service sinks.
E. Section 115300 - Laboratory Equipment: Laboratory sinks.
F. Section 123600 - Countertops: Preparation of counters for sinks and lavatories.
G. Section 221005 - Plumbing Piping.
H. Section 221006 - Plumbing Piping Specialties.
I. Section 223000 - Plumbing Equipment.
J. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.
C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
E. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
G. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.
H. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.
I. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2013.
J. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).
K. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
L. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011.
M. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures; 2013.
N. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

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O. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.

P. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2009).

Q. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.

R. ASME A112.19.15 - Bathtub/Whirlpool Bathtubs with Pressure Sealed Doors; 2012.

S. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers; 2005.

T. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015.

U. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

V. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

W. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

X. ASTM D696 - Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between - 30 C and 30 C with a Vitreous Silica Dilatometer; 2016.

Y. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).

Z. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

AA. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.

AB. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

AC. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

AD. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

AE. NSF 61 - Drinking Water System Components - Health Effects; 2016.

AF. NSF 372 - Drinking Water System Components - Lead Content; 2016.

AG. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 013000 - 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.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIRST INSTALL

A. Provide components for installation in first install.

B. First install may remain as part of the Work.

C. Owner shall be invited to participate.

1.07 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.

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1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL

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.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mount, siphon jet flush action.
   1. Bowl: ASME A112.19.2; elongated rim.
   2. Flush Valve: Exposed (top spud).
   3. Flush Operation: manual operated.
   4. Handle Height: 44 inches or less.
   5. Supply Size: 1 inches.
   6. Outlet Size: 1-1/2 inches.
   7. Color: White.
   8. Capacity: 1.6 gpf.
   9. Manufacturers:
      a. Kohler Company;
      d. Toto USA:;
      e. Substitutions: See Section 016000 - Product Requirements.

B. Flush Valves: ASME A112.18.1, piston type, complete with vacuum breaker and control stops that are a ball valve design with check stop and backflow prevention device on flush valve side of control stop. Tru-stop 1010A and accessories.
   1. Manual Operated Type
   2. Exposed Type: Chrome plated, escutcheon.
   3. Capacity: 1.6 gpf.
   4. Manufacturers:
      a. Toto USA; TMT1LN32CP
      b. Substitutions: See Section 016000 - Product Requirements.

C. Seats:
   1. Manufacturers:
      a. Bemis Manufacturing Company; _____1655SSC;
      b. Church Seat Company; _____295C;
      c. Olsonite; _____95SSC:
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Solid white plastic, open front, extended back, self-sustaining hinge, without cover.

2.04 LAVATORIES

A. Lavatory Manufacturers:
   1. Kohler Company;
   2. Zurn Industries, Inc;

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3. Sloan Valve Company;
5. Substitutions: See Section 016000 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, _____ with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression.
1. Drilling Centers: 4 inch.
2. Drilling: Single hole.

D. Supply Faucet Manufacturers:
1. Chicago;
2. Substitutions: See Section 016000 - Product Requirements.

E. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with open grid strainer, water economy aerator with maximum flow of 1.0 gallons per minute, indexed handles.

F. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.
1. Manufacturers:
a. Symmons;.
b. Powers;
c. Watts;
d. Zurn;
e. Honeywell;
f. Apollo;
g. Substitutions: See Section 016000 - Product Requirements.

G. Provide lavatory with combination stop and strainer.

H. Accessories:
1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
2. Quarter turn stops.
3. PEX supplies.
4. Carrier:
a. Manufacturers:
1) Jay R. Smith MFG. Co; _____
2) JOSAM Company; _____
3) Zurn Industries, Inc; _____
4) Substitutions: See Section 016000 - Product Requirements.
b. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.05 UNDER-LAVATORY PIPE SUPPLY COVERS

A. Manufacturers:
1. Plumberex Specialty Products, Inc; Handy-Shield MAXX;
2. TrueBro: Softguard Plus;
3. Substitutions: See Section 016000 - Project Requirements.

B. General:
1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
2. Construction: 1/8 inch PVC with antimicrobial, antifungal and UV resistant properties.
a. Velco fastening system.
b. Comply with ASTM E84 for flame and smoke development.
c. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
d. Comply with ICC A117.1.
3. Color: High gloss white.

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PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in plumbing fixture schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide 3" outlet floor drain with barrier type trap seal protection device below each emergency shower. _____

C. Provide PEX supplies to fixtures with _____stops, reducers, and escutcheons.

D. Install components level and plumb.

E. Install and secure fixtures in place with wall carriers or wall supports and bolts.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures, carriers, wall supports, and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Scheduled Equipment: Nameplates.

B. Air Handling Units: Nameplates.

C. Air Terminal Units: Adhesive label or legible hand-written permanent marker.

D. Automatic Control Sensors, Relays, Actuators: Adhesive label or legible hand-written permanent marker at closest junction box.

E. Control Panels: Nameplates.

F. Dampers: Adhesive label or legible hand-written permanent marker at closest junction box.

G. Heat Transfer Equipment: Nameplates.

H. Piping: Pipe markers.

I. Pumps: Nameplates.

J. Tanks: Nameplates.

K. Valves: Tags.

L. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC;
2. Brimar Industries, Inc;
3. Craftmark Pipe Markers;
4. Kolbi Pipe Marker Co;

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5. Seton Identification Products, a Tricor Direct Company;
6. Substitutions: See Section 016000 - Product Requirements.

B. Letter Color: White.
C. Letter Height: 1/4 inch.
D. Background Color: Black.
E. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Manufacturers:
1. Advanced Graphic Engraving;
2. Brady Corporation;
3. Brimar Industries, Inc;
4. Craftmark Pipe Markers;
5. Kolbi Pipe Marker Co;
6. Seton Identification Products, a Tricor Company;
7. Substitutions: See Section 016000 - Product Requirements.

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. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 PIPE MARKERS

A. Manufacturers:
1. Brady Corporation;
2. Brimar Industries, Inc;
3. Craftmark Pipe Markers;
4. Kolbi Pipe Marker Co;
5. Seton Identification Products, a Tricor Company;
6. Substitutions: See Section 016000 - Product Requirements.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 233423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet exhaust fans.

B. Ceiling exhaust fans.

1.02 RELATED REQUIREMENTS

A. Section 230513 - Common Motor Requirements for HVAC Equipment.

B. Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 233300 - Air Duct Accessories: Backdraft dampers.

D. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 13th Edition, Revised 2017.

F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating; 2013.

G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.

J. ANSI Z9.5 - Laboratory Ventilation; 2012.

K. NEMA MG 1 - Motors and Generators; 2016.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

M. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.

N. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

O. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.04 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.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

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B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.06 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. Coordinate with Owner's commissioning representative, on first install, to confirm compliance of specification requirements.

1.07 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

B. Handling and Storage: Handle and store fan units in accordance with manufacturer's published instructions. Examine units upon delivery for damage. Store units protected from weather.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Greenheck Fan Corporation;

B. Loren Cook Company;

C. Twin City Fan & Blower;

D. Substitutions: See Section 016000 - Product Requirements.

2.02 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: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated.

G. Enclosed Safety Switches: Conform to NEMA 250.

2.05 CABINET EXHAUST FANS

A. Performance Ratings: Scheduled on drawings denoting, minimally, the following information for each fan.
   1. Air Flow: _____ cfm.
   2. Static Pressure: _____ inches wg.
   3. Power: __ Bhp.
   4. Fan RPM: _____.
   5. Electrical Characteristics:
      a. Motor hp.
      b. Motor volts, phase, 60 Hz.

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B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, gravity backdraft damper in discharge.

C. Motor: Resilient mounted. Whenever possible, use direct-drive EC with either speed control potentiometer dial, mounted on the motor or by a 0-10 VDC signal. Motor shall be a minimum of 85% efficient at all speeds.

D. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.

E. Grille: Aluminum with baked white enamel finish.

F. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; fixed motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fans in accordance with Contract documents and manufacturer's published instructions.

B. Install fan units with adequate clearances for service and maintenance.

C. Provide sheaves required for final air balance.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

E. Duct Connections: Drawings indicate general arrangement of ducts and duct accessories. Where indicated on Drawings, make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 section "Air Duct Accessories."
   1. Install connecting ducts with adequate clearances for service and maintenance.

F. Electrical Connections: Connect wiring in accordance with NFPA 70 and Division 26 section "Low-Voltage Electrical Power Conductors and Cables."
   1. Ground and bond equipment according to Division 26 section "Grounding and Bonding for Electrical Systems."

3.02 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Verify that unit is secured to supports, and that duct and electrical connections are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   2. Verify that cleaning and adjusting are complete.
   3. Verify that manual and automatic volume control, and fire and smoke dampers in connected ductwork systems are in fully open position.
   4. Disable automatic temperature-control actuators, energize motor, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   5. Shut unit down and reconnect automatic temperature-control actuators.
   6. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Adjust, clean, and maintain installed fan units in accordance with manufacturer's published instructions

END OF SECTION

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SECTION 260505

SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Section 017000 - Execution and Closeout Requirements: Additional requirements for alterations work.

B. Section 028400 - Polychlorinate Biphenyl (PCB) Remediation: Removal of equipment and materials containing substances regulated under the Federal Toxic Substances Control Act (TSCA), including but not limited to those containing PCBs and mercury.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

B. Any existing equipment or materials to remain or be reused, shall meet current individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Owner and Owner's Construction Project Coordinator, before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Provide temporary wiring and connections to maintain existing systems in service during construction.

C. When work must be performed on energized equipment or circuits, use personnel experienced in such operations, with appropriate safety equipment and practices.

D. 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. Coordinate with Owner at least 72 hours before partially or completely disabling system.
   2. Make temporary connections to maintain service in areas adjacent to work area. In areas where fire alarm system is inoperable, provide fire watch per Division 28.
   3. For occupied buildings, provide a Fire Watch, per Section 284600, for all areas where the fire alarm detection and/or annunciation devices have been removed.

E. Existing Telephone/Data System: Maintain existing system in service until new system is complete and ready for service. Disable system only upon the approval of the Owner's Office of Information Technology (OIT), to make switchovers and connections. Minimize outage duration.
   1. Coordinate with Owner at least 72 hours before partially or completely disabling system.
   2. Notify Owner's Office of Information Technology (OIT) at least 24 hours before partially or completely disabling system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Contractor to perform work for removal of equipment and materials containing toxic substances, regulated under the Federal Toxic Substances Control Act (TSCA), in accordance with Section 028400 and applicable federal, state, and local regulations. Return equipment and materials to Owner's Chemical Management Building, for disposal by the Owner. 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 electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories, complete. Remove ballasts and lamps from light fixtures being abandoned. Place ballasts and lamps in Owner furnished barrels. Ballasts and lamps to be disposed of by the Owner.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.

K. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.

L. Abandoned Work: Cap raceways and patch surface to match existing finish.

M. Remove demolished material from Project site.

N. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

O. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

P. In areas where the electrical panel feeds loads in areas not affected by this project, do not turn off circuit breakers until the entire circuit have been verified to not affect areas outside this project.

3.04 CLEANING AND REPAIR

A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry.

END OF SECTION

SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

UPDATED 2/21

SEE CHANGES IN BOLD

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Underground feeder and branch-circuit cable.
C. Metal-clad cable.
D. Power and control tray cable.
E. Manufactured wiring systems.
F. Aluminum cable terminations.
G. Wiring connectors.
H. Electrical tape.
I. Heat shrink tubing.
J. Oxide inhibiting compound.
K. Wire pulling lubricant.
L. Cable ties.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.
B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
C. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
E. Section 284600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.03 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 (Reapproved 2017).
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 B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2015).
F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2016.
G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

K. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.

L. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

M. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF); 2007.

N. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2009.

O. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. UL 4 - Armored Cable; Current Edition, Including All Revisions.

R. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

S. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

T. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.

U. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

V. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

W. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

X. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables; Current Edition, Including All Revisions.

Y. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

Z. UL 719 - Nonmetallic-Sheathed Cables; Current Edition, Including All Revisions.

AA. UL 1277 - Electrical Power and Control Tray Cables with Optional Optical-Fiber Members; Current Edition, Including All Revisions.

AB. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
   3. Notify Architect and Owner's Construction Project Coordinator, of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - 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. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. Manufactured Wiring System Shop Drawings: Provide plan views indicating proposed system layout with components identified; indicate branch circuit connections.

E. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Project Record Documents:
   1. Underground circuits: Record actual installed circuiting arrangements for all underground/underslab circuits. Provide actual size and length of conductors installed.
      a. Provide actual size and length of conductors installed.
      b. Show all junction box locations. Provide dimensions from building, and other permanent structures.
   2. Building circuits: For conduit sizes 1-1/4" and larger, record actual installed circuiting arrangements for all circuits.
      a. Provide actual size and length of conductors installed.
      b. Show all junction box locations. Include boxes, above ceilings, below elevated floors and other hard to access areas.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Manufactured Wiring Systems Cable Assemblies: One of each configuration, 6 feet length.

1.06 QUALITY ASSURANCE

A. Conform to 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
   1. Exceptions:
      a. Use manufactured wiring systems for branch circuits where concealed under raised floors.
         1) Exception: Provide single conductor building wire in raceway for circuit homeruns from distribution box to panelboard.

b. Use power and control tray cable for installation in cable tray.

C. Nonmetallic-sheathed cable is permitted only as follows:
1. Where not otherwise restricted, may be used:
a. For branch circuit wiring in dry locations within one- and two-family dwellings and their attached or detached garages, and their storage buildings.
b. For branch circuit wiring in dry locations within multifamily dwellings permitted to be of Types III, IV, and V construction.
c. Use permitted by Owner's written approval..
2. In addition to other applicable restrictions, may not be used:
a. Where exposed to view.
b. Where exposed to damage.

D. Metal-clad (MC) cable is permitted only as follows:
1. Where not otherwise restricted, may be used:
a. When approved by Owner.
b. Where concealed above accessible ceilings for final connections from junction boxes to luminaires. **Daisy-chaining of light fixtures is not permitted.**
1) Maximum Length: 8 feet.
c. Areas approved for use with MC Cable: In office areas, conference rooms, labs and classrooms only.
d. Where concealed in hollow stud walls, above accessible ceilings, and under raised floors for branch circuits up to 20 A.
1) Exception: Provide single conductor building wire in raceway for circuit homerun from first outlet to panelboard.
2) Exception: When circuiting multiple rooms on a single circuit, provide single conductor building wire in raceway from circuit homerun panelboard, to each room's pull box.

2. Limitations for use with home run circuiting:
a. Metal-clad cable shall not be permitted for direct connection into panel boards. Provide single conductor building wire in raceway for circuit homerun from panel board to first outlet/pull box. Updated 2/21
3. In addition to other applicable restrictions, may not be used:
a. Unless approved by Owner.
b. Where exposed to view.
c. Where exposed to damage.
d. For damp, wet, or corrosive locations,
e. For isolated ground circuits,

E. Manufactured wiring systems are permitted only as follows:
1. Where not otherwise restricted, may be used:
a. For branch circuits where concealed under carpet flooring and for manufactured furniture systems..
1) Exception: Provide single conductor building wire in raceway for circuit homerun from distribution box to panelboard.
2) Exception: Not permitted for lighting or receptacle circuits, unless listed for manufacturer furniture systems.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

H. Conductors for Grounding and Bonding: Also comply with Section 260526.

I. Conductors and Cables Installed in Cable Tray: Listed and labeled as suitable for cable tray use.

J. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

K. 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.

L. Conductor Material:
   1. Provide copper or aluminum conductors. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
      a. Permitted use of aluminum conductors for copper is permitted, only for the following:
         1) Services: Aluminum conductors size 1/0 AWG and larger.
         2) Feeders: Aluminum conductors size 1/0 AWG and larger.
      b. Where aluminum conductors are substituted for copper, comply with the following:
         1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
         2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
         3) Provide copper equipment grounding conductor sized according to NFPA 70.
         4) Equip electrical distribution equipment with compression ~~mechanical~~ lugs for terminating aluminum conductors. No split bolts or chair lugs, permitted.
   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.
   4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.

M. 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.
         3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
   2. Control Circuits: 14 AWG.

N. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

O. 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.
      b. Color Coding for Power Conductors 600 V and Less: Comply with Section 260553.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Encore Wire Corporation: www.encorewire.com/#sle.
      c. General Cable Technologies Corporation; www.generalcable.com/#sle.
      d. Southwire Company: www.southwire.com/#sle.
      e. Windy City Wire; www.smartwire.com.
      f. Substitutions: See Section 016000 - Product Requirements.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution):
      a. Encore Wire Corporation: www.encorewire.com/#sle.
      b. Southwire Company: www.southwire.com/#sle.
      c. Stabiloy, a brand of General Cable Technologies Corporation; www.stabiloy.com/#sle.
      d. Windy City Wire; www.smartwire.com, 801-633-0651.
      e. Substitutions: See Section 016000 - Product Requirements.

B. Description: Single conductor insulated wire.

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Stranded.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: 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. Size 4 AWG and Larger: Type XHHW-2.
      b. Installed Underground: Type XHHW-2.
      c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
   2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Substitutions: See Section 016000 - 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: Stranded.
   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.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

K. Where used with 0-10v dc dimming, provide dimming cables within metal sheath.

2.05 MANUFACTURED WIRING SYSTEMS

A. Manufacturers:
   1. Steelcase.

B. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.

C. Provide components necessary to transition between manufactured wiring system and other wiring methods.

D. Branch Circuit Cables:
   1. Conductor Stranding (Size 10 AWG and Smaller): Stranded.
   2. Insulation Voltage Rating: 600 V.
   3. Insulation: Type THHN.
   4. Provide dedicated neutral conductor for each phase conductor where indicated or required.
   5. Grounding: Full-size integral equipment grounding conductor.
      a. Provide additional isolated/insulated grounding conductor where indicated or required.
   6. Armor: Steel, interlocked tape.

E. Connectors: Keyed and color-coded to prevent interconnection of different voltages.

F. Fixture Leads: Type TFN insulation.

2.06 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 260526.

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.
   3. Connection for Aluminum Conductors: Use mechanical terminals for all connections.

D. Wiring Connectors for Terminations:
   1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
   2. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
   3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
   4. Aluminum Conductors: Use compression terminals for all connections.
   5. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
   6. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.

H. Push-in Wire Connectors are not permitted on project.

I. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy LLC; www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

J. Compression Connectors: Provide circumferential type or hex type crimp configuration.
   1. Manufacturers:
      a. Burndy LLC; www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

K. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy LLC; www.burndy.com/#sle.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

2.07 WIRING ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
   2. 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.
      a. Substitutions: See Section 016000 - Product Requirements.
   3. 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.
      a. Substitutions: See Section 016000 - Product Requirements.
   4. 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.
      a. Substitutions: See Section 016000 - Product Requirements.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.

6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
    a. Substitutions: See Section 016000 - Product Requirements.
7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
    a. Substitutions: See Section 016000 - Product Requirements.

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.
1. Manufacturers:
    a. 3M: www.3m.com/#sle.
    b. Burndy LLC; www.burndy.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
1. Manufacturers:
    a. Burndy LLC; www.burndy.com/#sle.
    b. Ideal Industries, Inc: www.idealindustries.com/#sle.
    c. Ilsco: www.ilsco.com/#sle.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
1. Manufacturers:
    a. 3M: www.3m.com/#sle.
    b. American Polywater Corporation: www.polywater.com/#sle.
    c. Ideal Industries, Inc: www.idealindustries.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

E. Cable Ties: Material and tensile strength rating suitable for application.
1. Manufacturers:
    a. Burndy LLC; www.burndy.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

B. Pull conduit proofing pulling mandrel through all conduits, 3" or larger. See Section 260533.13 for mandrel pulling requirements.

3.03 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 permitted, under the following conditions:
    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required to account for ampacity derating.
    c. Size raceways, boxes, etc. to accommodate conductors.
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. Aluminum conductors:
    1. Install aluminum conductors in accordance with NECA 104.

E. Install nonmetallic-sheathed cable (Type NM-B) in accordance with NECA 121.

F. Install metal-clad cable (Type MC) in accordance with NECA 120.

G. 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.

H. Exposed Cable Installation (only where specifically permitted):
    1. Route cables parallel or perpendicular to building structural members and surfaces.
    2. Protect cables from physical damage.

I. Installation in Cable Tray: Also comply with Section 260536.

J. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

K. 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.

L. 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.

c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.
d. Use red insulating inserts in all terminated cable ends, per manufacturer's recommendations.

M. Install conductors with a minimum of 12 inches of slack at each outlet.

N. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

O. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

P. 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. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

Q. 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.
b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical 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.

R. Insulate ends of spare conductors using vinyl insulating electrical tape.

S. 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.

T. Identify conductors and cables in accordance with Section 260553.

U. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

V. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 conductors and cables.

END OF SECTION

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

1.02 RELATED REQUIREMENTS

A. Section 096500 - Resilient Flooring: Static control flooring.

B. Section 096900 - Access Flooring.

C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
   1. Includes oxide inhibiting compound.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 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. NFPA 99 - Health Care Facilities Code; 2017.

G. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2017.

H. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Notify Architect and Owner's Construction Project Coordinator, of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the Owner.

B. Do not use products for applications other than as permitted by NFPA 70 and product listing.

C. 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.

D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable

E. Bonding and Equipment Grounding:
   1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways, data racks, communication equipment, cable trays 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. Bonding of metal boxes. Metal boxes shall be grounded with a separate pig-tailed conductor and threaded screw. Provide a fork terminal for connection to box. Wrapping conductors around box grounding screw or post is not acceptable.
   8. Provide bonding for interior metal air ducts.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   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 or compression connectors for underground, concealed and other inaccessible connections.
    a. Exceptions:
        1) Use mechanical connectors for connections to electrodes at ground access wells.
        2) Grounding of communication systems, use compression connectors for concealed and other inaccessible connections.
3. Unless otherwise indicated, use 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/#sle.
    b. Burndy LLC; www.burndy.com/#sle.
    c. Harger Lightning & Grounding; www.harger.com/#sle.
    d. Ilsco.
    e. Thomas & Betts Corporation; www.tnb.com/#sle.
    f. Substitutions: See Section 016000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
    a. Burndy LLC; www.burndy.com/#sle.
    b. Cadweld, a brand of Erico International Corporation; www.erico.com/#sle.
    c. ThermOweld, a brand of Continental Industries, Inc; www.thermoweld.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. 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.

D. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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.

END OF SECTION

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

B. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

C. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

D. Section 265113 - Luminaires, Ballasts, and Drivers: Additional support and attachment requirements for luminaires.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2015.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect and Owner's Construction Project Coordinator, of any conflicts with or deviations from the 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 033000.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal 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. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. 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 055000.

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.
   2. Conduit Clamps: Bolted type unless otherwise indicated.
   3. Use of cable/conduit clips (batwings) are not an approved method for conduit supports.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

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 (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
   3. Channel Material:
      a. Indoor Dry Locations: Use galvanized steel.
      b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
   4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
   5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
   6. Minimum Channel Length 24 inches.
   7. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation; www.cooperindustries.com/#sle.
      b. Thomas & Betts Corporation; www.tnb.com/#sle.
      c. Unistrut, a brand of Atkore International Inc; www.unistrut.com/#sle.
      d. nVent/Caddy.

F. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
   1. Minimum Size, Unless Otherwise Indicated or Required:
      a. Equipment Supports: Hanger rods per equipment manufacturers recommendations or per the recommendations of a licensed structural engineer.
      b. Busway Supports: Hanger rods per equipment manufacturers recommendations or per the recommendations of a licensed structural engineer.
      c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
      d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
      e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
      f. Outlet Boxes: 1/4 inch diameter.
      g. Luminaires: 1/4 inch diameter.

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 2" inches under supported component to top of roofing.
   4. Manufacturers:
      a. Cooper B-Line, a division of Eaton Corporation; www.cooperindustries.com/#sle.
      b. Erico International Corporation; www.erico.com/#sle.
      c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.

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 permitted.
10. Powder-actuated fasteners are permitted.
    a. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are permitted..
    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/#sle.
    b. ITW Red Head, a division of Illinois Tool Works, Inc; www.itwredhead.com/#sle.
    c. Powers Fasteners, Inc; www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc; www.strongtie.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.
15. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc; www.us.hilti.com/#sle.
    b. ITW Ramset, a division of Illinois Tool Works, Inc; www.ramset.com/#sle.
    c. Powers Fasteners, Inc; www.powers.com/#sle.
    d. Simpson Strong-Tie Company Inc; www.strongtie.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from metal roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.

H. Field-Welding (where approved by Architect): Comply with Section 055000.

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 4 inch high concrete pad constructed in accordance with Section 033000.
   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 260533.13.

K. Box Support and Attachment: Also comply with Section 260533.16.

L. Interior Luminaire Support and Attachment: Also comply with Section 265100.

M. Exterior Luminaire Support and Attachment: Also comply with Section 265600.

N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

O. Secure fasteners according to manufacturer's recommended torque settings.

P. Remove temporary supports.

Q. 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.

R. Multiple Raceway trapeze-type support structure minimum width shall be 24 inches, unless specified otherwise. For shorter widths, obtain permission from the Owners engineer, prior to installation. Sized support structure so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - 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 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Intermediate metal conduit (IMC).
C. PVC-coated galvanized steel rigid metal conduit (RMC).
D. Flexible metal conduit (FMC).
E. Liquidtight flexible metal conduit (LFMC).
F. Electrical metallic tubing (EMT).
G. Rigid polyvinyl chloride (PVC) conduit.
H. Electrical nonmetallic tubing (ENT).
I. Liquidtight flexible nonmetallic conduit (LFNC).
J. Conduit fittings.
K. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
B. Section 078400 - Firestopping.
C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
D. Section 260526 - Grounding and Bonding for Electrical Systems.
   1. Includes additional requirements for fittings for grounding and bonding.
E. Section 260529 - Hangers and Supports for Electrical Systems.
F. Section 260533.16 - Boxes for Electrical Systems.
G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
H. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2015.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2015.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
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; 2014.
H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2005 (Reaffirmed 2013).
I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.
J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2016.
K. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

O. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

P. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

R. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

S. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

T. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

U. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

V. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
   5. Notify Architect and Owner's Construction Project Coordinator, of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 013000 - 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. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Conform to 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

D. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

E. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit. Electrical metal conduit (EMT) acceptable for damp locations only where indicated in the Drawings.

F. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. 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.

H. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

I. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Fittings for Grounding and Bonding: Also comply with Section 260526.

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 inch (21 mm mm) trade size.
   4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
   5. Underground, Interior: 3/4 inch (21 mm) trade size.
   6. Underground, Exterior: 1 inch (27 mm) trade size.
   7. **Communication conduits:**
      a. Interior communication conduits: 1 inch (27mm) trade size.
      b. Duct bank conduits:
         1) Minimum conduit bend radii:

(a) Minimum of 48-inch radius bends.

2) No more than two (2) 90 degree bends, per conduit run.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube Company: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - 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/#sle.
   b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions: See Section 016000 - 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.
   a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type, threadless set screw and compression (gland) fittings are permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube Company: www.wheatland.com/#sle.
4. Substitutions: See Section 016000 - 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/#sle.
   b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
   c. Thomas & Betts Corporation: www.tnb.com/#sle.
   d. Substitutions: See Section 016000 - 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.
   a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type, threadless set screw and compression (gland) fittings are permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Thomas & Betts Corporation; www.tnb.com/#sle.
   2. Robroy Industries; www.robroy.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. Interior Coating: Urethane, minimum thickness of 2 mil, where identified on the Drawings.

E. PVC-Coated Fittings:
   1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
   2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
   3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
   4. Material: Use steel.
   5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
   6. Interior Coating: Urethane, minimum thickness of 2 mil, where identified on the Drawings.

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. Substitutions: See Section 016000 - 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/#sle.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel, malleable iron, or die cast zinc.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. Substitutions: See Section 016000 - 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. Substitutions: See Section 016000 - 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.

2.08 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Substitutions: See Section 016000 - 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. Substitutions: See Section 016000 - 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.
   4. Connectors and Couplings: Use compression (gland) or set-screw 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.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Substitutions: See Section 016000 - 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.

2.10 ELECTRICAL NONMETALLIC TUBING (ENT)

A. Manufacturers:
   1. Cantex Inc; www.cantexinc.com/#sle.
   2. Carlon, a brand of Thomas & Betts Corporation; www.carlon.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.

C. Fittings:
   1. Manufacturer: Same as manufacturer of ENT to be connected.
   2. Use solvent-welded type fittings. Snap-on fittings are not permitted.
   3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.11 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. Substitutions: See Section 016000 - Product Requirements.

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
   1. Substitutions: See Section 016000 - Product Requirements.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
   1. Substitutions: See Section 016000 - Product Requirements.

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.
   1. Product: Linkseal.
   2. Other manufacturer's approved through submittal process.
   3. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

I. 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 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. Data conduit systems: Arrange conduit to provide no more than the equivalent of two 90 degree bends between pull points. Three 90 degree bends are acceptable, if one 90 degree bend is located within 5 feet of the first or last box.
8. Arrange conduit to provide no more than [100] feet between pull points.
9. Arrange conduit to maintain adequate headroom, clearances, and access.
10. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
11. Above Grade: Arrange conduit to provide no more than 150 feet between pull points.
12. Below Grade: Arrange conduit to provide no more than 400 feet between pull points.
13. Route conduits above water and drain piping where possible.
14. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
15. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
16. 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.
17. Group parallel conduits in the same area together on a common rack.
18. Elevator shafts and elevator equipment areas. Only conduits associated with the elevator system shall be permitted in the elevator equipment room and elevator shaft area. All other conduit systems shall not be routed through these areas.

J. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
4. 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.
5. 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.
6. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
8. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
9. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
10. Use of spring steel conduit clips for support of conduits is not permitted.
11. Use of wire for support of conduits is permitted only as follows:
    a. For securing conduits to studs in hollow stud walls.
12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

K. 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.

L. 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 modular seal assembly where conduits penetrate through below grade, exterior walls.
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 078400.

M. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316 and Section 312323.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 260553 along entire conduit length.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

P. 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.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   3. Where conduits penetrate coolers or freezers.

R. 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.

S. Provide grounding and bonding in accordance with Section 260526.

T. Identify conduits in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING AND PROOFING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

3.06 SURVEY ALL UNDERGROUND CONDUITS.

A. Prior to burial of exterior conduits, contact Owner's project coordinator, to schedule Owner's survey crew to survey all exterior conduits.

END OF SECTION

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Floor boxes.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260529 - Hangers and Supports for Electrical Systems.

E. Section 260533.13 - 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.

F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 260916 - Electrical Controls and Relays.

H. Section 262725 - Wiring Devices:
   1. Wall plates.
   2. Floor box service fittings.
   3. Poke-through assemblies.
   4. Access floor boxes.
   5. Additional requirements for locating boxes for wiring devices.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

L. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

M. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

N. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
   2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
   4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
   5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
   6. Coordinate the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect and Owner's Construction Project Coordinator, of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, and floor boxes.

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. Project Record Documents: Record actual locations for outlet and device boxes, junction boxes, pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.06 QUALITY ASSURANCE

A. Conform to 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.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

A. General Requirements:
   1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use suitable concrete type boxes where flush-mounted in concrete.
5. Use suitable masonry type boxes where flush-mounted in masonry walls.
6. Use raised covers suitable for the type of wall construction and device configuration where required.
7. Use shallow boxes where required by the type of wall construction.
8. Do not use "through-wall" boxes designed for access from both sides of wall.
9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
11. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
12. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required. For light fixtures 50 pounds and heavier, provide boxes rated at 150% of fixture weight.
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 2-1/8 inch deep (100 by 54 mm) trade size.
    b. Communications Systems Outlets: Comply with Section 271005.
    c. Ceiling Outlets: 4 inch octagonal or square by 2-1/8 inch deep (100 by 54 mm) trade size.
15. Wall Plates: Comply with Section 262725.
16. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation; www.cooperindustries.com/#sle.
    b. Hubbell Incorporated; Bell Products; www.hubbell-rtb.com/#sle.
    c. Hubbell Incorporated; RACO Products; www.hubbell-rtb.com/#sle.
    d. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com/#sle.
    e. Thomas & Betts Corporation; www.tnb.com/#sle.
    f. Bowers.
    g. Substitutions: See Section 016000 - 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 4, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide hinged-cover enclosures, unless otherwise indicated.

4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: For low voltage controls, provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity. Terminal blocks not permitted for Class 1 wiring. Class 1 wiring to utilize wirenut termination methods.
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/#sle.
    b. Hoffman, a brand of Pentair Technical Products; www.hoffmanonline.com/#sle.
    c. Hubbell Incorporated; Wiegmann Products; www.hubbell-wiegmann.com/#sle.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.
1. See Section 271005.

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
1. Manufacturers:
    a. Appleton, a brand of Emerson Industrial Automation; www.emersonindustrial.com/#sle.
    b. Cooper Crouse-Hinds, a division of Eaton Corporation; www.cooperindustries.com/#sle.
    c. Hubbell Incorporated; Killark Products; www.hubbell-killark.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

F. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262725; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
3. Manufacturer: Same as manufacturer of floor box service fittings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 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 262725.
   b. Communications Systems Outlets: Comply with Section 271005.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
   a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
   b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 260529 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 3 inch high concrete pad constructed in accordance with Section 033000.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.

P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. Close unused box openings.

S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

T. Provide grounding and bonding in accordance with Section 260526.

U. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Wire and cable markers.

C. Voltage markers.

D. Identification for conductors.

E. Identification for raceways.

F. Circuit identification of wiring devices.

1.02 RELATED REQUIREMENTS

A. Section 099113 - Exterior Painting.

B. Section 099123 - Interior Painting.

C. Section 260519 - 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 260526 - Grounding and Bonding for Electrical Systems.

E. Section 260533.13 - Conduit for Electrical Systems.

F. Section 262300 - Low-Voltage Switchgear: Factory-installed mimic bus.

G. Section 262725 - Wiring Devices: Electrical power devices.

H. Section 262713 - Electricity Metering: Metering for main service entrance gear.

I. Section 284050 - Conductors and Cables for Fire Detection and Alarm.

J. Section 285600 - Fire Detection and Alarm.

1.03 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; 2017.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - 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.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

B. Coordinate installation of labels, marking, stickers, etc., on devices, conduit, equipment, conductors, etc., after installation and painting phases are complete.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.

B. Identification for Equipment:
   1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
      a. Emergency system boxes and enclosures:
         1) Identify input and output voltage and phase.
         2) Identify power source and circuit number for normal power source. Include location when not within sight of equipment.
         3) Identify load(s) served. Include location.
   2. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
   3. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
   4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
   5. 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.
   6. 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.
   7. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

C. Identification for Conductors and Cables:
   1. Identification for Communications Conductors and Cables: Comply with Section 271005.
   2. Color Coding for Power Conductors and Cables, 600V or Less:
      a. Color Code:
         1) 480Y277 V, 3 Phase, 4 Wire System:

(a) Phase A: Brown.
(b) Phase B: Orange.
(c) Phase C: Yellow.
(d) Neutral/Grounded:
(1) Phase A: Gray with Brown stripe.
(2) Phase B: Gray with Orange stripe.
(3) Phase C: Gray with Yellow stripe.

2) 208Y120 V, 3 Phase, 4 Wire System:
(a) Phase A: Black.
(b) Phase B: Red.
(c) Phase C: Blue.
(d) Neutral/Grounded:
(1) Phase A: White with Black stripe.
(2) Phase B: White with Red stripe.
(3) Phase C: White with Blue stripe.

3) 240/120 V (High-Leg) Delta: 3 Phase, 4 Wire System:
(a) Phase A: Black.
(b) Phase B: (High Leg): Orange.
(c) Phase C: Blue.
(d) Neutral/Grounded:
(1) Phase A: White with Black stripe.
(2) Phase C: White with Blue stripe.

4) 240/120 V, 1 Phase, 3 Wire System:
(a) Phase A: Black.
(b) Phase B: Red.
(c) Neutral/Grounded:
(1) Phase A: White with Black stripe.
(2) Phase B: White with Red stripe.

3. Equipment Ground, All Systems: Green.
4. Isolated Ground, All Systems: Green with yellow stripe.
5. Travelers for 3-Way and 4-Way Switching: Pink and Purple.
6. Color shall be factory applied or field applied for sizes larger than No. 8 AWG
7. Use identification label to identify color code for ungrounded and grounded power conductors and cables, at each piece of feeder or branch-circuit distribution equipment.
8. 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.
   d. In cable tray, at maximum intervals of 20 feet.
9. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.
10. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.

11. Multiple Control and Communication Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.

D. Identification for Raceways and Boxes. For all raceways, 600v and less:
   1. Use paint identification to identify the system cables/conductors, inside the conduit.
   2. Use color-coded paint to identify all, accessible and inaccessible, conduits as follows:
   3. Paint all conduit fittings.
      a. Paint the exterior of pull and junction boxes. Paint the exterior of all box covers.
      b. Paint counduit as it enters/exits wall and floors.
      c. In congested areas, paint bands at 5 foot intervals.
      d. Only paint boxes dimensions that are 12" by 12" and smaller.
      e. Color Code:
         1) Fire-Alarm System: Red.
         2) Fire-Suppression Supervisory and Control System: Red and Yellow.
         3) Security System: Purple
         4) Mechanical and Electrical Supervisory System: Green and Blue.
         5) Telecommunications System: Blue
         6) Emergency/UPS power system: Yellow.
         7) 277/480 volts system: Brown.
         8) 120/208 volts system: Black.
         9) Clocks & Bells: Orange.
         10) Sound System: Green.
         11) Traveler (switch to light or switch to switch) 120 volts: Pink and Black.
         12) Traveler (switch to light or switch to switch) 277 volts: Pink and Brown.
         13) Lighting control and dimmers systems: White.
         14) Field-Painting: Comply with Section 099123 and 099113.
   4. Use underground warning tape to identify underground raceways and duct banks.
   5. For all pull and junction boxes, write the source panel and circuit number on the the inside box cover, with a permanent, waterproof type marker.
   6. Conductors to Be Extended in the Future: Attach write-on tags to raceways and list source.

E. Identification for Raceways. For all raceways, over 600v:
   1. Install self-adhesive labels on 10-foot centers over the full length of the raceway or duct. The labels shall read "DANGER - HIGH VOLTAGE".
   2. Apply to the following finished surfaces:
      a. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
      b. Wall surfaces directly external to raceways concealed within wall.
      c. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

F. Identification for Cable Tray Conductors: Comply with Section 260536.
   1. Use color-coded bands to identify conductors at maximum intervals of 10 feet.
      a. Color-Coded Bands: Use vinyl color coding electrical tape to mark bands 1/2 inch(es) wide.
         1) Color Code:

(a) Fire-Alarm System: Red.
(b) Fire-Suppression Supervisory and Control System: Red and Yellow.
(c) Security System: Purple
(d) Mechanical and Electrical Supervisory System: Green and Blue.
(e) Telecommunications System: Blue
(f) Emergency/UPS power system: Yellow.
(g) 277/480 volts system: Brown.
(h) 120/208 volts system: Black.
(i) Clocks & Bells: Orange.
(j) Sound System: Green.
(k) Traveler (switch to light or switch to switch) 120 volts: Pink and Black.
(l) Traveler (switch to light or switch to switch) 277 volts: Pink and Brown.
(m) Lighting control and dimmers systems: White.

b. Field-Painting: Comply with Section 099123 and 099113.
c. Vinyl Color Coding Electrical Tape: Comply with Section 260519.

2. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
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.

G. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271005.
2. Identification for Fire Alarm Equipment and Devices: Comply with Section 284600.
3. Wiring Device and Wallplate Finishes: Comply with Section 262725.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
5. Use identification label or 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.
6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

H. Identification in Tunnels/Vaults:
1. Where ductbanks enter/exit vaults and tunnels, label the origination point of all conduits. ie., vaults, tunnels building, etc.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Manufacturers:
a. Brimar Industries, Inc: www.brimar.com/#sle.
b. Kolbi Pipe Marker Co; www.kolbipipemarkers.com/#sle.
c. Seton Identification Products; www.seton.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
1. Manufacturers:
   a. Brady Corporation; www.bradyid.com/#sle.
   b. Brother International Corporation: www.brother-usa.com/#sle.
   c. Panduit Corp: www.panduit.com/#sle.
   d. Substitutions: See Section 016000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   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.
   c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.
   a. Exceptions:
      1) Provide white text on red background for general information or operational instructions for emergency systems.
      2) Provide white text on red background for general information or operational instructions for fire alarm systems.

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. Label Type: Machine printed, pressure-sensitive adhesive labels.
5. Minimum Text Height: 3/16 inch.
6. 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. See Section 284600 - Fire Detection and Alarm, for identification of fire alarm devices and equipment.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation; www.bradyid.com/#sle.
2. HellermannTyton; www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 016000 - 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.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:
1. Brady Corporation; www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products; www.seton.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl type markers.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl 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 and voltage 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. Communication and fiber optic cables: Text "COMMUICATION".

F. Color: Black text on orange background unless otherwise indicated.

2.05 CABLE TIES:

A. General Purpose Cable Ties: Fungus Inert, Self Extinguishing, One Piece, Self Locking, Nylon:
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, nylon:
1. Minimum Width: 3/16 inch.
2. For MV cabling, provide 1/4 inch or larger cable ties.
3. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
4. Temperature Range: Minus 40 to plus 185 deg F.
5. Color: Black.

C. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking:
1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 deg F, According to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

D. Use general-purpose type cable ties, with the following exceptions:
1. Exterior: UV-stabilized nylon.
2. Areas of Environmental Air: Plenum rated.

2.06 WARNING SIGNS AND LABELS

A. Manufacturers:
1. Brimar Industries, Inc: www.brimar.com/#sle.
2. Clarion Safety Systems, LLC; www.clarionsafety.com/#sle.
3. Seton Identification Products; www.seton.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. 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 or rigid plastic signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
   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

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Use consistent naming designations, throughout project.

C. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Do not install where label will interfere with maintenance and operation of equipment. 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.

D. Labeling of conduits and cables in Tunnels:
   1. Install labels where upon conduits/cables enter and exit from tunnel. Label every 10 feet, thereafter.

E. Install identification products centered, level, and parallel with lines of item being identified.

F. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

G. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

H. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

I. Secure rigid signs using stainless steel screws.

J. Mark all handwritten text, where permitted, to be neat and legible.

3.03 UNDERGROUND WARNING TAPE:

A. Install continuous, underground-line warning tape. Locate directly above duct bank.

B. Locate warning tape at 6 to 8 inches, below finished grade.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 260583
WIRING CONNECTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 260533.13 - Conduit for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems.

E. Section 262725 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
   2. Determine connection locations and requirements.

B. Sequencing:
   1. Install rough-in of electrical connections before installation of equipment is required.
   2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide wiring device manufacturer's catalog information showing dimensions, configurations, and construction.

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.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
   1. Colors: Conform to NEMA WD 1. Comply with Section 260553 - Identification for Electrical Systems, for device and cable/conductor colors.

2. Cord Construction: NFPA 70, Type SJO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
4. Provide receptacles from same manufacturers as Wiring Devices - Section 26 2726.

B. Wiring Devices: As specified in Section 262725.

C. Flexible Conduit: As specified in Section 260533.13.

D. Wire and Cable: As specified in Section 260519.

E. Boxes: As specified in Section 260533.16.

2.02 EQUIPMENT CONNECTIONS

A. See construction drawings for equipment device requirements.

B. Strain Relief/Support Grip Connections:
1. Provide strain relief for all suspended cables with over 10 in feet drop.
2. Provide strain relief for all wiring devices, suspended from the ceiling. Provide strain relief at both the ceiling and device box connections.
3. Provide flexible conduit connection to all vibrating equipment.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION

SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy Sensors.

B. Dimming Occupancy Sensors.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.16 - Boxes for Electrical Systems.

D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 260573 - Power System Studies.

F. Section 260923 - Modular Lighting Control Systems

G. Section 262725 - Wiring Devices: Devices for manual control of lighting, including wall switches.
   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.

H. Section 265100 - Interior Lighting.

I. Section 265113 - Luminaires, Ballasts, and Drivers.

1.03 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; 2015.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

H. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000, with Errata (2008).

I. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

J. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

M. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

N. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

O. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

P. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

Q. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

R. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the 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. Notify Architect and Owner's Construction Project Coordinator, of any conflicts or deviations from the 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.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
   1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:
   1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Conform to 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.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers (non-dimmming):
   1. Hubbell Incorporated: www.hubbell.com/#sle.
   2. Sensor Switch Inc: www.sensorswitch.com/#sle.
   3. WattStopper: www.wattstopper.com/#sle.
   4. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
   1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
   2. Sensor Technology:
      a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
      b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and audible sound sensing 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. When specified on contract documents.
14. Where wired sensors are indicated, wireless sensors are not acceptable without prior approval of Architect.

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. Finish: Match finishes specified for wiring devices in Section 262725, unless otherwise indicated.
      g. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.
   2. 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 262725, unless otherwise indicated.

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 the drawings, provide line voltage units with self-contained relay, or low votlage units, for use with separate compatible accessory power packs.

c. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Wall 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.
      1) Products:
         (a) Wattstopper, DW-311.
3. 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.
      1) Products:
         (a) Wattstopper, DT-355 series

F. 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.

G. Accessories:
   1. Provide heavy duty coated steel wire protective guards compatible with specified occupancy sensors where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 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.
   2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.

3. Locate wall switch occupancy sensor on strike side of door. 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 262725.

G. Provide required supports in accordance with Section 260529.

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 260553.

J. Occupancy Sensor Locations:
   1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
   2. Locate 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. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

L. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

M. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

N. Where indicated or required, provide cabinet or enclosure in accordance with Section 260533.16 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on dual technology occupancy sensor lenses to block undesired motion detection.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

B. Clean inside of boxes and control enclosures, prior to installing devices, equipment, etc.

3.07 COMMISSIONING

A. See Section 019113 - General Commissioning Requirements for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - 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 262725
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Wall plates.

D. Poke-through assemblies.

1.02 RELATED REQUIREMENTS

A. Section 096900 - Access Flooring.

B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

C. Section 260526 - Grounding and Bonding for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

F. Section 260539 - Underfloor Raceways for Electrical Systems.

G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 260583 - Wiring Connections: Cords and plugs for equipment.

I. Section 260923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.

J. Section 260936 - Modular Lighting Control Systems: Lighting controls, to match accessory receptacles and wallplates specified in this section.

K. Section 262723 - Indoor Service Poles.

L. Section 262913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

M. Section 271005 - Structured Cabling for Voice and Data - Inside-Plant: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Revision H, 2014.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Revision G, 2014.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R2015).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2016.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1310 - Class 2 Power Units; Current Edition, Including All Revisions.

M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

N. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
   3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
   4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
   5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
   6. Notify Architect and Owner's project coordinator, of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

B. Sequencing:
   1. Do not install wiring devices until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
   1. Surge Protection Receptacles: Include surge current rating, voltage protection rating (VPR) for each protection mode, and diagnostics information.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.
   2. Surge Protection 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 016000 - Product Requirements, for additional provisions.
   2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
   3. Extra Keys for Locking Switches: Two of each type.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

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.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in dwelling units and children areas.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Gray with stainless steel wall plate.

C. Wiring Devices Installed in Finished Spaces: Gray with stainless steel wall plate.

D. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

E. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.

F. Wiring Devices Installed in ceilings: White with stainless steel wall plate, except for surge protection receptacles.

G. Isolated Ground Convenience Receptacles: Orange with a stainless steel cover plate.

H. Surge Protection Receptacles: Blue with a stainless steel cover plate.

I. Wiring Devices Connected to Emergency Power: Red with wall plate as specified for wiring devices connected to normal power, but engraved "Emergency".

J. Clock Hanger Receptacles: Gray with stainless steel wall plate.

2.03 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated; www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc; www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; www.legrand.us/#sle.

B. Wall Switches - General Requirements: AC only, quiet operating, extra heavy duty industrial grade, 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 screw actuated binding clamp for back and side 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.

   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

D. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with clear illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

E. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with clear illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

F. Locking Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed switch actuator and maintained contacts; switches keyed alike; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.
   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

G. 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.
   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

H. Locking Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with lever type keyed three position switch actuator and momentary contacts; switches keyed alike; single pole double throw, off with switch actuator in center position.
   1. Products:
      a. Hubbell,
      b. Leviton,
      c. Pass & Seymour,

2.04 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated; www.hubbell.com/#sle.
   2. Leviton Manufacturing Company, Inc; www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; www.legrand.us/#sle.
   4. 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 screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,
   2. Automatically Controlled Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; controlled receptacle marking on device face per NFPA 70; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,
   3. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,
   4. 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.
      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,
   5. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,
   6. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

      a. Products:
         1) Hubbell,
         2) Leviton,
         3) Pass & Seymour,

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.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,
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.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,
4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,
5. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,

E. USB Charging Devices:
1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.
    a. Charging Capacity - Two-Port Devices: 2.1 A, minimum.
    b. Charging Capacity - Four-Port Devices: 4.2 A, minimum.
2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,
3. USB Charging Noncombination Devices: Four-port (Type A); rectangular decorator style.
    a. Products:
        1) Hubbell,
        2) Leviton,
        3) Pass & Seymour,

F. Surge Protection Receptacles:
1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.
    a. Energy Dissipation: Not less than 240 J per mode.
    b. Protected Modes: L-N, L-G, N-G.
    c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.

d. Diagnostics:
1) Visual Notification: Provide indicator light to report functional status of surge protection.

2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
a. Products:
1) Hubbell,
2) Leviton,
3) Pass & Seymour,

G. Clock Hanger Receptacles: See Section 275313 for additional information.

2.05 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated; www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc; www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc; www.legrand.us/#sle.
4. 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. Stainless Steel Wall Plates: Brushed satin finish, 0.032 inch thick, Type 302/304 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

F. Weatherproof Covers for Wet 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.

2.06 FLOOR BOX SERVICE FITTINGS

A. Manufacturers:
1. Hubbell Incorporated; www.hubbell.com/#sle.
2. Thomas & Betts Corporation; www.tnb.com/#sle.
3. Wiremold, a brand of Legrand North America, Inc; www.legrand.us/#sle.

B. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

C. Above-Floor Service Fittings:
1. Coverplate configuration as shown on the drawings.
2. Single Service Pedestal Furniture Feed:
3. Dual Service Pedestal Combination Outlets:
a. Provide barrier to separate line and low voltage compartments.

D. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Round.
b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
2. Single Service Flush Communications Outlets:
a. Cover: Round.

b. Configuration: As shown on the drawings.
c. Voice and Data Jacks: As specified in Section 271005.

3. Single Service Flush Furniture Feed:
   a. Cover: Round.
   b. Configuration: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
4. Dual Service Flush Combination Outlets:
   a. Cover: Round.
   b. Configuration:
      1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
      2) Voice and Data Jacks: As specified in Section 271005.
5. Dual Service Flush Furniture Feed:
   a. Cover: Round.
   b. Configuration:
      1) Power: One 2-1/8 inch by 3/4 inch combination threaded opening(s).
      2) Communications: One 2-1/8 inch by 1 inch combination threaded opening(s).
6. Accessories:
   a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
   b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.07 POKE-THROUGH ASSEMBLIES

A. Manufacturers:
   1. Hubbell Incorporated; www.hubbell.com/#sle.
   2. Thomas & Betts Corporation; www.tnb.com/#sle.
   3. Wiremold, a brand of Legrand North America, Inc; www.legrand.us/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Above-Floor Service Fittings:
   1. Single Service Pedestal Convenience Receptacles:
      a. Configuration: One standard convenience duplex receptacle.
   2. Single Service Pedestal Communications Outlets:
      a. Configuration: One 1 inch bushed opening.
      b. Voice and Data Jacks: As specified in Section 271005.
   3. Single Service Pedestal Furniture Feed:
      a. Configuration: One 3/4 inch knockout.
   4. Dual Service Pedestal Combination Outlets:
      a. Configuration:
         1) Power: One standard convenience duplex receptacle.
         2) Communications: One 1 inch bushed opening.
         3) Voice and Data Jacks: As specified in Section 271005.
      b. Provide barrier to separate line and low voltage compartments.

D. Flush Floor Service Fittings:
   1. Single Service Flush Convenience Receptacles:
      a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
   2. Single Service Flush Communications Outlets:
      a. Voice and Data Jacks: As specified in Section 271005.
   3. Single Service Flush Furniture Feed:

a. Configuration: One 2 inch by 1-1/4 inch combination threaded opening(s).

4. Dual Service Flush Combination Outlets:
   a. Cover: Hinged door(s).
   b. Configuration:
      1) Power: One standard convenience duplex receptacle(s).
      2) Communications:
      3) Voice and Data Jacks: As specified in Section 271005.
5. Dual Service Flush Furniture Feed:
   a. Configuration:
      1) Power: One 3/4 inch threaded opening(s).
      2) Communications: One 1-1/4" threaded opening(s).
6. Accessories:
   a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
   1. Mounting Heights: Unless otherwise indicated, as follows:
      a. Wall Switches: 48 inches above finished floor.
      b. Receptacles: 18 inches above finished floor or 6 inches above counter.
      c. All box height measurements are to the top of the box.
   2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
   3. Where multiple receptacles or wall switches 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 8 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 12 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by inserting conductors into back of device 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. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

K. Install wiring devices plumb and level with mounting yoke held rigidly in place.

L. Install wall switches with OFF position down.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

P. Identify wiring devices and circuiting, in accordance with Section 260553.

Q. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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. Inspect each surge protection receptacle to verify surge protection is active.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 265100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

1.02 RELATED REQUIREMENTS

A. Section 260529 - Hangers and Supports for Electrical Systems.

B. Section 260533.16 - Boxes for Electrical Systems.

C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 260923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

E. Section 262725 - Wiring Devices: Manual wall switches and wall dimmers.

F. Section 265013 - Luminaire Schedule.

1.03 REFERENCE STANDARDS

A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013-08, with 2015 Corrigendum.

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. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

E. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

F. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

G. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; 2015.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.

I. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

J. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2015.

K. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 101 - Life Safety Code; 2015.

N. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

O. UL 1598 - Luminaires; Current Edition, Including All Revisions.

P. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
   2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
   3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
   4. Notify Architect and Owner's Construction Project Coordinator, of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
   2. Ballasts/Drivers: Include wiring diagrams and list of compatible lamp configurations.

D. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 016000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

A. 2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Provide products complying with Federal Energy Management Program (FEMP) requirements.

E. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

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.

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.

2.03 EXIT SIGNS

A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

B. Photoluminescent Exit Signs: Powder-coated sheet aluminum with photoluminescent pigmented material, are not permitted for use on this project.

C. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

2.04 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:
   1. Provide drivers based upon luminaire manufacture's recommodations.
   2. Provide ballasts containing no polychlorinated biphenyls (PCBs).

3. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
4. Electronic Ballasts/Drivers: Inrush currents not exceeding peak currents specified in NEMA 410.

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. Lighting Controls: See Section 260923.
b. Lighting Control Systems: See Section 260936.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 260529.

F. Provide required seismic controls in accordance with Section 260548.

G. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

H. 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. Fixture length shall not exceed 12 ft.
4. Secure surface-mounted, recessed, and pendant-mounted luminaires to framing members or 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.

I. 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.

J. 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 12 feet between supports, as per manufacture recommendations.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

K. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Emergency Lighting Units:
1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

O. Exit Signs:
1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

P. Emergency Power Supply Units:
1. For field-installed units, install inside luminaire unless otherwise indicated. Where installation inside luminaire is not possible, install on top of luminaire.
2. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal ballast(s) in luminaire. Bypass local switches, contactors, or other lighting controls.
3. Remote Power Supply Units: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

Q. Identify luminaires connected to emergency power system in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - 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 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 generator transfer device as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - 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, LED drivers or boards that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION