THE UNIVERSITY OF UTAH®

SPECIFICATIONS
FOR
GENETICS SCIENCE LEARNING CENTER

STATE OF UTAH
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EXPIRES: 05.31.26
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10.30.2024

UNIVERSITY OF UTAH PROJECT NUMBER: #22812
10.30.24 PREPARED BY STUDIO LONG PLAYING + DESIGN CONSULTANTS

STUDIO LP

Division	Section Title

SPECIFICATIONS GROUP

General Requirements Subgroup

CONTRACTOR TO REFERENCE DFCM GENERAL CONDITIONS AND U OF U DESIGN AND CONSTRUCTION STANDARDS

DIVISION 01 - GENERAL REQUIREMENTS

011000 SUMMARY
012500 SUBSTITUTION PROCEDURES
012600 CONTRACT MODIFICATION PROCEDURES
012900 PAYMENT PROCEDURES
013100 PROJECT MANAGEMENT AND COORDINATION
013200 CONSTRUCTION PROGRESS DOCUMENTATION
013233 PHOTOGRAPHIC DOCUMENTATION
013300 SUBMITTAL PROCEDURES
013516 ALTERATION PROJECT PROCEDURES
014000 QUALITY REQUIREMENTS
014200 REFERENCES
015000 TEMPORARY FACILITIES AND CONTROLS
016000 PRODUCT REQUIREMENTS
017300 EXECUTION
017419 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
017700 CLOSEOUT PROCEDURES
017823 OPERATION AND MAINTENANCE DATA
017839 PROJECT RECORD DOCUMENTS
017900 DEMONSTRATION AND TRAINING

Facility Construction Subgroup

DIVISION 02 - EXISTING CONDITIONS

024119 SELECTIVE DEMOLITION

DIVISION 05 - METALS

055213 PIPE AND TUBE RAILINGS

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

061000 ROUGH CARPENTRY
064116 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

079200 JOINT SEALANTS
079219 ACOUSTICAL JOINT SEALANTS
07951313 INTERIOR EXPANSION JOINT COVER ASSEMBLIES

DIVISION 08 - OPENINGS

081113 HOLLOW METAL DOORS AND FRAMES
081416 FLUSH WOOD DOORS
083113 ACCESS DOORS AND FRAMES
08347316 WOOD SOUND CONTROL DOOR ASSEMBLIES
084113 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS
087100 DOOR HARDWARE
088000 GLAZING

DIVISION 09 - FINISHES

092216 NON-STRUCTURAL METAL FRAMING
092900 GYPSUM BOARD
095113 ACOUSTICAL PANEL CEILINGS
095426 SUSPENDED WOOD CEILINGS
096513 RESILIENT BASE AND ACCESSORIES
096543 LINOLEUM FLOORING
096813 TILE CARPETING
097200 WALL COVERINGS
099123 INTERIOR PAINTING

DIVISION 10 - SPECIALTIES

101100 VISUAL DISPLAY UNITS
102600 WALL AND DOOR PROTECTION

DIVISION 12 - FURNISHINGS

122200 CURTAINS AND DRAPES
122413 ROLLER WINDOW SHADES
12362313 PLASTIC-LAMINATE-CLAD COUNTERTOPS
12366116 SOLID SURFACING COUNTERTOPS

END OF TABLE OF CONTENTS

The University of Utah
U FACILITIES

G E N E R A L C O N D I T I O N S

September 1, 2020

Table of Contents

The University of Utah
U FACILITIES

G E N E R A L C O N D I T I O N S

September 1, 2020

THESE GENERAL CONDITIONS ("General Conditions") are part of and subject to the Contractor's Agreement (defined below) between University of Utah (defined below) and Contractor (defined below).

ARTICLE 1. GENERAL PROVISIONS.

1.1 DEFINITIONS.

ARCHITECT/ENGINEER OR A/E. "Architect / Engineer" or "A/E" means the person or entity practicing as a design professional, including architect, engineer, interior designer, and/or landscape architect, retained under separate agreement with University to act on behalf of University according to the Contract Documents (defined below) and the A/E's employees, representatives and consultants. For Work (defined below) where there is no A/E hired by University, references in these General Conditions to A/E shall be deemed to refer to University's Representative.

ADDENDA. "Addenda" means the written or graphic instruments issued prior to the execution of the Contractor's Agreement (defined below) that clarify, correct, or change the bidding documents or the Contract Documents.

A/E's SUPPLEMENTAL INSTRUCTION OR ASI. "A/E's Supplemental Instruction" or "ASI" means a supplemental instruction issued by the A/E to Contractor that results in a clarification, correction, or minor change in the Work and does not affect the Contract Time (defined below) or the Contract Price (defined below).

AMENDMENT. "Amendment" means any document or communication that changes (or purports to change) the terms of Contractor's Agreement and/or the General Conditions, except as to: (1) scope of the Work; (2) Contract Price; and/or (3) Contract Time. With the exception of Supplemental General Conditions (defined below), no Amendment shall be valid and/or binding on University unless: (1) the Amendment is set forth in a separate document, clearly titled "Amendment"; and (2) the Amendment is specifically and expressly accepted in writing by the Executive Director (defined below).

BID. "Bid" means the offer or proposal of the bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

BONDS. "Bonds" means collectively the bid bond, performance bond, payment bond, and any other instruments of security.

CHANGE ORDER. "Change Order" means a written instrument signed by both University and Contractor, issued after the execution of the Contractor's Agreement on University's form, authorizing: (1) a change in the Work; (2) an adjustment of the Contract Price; and/or (3) an adjustment of the Contract Time.

CLAIM. "Claim" means a dispute, demand, assertion or other matter submitted by Contractor, including a subcontractor at any tier, subject to the provisions of these General Conditions. The claimant may seek, as a matter of right, modification, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. A request for Preliminary Resolution Effort ("PRE") (defined below) shall not be considered a "Claim". A request for an amendment of the Contract Documents, requested Change Order or a Construction Change Directive ("CCD") (defined below) is not a PRE or Claim unless agreement cannot be reached, and the procedures of these General Conditions are followed.

CONSTRUCTION CHANGE DIRECTIVE. "Construction Change Directive" means a written order signed by University, issued after execution of the Contractor's Agreement, directing Contractor to perform a change in the Work and stating a proposed basis for adjustment, if any, in the Contract Price and/or Contract Time.

CONTRACT DOCUMENTS. "Contract Documents" means collectively Contractor's Agreement, these General Conditions of Contractor's Agreement, applicable Supplemental General Conditions, Drawings (defined below), Specifications (defined below), Addenda, other documents listed in the Contractor's Agreement, authorized Amendments and Supplementary Conditions and Modifications (defined below) issued after execution of the Contractor's Agreement. The Contract Documents shall also include the bidding/proposal documents, including the Instructions to Bidders/Proposers, Notice to Contractors and the Bid/Proposal Form, to the extent not in conflict with the other above-stated Contract Documents and other documents and oral representations which are memorialized in writing and documented as an attachment to the Contractor's Agreement.

CONTRACT PRICE. "Contract Price" means the total amount payable by University to Contractor for performance of the Work, including any authorized changes in the Work.

CONTRACT TIME. "Contract Time" means the time within which Contractor shall complete the Work, including any authorized changes in the Work

CONTRACTOR. "Contractor" means the person or entity identified as such in the Contractor's Agreement. As used in the Contract Documents, "Contractor" includes Contractor's employees, agents, representatives, subcontractors at any tier, and any other third party hired by Contractor to perform a portion of the Work and is referred to throughout the Contract Documents as if singular in number.

CONTRACTOR'S AGREEMENT. "Contractor's Agreement" means, unless the context requires otherwise, the agreement executed by the Contractor and University for the Work.

DAY. "Day" or "days" means calendar day unless otherwise specifically defined.

DEFECTIVE. "Defective" is an adjective which when modifying the word "Work" refers to Work that does not conform to the Contract Documents, or does not meet the requirements of any inspection, referenced standard, code, test or approval referred to in the Contract Documents, or which fails to meet generally accepted craft standards, or which has been damaged.

DIRECTOR. "Director" means the Director of Design and Construction Support of the U Facilities department of the University of Utah, unless the context requires otherwise. Director may include a designee selected by the Director for a particular function described in the Contract Documents.

DRAWINGS. "Drawings" means the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location, and dimensions of the Work and generally includes drawings, elevations, sections, details, schedules, and diagrams, including electronic copies.

EXECUTIVE DIRECTOR. "Executive Director" means the Chief Facilities Officer of the University of Utah including unless otherwise stated, the Executive Director's duly authorized designee.

FINAL COMPLETION. "Final Completion" means the date when all Work to be performed by Contractor has been completed and accepted in writing by University.

INSPECTION. "Inspection" or its derivatives means a review of the Work, including but not limited to a visual review of the Work completed to date to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

MODIFICATION. "Modification" means: (1) a Change Order; (2) a Construction Change Directive; or (3) an ASI. Contractor's Agreement may be amended or modified only by: (1) an authorized Amendment; or (2) a Modification.

NOTICE TO PROCEED. "Notice to Proceed" means a document prepared by University that authorizes Contractor to commence Work. It shall be deemed issued upon being sent by University to Contractor's address specified in Contractor's Bid.

PRELIMINARY RESOLUTION EFFORT OR PRE. "Preliminary Resolution Effort" or "PRE" means the processing of a request for preliminary resolution or any similar notice about an issue that could potentially lead to a Claim and is prior to reaching the status of a Claim.

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

PROPOSAL REQUEST OR PR. "Proposal Request" or "PR" means a request made by University to Contractor requesting a proposal to resolve an issue as part of the Change Order process.

PROPOSED CHANGE ORDER OR PCO. "Proposed Change Order" or "PCO" means a request by Contractor submitted to the University Representative to commence the Change Order process. It shall not be considered a "PRE" or a "Claim". The PCO may be related to any potential or actual delay, disruption, unforeseen condition or any other matter for which Contractor intends to seek an increase in the Contract Price and/or extension of the Contract Time.

REQUEST FOR INFORMATION OR RFI. "Request for Information" or "RFI" means a written request from Contractor to the A/E seeking information, direction, or clarification related to the Contract Documents, including Drawings and/or Specifications.

RULE. "Rule", unless the context requires otherwise, means a rule of the Utah Administrative Code.

SALES TAX AND/OR USE TAX. "Sales Tax" and/or "Use Tax", unless the context requires otherwise, means the sales tax and/or use tax collected or to be collected by the Utah State Tax Commission and shall include any sales and/or use tax that the Utah State Tax Commission collects on behalf of any special district, local government, or political subdivision.

SAMPLES. "Samples" mean physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work shall be judged.

SHOP DRAWINGS. "Shop Drawings" means drawings, diagrams, schedules and other data specially prepared for the Work by Contractor, or a subcontractor at any tier, manufacturer, supplier or distributor to illustrate some portion of the Work.

SPECIFICATIONS. "Specifications" means that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, installation and workmanship for the Work and performance of related systems and services.

SUBCONTRACTOR. "Subcontractor" means any person or entity under contract with Contractor to provide services or labor for the Work. "Subcontractor" includes a trade contractor or specialty contractor. "Subcontractor" does not include suppliers who provide only materials, equipment or supplies to Contractor or a Subcontractor. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or authorized representative of the Subcontractor. The term "Sub-subcontractor" means a person or entity that has a contract with a Subcontractor to provide services or labor for the Work and also includes all lower tier sub-subcontractors. The terms "Subcontractor" and "Sub-subcontractor" do not include a separate contractor retained by University or subcontractors or sub-subcontractors of a separate contractor retained by University.

SUBSTANTIAL COMPLETION. "Substantial Completion" and its derivatives means the date certified in accordance with Section 9.2 when the Work, or a designated portion thereof, is sufficiently complete, and any lack of completion or performance does not materially interfere with University's intended use of the Work, in accordance with the Contract Documents, so that University can occupy and use the Work for its intended use. University's "intended use" or "occupy" as used in this definition, shall include any intended use or occupation by any agency or entity that University intends to use or occupy the Work.

SUPPLEMENTAL GENERAL CONDITIONS. "Supplemental General Conditions" means the Supplemental General Conditions identified on DFCM's website, dfcm.utah.gov, applicable to the Work, if any, that supplements these General Conditions. Supplemental General Conditions are authorized Amendments.

SUPPLEMENTARY CONDITIONS. "Supplementary Conditions" means the part of the Contract Documents, if any, that amends or supplements these General Conditions and/or applicable Supplemental General Conditions. Supplementary Conditions, if authorized, are an Amendment.

UNIVERISTY. "University" means the University of Utah, Unless the context requires otherwise, University is the "Owner" as that term is commonly understood in the construction industry.

WORK. "Work" means the construction, services, supervision, labor, tools, equipment, materials, products and transportation, to be furnished by Contractor, so as to fulfill the Contractor's obligations as required by the Contract Documents.

ARTICLE 2. University.

2.1 INFORMATION AND SERVICES REQUIRED OF UNIVERSITY.

2.1.1 UNIVERSITY'S REPRESENTATIVE. University shall designate a representative authorized to act on behalf of University with respect to the Work ("University's Representative"). Unless the context requires otherwise, "University's Representative" is the "Owner's representative" as that term is commonly understood in the construction industry. University's Representative shall have authority to review and approve the Work, including the time schedule for completion, and the authority (but not a duty) to stop the Work for any reason, including, without limitation, unsafe conditions, or to direct Contractor to remedy, repair, or replace

any Work, if necessary, to ensure its proper execution. University and University's Representative shall endeavor to render decisions pertaining to documents submitted by the A/E and/or Contractor to avoid a delay in the orderly and sequential progress of the Work. Contractor shall be responsible for time lost and the cost of correcting Work that in University's judgment was executed improperly. University shall be the final interpreter of the Contract Documents; the decision of University in the absence of arbitrary or capricious conduct shall be conclusive. Notwithstanding anything to the contrary in the Contract Documents, University's approval shall not relieve Contractor of Contractor's sole responsibility for the Work.

2.1.2 SPECIALISTS AND INSPECTORS. University shall provide building inspection services in accordance with the applicable building codes, including routine and special inspections unless otherwise noted in the Contract Documents. University may assign an inspector or specialist to note deviations from, or necessary adjustments to, the Contract Documents or to report deficiencies or defects in the Work. The inspector's or specialist's activities in no way relieve Contractor from the responsibilities set forth in the Contract Documents.

2.1.3 SURVEYS AND LEGAL DESCRIPTION. Except to the extent not applicable to the type of Work to be performed pursuant to Contractor's Agreement, University shall furnish surveys describing physical characteristics, legal limitations and utility locations for the Work site, and a legal description of the Work site. The Contractor shall be entitled to rely on the accuracy of such survey information furnished by University but shall exercise proper precautions relating to the safe performance of the Work. The Contractor recognizes that the exact location of underground or hidden utilities, plumbing and electrical runs may be somewhat different from the location indicated on such surveys furnished by University or in the Contract Documents. The Contractor shall exercise reasonable skill and care to locate underground or hidden utilities, plumbing and electrical runs that are to remain to prevent damage thereto. The Contractor shall review the survey information provided by University and shall promptly provide written notice to University of any survey information that Contractor knows or discovers to be inaccurate.

2.1.4 PROMPT INFORMATION AND SERVICES. Upon receipt of a written request from Contractor, University shall endeavor to furnish information or services under University's control with reasonable promptness to avoid delay in the orderly progress of the Work.

2.1.5 COPIES OF CONTRACT DOCUMENTS. Unless otherwise provided in the Contract Documents, University shall provide or make available to Contractor, free of charge, paper or electronic copies of Contract Documents, as determined by University, as are reasonably necessary for execution of the Work. University's website may also provide Contract Documents for the Work.

2.2 CONSTRUCTION BY UNIVERSITY OR BY SEPARATE CONTRACTORS.

2.2.1 UNIVERSITY'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS. University reserves the right to enter into contracts with third parties in connection with the Work and to perform construction or other activities itself on or about the Work site.

2.2.2 COORDINATION OF WORK. Contractor shall afford University and the separate contractors or subcontractors retained by University adequate opportunity for the introduction and storage of their materials and equipment and the execution of their work. Contractor shall properly connect and coordinate the Work with the work of University and separate contractors or subcontractors.

2.2.3 COORDINATION OF SCHEDULES. Contractor shall cooperate with University and any separate contractors and subcontractors hired by University in performing the Work so that all portions of the Work may be completed in the shortest possible time within normal working hours. Contractor shall furnish separate contractors and subcontractors full information regarding time schedules for Contractor's Work.

Contractor shall coordinate the Work with the workers who may be retained by University, all separate contractors and subcontractors, and their activities in the vicinity of the Work site.

2.2.4 REPORTING PROBLEMS TO UNIVERSITY. If part of Contractor's Work depends on work by University or a separate contractor, Contractor shall, prior to proceeding with that portion of the Work, promptly report in writing to University any apparent defects in workmanship of the work of University and/or such separate contractor that would render it unsuitable for proper execution of the Work. Failure of Contractor to report defects shall constitute an acknowledgment that University's or the separate contractor's completed or partially completed work is fit and proper to receive Contractor's Work, except as to defects in workmanship not then reasonably discoverable.

2.2.5 CONTRACTOR REMEDIAL WORK. If Contractor causes damage to the work of University or any separate contractors or subcontractors, Contractor shall promptly remedy such damage and shall use all reasonable efforts to promptly negotiate a settlement with University and such separate contractors and subcontractors.

ARTICLE 3. A/E.

3.1 A/E'S ADMINISTRATION OF THE CONTRACT.

3.1.1 IN GENERAL. The A/E shall assist University in administering the Contract in accordance with the Contract Documents. The A/E shall have authority to act on behalf of University, but only to the extent provided in the Contract Documents and/or A/E's agreement with University.

3.1.2 SITE VISITS.

3.1.2.1 Site visits or inspections by the A/E or University shall in no way limit or affect Contractor's responsibility to comply with all the requirements and the overall design concept of the Contract Documents as well as all federal, state, and local laws, rules, regulations, ordinances and orders of public authorities applicable to the Work.

3.1.2.2 The A/E shall promptly submit to University a written report subsequent to each site visit detailing the visit.

3.1.3 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION. Except as authorized by University or as otherwise provided in the Contract Documents, including these General Conditions, the A/E and Contractor shall communicate through University on issues regarding the timing of the Work, cost of the Work, and scope of the Work. Communications by and with the A/E's consultants shall be through the A/E. Communications by and with Subcontractors shall ordinarily be through Contractor. Communications by and with separate contractors shall be through University.

3.1.4 A/E MAY REJECT WORK, ORDER INSPECTIONS, TESTS. The A/E shall have the authority to reject Work which, based upon the A/E's knowledge or what may be reasonably inferred from the A/E's site observations and review of data, does not conform to the Contract Documents. Whenever the A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, the A/E shall have the authority to require additional inspections or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed, or completed; however, the A/E must obtain University's prior written approval of any such additional inspections or testing. Neither this authority of the A/E nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the A/E to Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors. If Contractor disputes the rejection of

any Work and the correction thereof shall involve additional cost or time, it shall be University's option to accept such Work whether it shall be conforming or nonconforming.

3.1.5 A/E REVIEW OF CONTRACTOR'S SUBMITTALS.

3.1.5.1 Contractor shall submit Shop Drawings, Product Data, and Samples and other submittals required by the Contract Documents to the A/E as required by the approved submittal schedule.

3.1.5.2 The A/E shall review and take appropriate action upon Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the purpose of checking for conformance with the information and design concepts expressed in the Contract Documents. A/E action taken on a submittal shall not constitute a Modification.

3.1.5.3 The A/E's action shall be taken no later than fourteen (14) days following A/E's receipt of the submittal, unless agreed to otherwise by Contractor and University, in order to avoid a delay in the Work of Contractor or of separate contractors while allowing sufficient time in the A/E's professional judgment to permit adequate review.

3.1.5.4 Review of such submittals shall not be conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor as required by the Contract Documents.

3.1.5.5 The A/E's review of Contractor's submittals shall not relieve Contractor of Contractor's obligations under the Contract Documents.

3.1.5.6 The A/E's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the A/E, of any construction means, methods, techniques, sequences, or procedures.

3.1.5.7 The A/E's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

3.1.5.8 When professional certification of performance characteristics of materials, systems, or equipment is the responsibility of the Contractor under the Contract Documents, the A/E shall be entitled to rely upon such certifications to establish that the materials, systems or equipment shall meet the performance criteria required by the Contract Documents.

3.2 OWNERSHIP AND USE OF A/E'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS. All Drawings, Specifications, and other documents prepared by the A/E for the Work are and shall remain the property of University, and University shall retain all common law, statutory, and other reserved rights with respect thereto. Said documents are intended for use as an integrated set for the Work. Neither Contractor nor A/E shall modify or use Contract Documents on any other project without the prior written consent of University. Any such non-permissive use or modification by Contractor, Contractor's Subcontractors at any tier, or anyone else for whose acts Contractor is liable, shall be at Contractor's sole risk. To the fullest extent permitted by law, Contractor shall release, indemnify, hold harmless, and defend University, and require all Subcontractors to release, indemnify, hold harmless, and defend University, from and against any and all liabilities, claims, demands, actions, damages, losses, and expenses, including but not limited to attorney fees and costs of litigation, arising out of such non-permissive use or modification by Contractor or its Subcontractors. Contractor, including its Subcontractors, are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by the A/E appropriate to and for use in the execution of the Work. Contractor shall preserve the copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the A/E for the Work, on all copies.

Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to the Work shall not be construed as a publication in derogation of University's copyright or other reserved rights.

ARTICLE 4. CONTRACTOR.

4.1 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR.

4.1.1 REVIEW OF DOCUMENTS. Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by University and shall at once report to University and A/E all errors, omissions, inconsistencies and/or ambiguities discovered. Contractor shall not be liable to University or A/E for damage resulting from errors, omissions, inconsistencies and/or ambiguities in the Contract Documents unless Contractor recognized such error, omission, inconsistency and/or ambiguity or a contractor of ordinary skill and expertise for the type of Work involved would have readily so recognized such error, omission, inconsistency and/or ambiguity, and Contractor failed to report such to University and A/E. If Contractor performs any Work without such notice to University and A/E and prior to resolution of the error, omission, inconsistency and/or ambiguity, Contractor shall be responsible for such performance and shall bear the costs for correction.

4.1.2 REVIEW OF FIELD CONDITIONS. Contractor shall take field measurements, verify field conditions and carefully compare such field measurements and conditions and other information known to Contractor, or information that a contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing Work. Contractor shall immediately report to University and A/E all errors, omissions, inconsistencies and/or ambiguities discovered. If Contractor performs any Work without such notice to University and A/E and prior to resolution of the error, omission, inconsistency and/or ambiguity, Contractor shall be responsible for such performance and shall bear the costs for correction.

4.1.3 SUBSURFACE INVESTIGATIONS. If University has provided the Contractor with reports of subsurface investigations and/or tests of soils at the Work site ("Geotechnical Report") as part of the Contract Documents, the Contractor may rely upon the accuracy of the technical data contained in such Geotechnical Report at the locations where the data was obtained and to the depth indicated. However, Contractor acknowledges that the conditions indicated in any Geotechnical Report of any subsurface investigations and/or tests of soils at the Work site may not be representative of conditions existing at locations and/or at depths other than where data was obtained or that conditions different than those indicated by such Geotechnical Report may exist at the Work site. Contractor shall not be entitled to any increase in the Contract Price and/or increase in the Contract Time based on any data, opinion and/or recommendation in any Geotechnical Report and/or any inaccuracy, incompleteness, mistake and/or error in any Geotechnical Report except to the extent that Contractor is entitled to an increase in the Contract Price and/or extension of the Contract Time for a concealed or unknown condition as provided in Section 7.1.5.

4.1.4 PERFORM IN ACCORDANCE WITH CONTRACT DOCUMENTS AND SUBMITTALS. Contractor shall perform the Work in accordance with the Contract Documents and submittals to which no exception has been taken in accordance with the Contract Documents.

4.1.5 PERFORMANCE TO PRODUCE THE COMPLETE SYSTEM AND INTENDED RESULTS. The Contract Documents shall be read as a whole and wherever possible, the provisions shall be construed in order that all provisions are operable. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by Contractor, whether or not specifically set forth in the Contract Documents, for the Contract Price and within the Contract Time. Performance by Contractor shall be required to the extent consistent with and reasonably inferable from the Contract Documents as being necessary to allow the Work to function for its intended use.

4.1.6 INTENT AND HIERARCHY. The Contract Documents are complimentary, and what is required by one Contract Document or provisions thereof, shall be as binding as if required by all the Contract

Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities shall govern as listed below:

4.1.6.1 A Modification or authorized Amendment (including authorized Supplementary Conditions) shall govern over all Contract Documents listed in Sections 4.1.6.2 – 4.1.6.6 or previous Modifications or authorized Amendments (including authorized Supplementary Conditions).

4.1.6.2 The Contractor's Agreement shall govern over all Contract Documents listed in Sections 4.1.6.3 - 4.1.6.6**.**

4.1.6.3 Supplemental General Conditions shall govern over all Contract Documents listed in Sections 4.1.6.4 – 4.6.1.6.

4.1.6.4 These General Conditions shall govern over the Contract Documents listed in Sections 4.1.6.5 – 4.1.6.6.

4.1.6.5 The Drawings and Specifications shall govern over the Contract Documents listed in Section 4.1.6.6.

4.1.6.6 Attachments to the Contractor's Agreement, Contractor's management plan, bidding/proposal documents, including the Instructions to Bidders/Proposers, Notice to Contractors and the Bid/Proposal Form and/or documented interview information, if any, are Contract Documents, binding on Contractor, but are subordinate to the Contract Documents listed in Sections 4.1.6.1 – 4.1.6.5.

4.1.6.7 An Addendum shall govern over all other Contract Documents and any previously issued Addendum.

4.1.6.8 In case of a conflict or ambiguity within the same level of hierarchy of described documents, University reserves the right to revise the documents to select the most stringent requirement unless the preponderance of the Contract Documents indicate a less stringent requirement.

4.1.7 DIVIDING WORK AND CONTRACTOR REPRESENTATION. Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings, shall not control Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Contractor shall ensure that the Subcontractors at any tier, manufacturers and suppliers engaged or to be engaged by Contractor, are and shall be familiar with the requirements for performance by them of their obligations.

4.1.8 PLANNING AND PRIORITY. Contractor shall plan and schedule the Work and shall maintain the schedule to Substantially Complete the Work within the Contract Time.

4.2 SUPERVISION AND REPRESENTATIVES.

4.2.1 SUPERVISION AND CONTROL. Contractor shall supervise and direct the Work using Contractor's best skill and attention to complete the Work within the Contract Time. Contractor shall be solely responsible for and have control over the construction means, methods, techniques, sequences, and procedures and for coordinating all portions of the Work, except to the extent that the Contract Documents specifically and expressly state otherwise.

4.2.2 PERSONS PERFORMING WORK. Contractor shall perform the Work using qualified employees, consultants, and Subcontractors selected and paid for by Contractor, adequately trained in the requirements of their particular jobs, and skilled in the Work assigned to them. Contractor shall use all

reasonable efforts to maintain a stable project team and minimize changes in key members of the team where loss of key members could have an adverse impact on the Contract Time. Any change in key personnel assigned to the Work must be approved by University in writing.

4.2.3 DESIGNATED REPRESENTATIVES. Contractor shall employ a competent superintendent and necessary assistants, fluent in spoken and written English, who shall be at the Work site during performance of the Work. Contractor's superintendent shall maintain communication between University, the A/E, and Contractor and be responsible for the management of Contractor's activities and deliverables described in the Contract Documents, as well as management of any third-party resources hired by Contractor to provide services or products under the Contract Documents. Contractor's superintendent shall represent Contractor, and communications given to the superintendent shall be as binding as if given to Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed in writing on written request in each case.

4.2.4 DISCIPLINE AND COMPETENCE. Contractor shall enforce safety procedures, strict discipline, and good order among Contractor's employees, Contractor's Subcontractors, agents, representatives and other persons performing the Work under the Contract Documents. If University reasonably determines that a particular person does not follow safety procedures, is unfit or unskilled for the assigned Work, disregards instructions, ignores the environmental restraints of the Work, or jeopardizes the goodwill between University and the public, Contractor shall immediately replace the person upon receipt of University's request to do so and shall not employ the person again on the Work.

4.2.5 RESPONSIBILITY. Contractor shall be responsible to the State of Utah and University for the acts and omissions of Contractor's employees, Subcontractors and their agents and employees and other persons performing portions of the Work under a contract with Contractor or on behalf of Contractor.

4.2.6 NOT RELIEVED OF OBLIGATIONS. Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of University or University's agents in University's administration of the Contractor's Agreement, or by tests, inspections, or approvals required or performed by persons other than Contractor or for those that Contractor is liable.

4.2.7 INSPECTIONS AND APPROVALS.

4.2.7.1 All Work performed by Contractor shall be subject to the inspection and approval of University to determine whether the Work is in accordance with the Contract Documents. Contractor shall permit and facilitate inspection of the Work at all times by University, University's representatives and governmental authorities having jurisdiction.

4.2.7.2 Contractor shall be responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner in accordance with the process and document requirements of the applicable inspection authority. In the event Work is not in a condition to be inspected at the time scheduled for the inspection of such Work for causes for which the Contractor is responsible, Contractor shall bear all associated costs and expenses without reimbursement by University.

4.2.7.3 If any of the Work is required to be inspected or approved by the terms of the Contract Documents, Contractor shall timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, Work shall not proceed without any required inspection and the associated authorization to proceed. Contractor shall promptly notify University if the inspector fails to appear at the site.

4.2.7.4 Contractor shall work with the inspector to maintain an Open Issues Log and Contractor shall proceed diligently to resolve all open issues.

4.3 PAYMENT BY CONTRACTOR. Except to the extent it is otherwise stated in the Contract Documents, Contractor shall provide and pay for all supervision, labor, tools, equipment, materials and transportation, including, without limitation: construction equipment and machinery; water; heat; utilities; and other facilities, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.4 TAXES AND OTHER PAYMENTS TO GOVERNMENT. Contractor shall pay Sales Tax and/or Use Tax, consumer, employment-related and similar taxes related to the Work or portions thereof provided by Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect. Contractor shall comply with the laws and regulations regarding the payment of Sales Tax and/or Use Tax and any exemptions. The procurement documents may have a provision regarding specific items which are exempt from State of Utah Sales Tax and/or Use Tax. Any such exemption shall be used only for the items and the project specified in the procurement documents. Any such exemption does not apply to taxes levied by the federal government or any taxing entity outside of the State of Utah. If Contractor properly relies upon a provision(s) of the bidding or proposal documents indicating exemption from State of Utah Sales Tax and/or Use Tax, and if State of Utah Sales Tax and/or Use Tax subsequently becomes due, then Contractor shall be paid such tax amount not included in the bid/proposal amount due to the reliance upon such provision.

4.5 PERMITS, FEES, NOTICES, LABOR AND MATERIALS.

4.5.1 PERMITS AND FEES. Unless otherwise required in the Contract Documents, it shall not be necessary for Contractor to obtain or pay for local building permits, plan check fees, electrical permits, plumbing permits, connection fees, or impact fees, nor shall it be necessary to pay fees for inspections pertaining thereto.

4.5.2 COMPLIANCE, NOTICES. Contractor shall comply with and give notices required by all federal, state, and local laws, rules, regulations, ordinances, and orders of public authorities applicable to the Work.

4.5.3 CORRELATION OF CONTRACT DOCUMENTS AND LAW. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable federal, state and/or local laws, rules, regulations, ordinances, and/or orders of public authorities having jurisdiction. However, if Contractor observes, or if such would be readily observable to a contractor of ordinary skill and expertise for the type of Work involved, that a portion of the Contract Documents is at variance therewith, Contractor shall promptly notify the A/E and University in writing, and necessary changes shall be accomplished by appropriate Modification and/or Amendment.

4.5.4 FAILURE TO GIVE NOTICE. If Contractor, or any Subcontractor, performs Work without complying with the requirements of this Section 4.5, Contractor shall assume responsibility for such Work and shall bear the appropriate amount of the applicable costs of correction.

4.6 TIME AND CONTRACTOR'S CONSTRUCTION SCHEDULES.

4.6.1 PROGRESS AND COMPLETION.

4.6.1.1 Time is of the essence in this Contract. By executing the Contractor's Agreement, Contractor confirms that the Contract Time is adequate to perform the Work. The Contractor shall proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.

4.6.1.2 Contractor shall commence and complete the Work within the Contract Time and pursuant to the schedule, an initial version of which shall be prepared and provided by Contractor to University and the A/E for approval, as it may be modified with University's consent. Unless and except to the extent that preliminary Work at the Work site is authorized in writing by University, Contractor shall not prematurely commence the Work at the Work site or elsewhere until University issues a Notice to Proceed or prior to the effective date of insurance required by Article 10 to be furnished by Contractor, whichever is later. Contractor shall proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time. All other Work shall be completed no later than the date established for Final Completion. Contractor shall notify University when Contractor considers the entire Work to be completed. University shall be entitled to a final inspection to determine whether the Work has been completed in accordance with the Contract Documents. The date of Substantial Completion shall be established by a certificate of Substantial Completion issued by the A/E or a written acknowledgement of Substantial Completion signed by University.

4.6.1.3 INITIAL CONTRACT TIME. Unless otherwise specified in the bidding documents, the initial Contract Time shall be the time identified in the Contractor's Agreement.

4.6.2 SCHEDULE PREPARATION.

4.6.2.1 Promptly after being awarded the Work, Contractor shall prepare and submit for University's and the A/E's approval, a planned progress schedule for the Work. Contractor shall plan and schedule the Work to facilitate the Work and shall maintain a schedule to place proper priority to sequence the Work to complete the Work within the Contract Time. Contractor shall commence and complete the Work by the dates set forth in the agreed upon schedule and Contractor's Agreement.

4.6.2.2 The schedule shall include a time-line for procurement, fabrication, construction, and testing activities, including interdependence of items necessary to complete the Work, duration of activities, interim completion dates, milestones, closeout and commissioning, submittals, and critical path.

4.6.2.3 Contractor shall advise and consult with University during progress of the Work and keep University fully informed as to the status of the Work at intervals as required by University. Contractor shall provide University with a daily listing of personnel and equipment used on the Work. If the Work is not on schedule, Contractor shall immediately advise University in writing of Contractor's proposed action to bring it on schedule.

4.6.2.4 University may take reasonable exception to activity duration, activity placement, construction logic, and time frame for any element of the Work to be scheduled and may recommend revisions.

4.6.3 SCHEDULE SUBMITTAL.

4.6.3. Contractor shall develop the CPM schedule using Primavera, MS Project or Phoenix unless otherwise authorized by University. The critical path shall be identified, including the critical paths for interim completion dates and milestones.

4.6.3.2 Contractor shall update the schedule at least once a month and submit the updated schedule with each Application for Payment.

4.6.3.3 No progress payments shall be approved until Contractor has submitted a detailed CPM schedule covering the first ninety (90) days of the Work with a general CPM schedule for the entire Work. The detailed schedule for the entire Work shall be completed prior to the second Application for Payment, unless otherwise authorized in writing by University.

4.6.4 SCHEDULE CONTENT REQUIREMENTS.

4.6.4.1 The schedule shall indicate the duration of activities and order, sequence and interdependence of all items known to be necessary to complete the Work, including construction, procurement, fabrication and delivery of materials and equipment, commissioning, submittals and approvals of submittals or other documents. Work items of University, other contractors, utilities, and other third parties that may affect or be affected by Contractor shall be included.

4.6.4.2 If University is required by the Contract Documents to furnish any materials, equipment, or other items to be incorporated into the Work by Contractor, Contractor shall submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Work site.

4.6.4.3 The schedule shall indicate an early Substantial Completion date for the Work that is no later than the Work's required Substantial Completion date.

4.6.4.4 The schedule, including duration of all activities, shall be given in calendar days and indicate all of the following:

4.6.4.4.1 Interfaces with the Work of outside contractors (e.g., utilities, power, and any separate contractors retained by University);

4.6.4.4.2 Description of activity including activity number/numbers;

4.6.4.4.3 Estimated duration time for each activity and remaining duration;

4.6.4.4.4 Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity – all activities shall have a predecessor and a successor, except for the start milestone and finish milestone;

4.6.4.4.5 Total Float and Free Float available to each path of activities;

4.6.4.4.6 Actual start date for each activity begun;

4.6.4.4.7 Actual finish date for each activity completed;

4.6.4.4.8 The percentage complete of each activity in progress or completed;

4.6.4.4.9 Identification of all critical path activities;

4.6.4.4.10 The critical path for the Work, with the path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float must be identified. Except as may otherwise be explicitly and specifically provided in the Contract Documents, no more than forty-percent (40%) of all activities may be identified as critical path items. The relationship between non-critical activities and

activities on the critical path shall be clearly shown on the network diagram. Near critical path activities shall also be identified;

4.6.4.4.11 Unless otherwise authorized by University, all activities on the schedule representing construction on the site may not have a duration longer than fourteen (14) days. Construction items that require more than fourteen (14) days to complete must be broken into identifiable activities on the schedule with durations less than fourteen (14) days. The sum of these activities represents the total length required to complete that construction item; and

4.6.4.4.12 Additional requirements, if any, as specified in the Supplemental General Conditions and/or authorized Supplementary Conditions.

4.6.5 INTERIM COMPLETION DATES AND MILESTONES. The schedule must include contractually specified interim completion dates and milestones (which completion milestones must have a "finish on or before" soft constraint added). The milestones and completion dates indicated are considered essential to the satisfactory performance of the Contractor's Agreement and to the coordination of all Work. The milestone dates listed are not intended to be a complete listing of all Work or of interfaces with other contractors.

4.6.6 FLOAT TIME. "Total Float" is defined as the amount of time that an activity can be delayed from its early without delaying Substantial Completion. "Free Float" is the amount of time that an activity can be delayed without delaying the early start date of any successor activity. Total Float time and Free Float time shall belong to the project and University and Contractor have the right to use the Total Float time and/or Free Float Time for non-critical path activities until Contractor has reallocated such time on a newly submitted schedule.

4.6.7 UPDATES. Prior to any approval of an Application for Payment, University, A/E, and Contractor shall review Contractor's schedule compared to the Work completed. The amount of Work completed shall be approved by University as supported by the schedule of values and as verified by the determination of Work completed. If necessary, Contractor shall then update and submit to University the schedule with the Application for Payment; all of which shall be in accordance with University's approval. All updates shall be provided in electronic and hard copy formats. At each scheduled meeting with University, Contractor shall provide a four week look ahead, with long lead items identified. If the Work is not on schedule, Contractor shall immediately advise University in writing of Contractor's proposed action to bring it on schedule.

4.6.8 SCHEDULE OF SUBMITTALS. Contractor shall prepare and keep current, for the A/E's and University's review and approval, a schedule of submittals required by the Contract Documents, which shall be coordinated with Contractor's construction schedule and allow the A/E a reasonable time to review the submittals. The submittal schedule shall be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals. Contractor shall coordinate and agree upon a submittal schedule with A/E. If a submittal does not pass a second review, then a meeting will be held to determine a path to proceed and expedite approval. Contractor shall notify A/E in writing if expedited review of a submittal is critical.

4.6.9 SCHEDULE RECOVERY. If the Work represented on the critical path falls behind more than seven (7) days, Contractor shall redo the schedule within seven (7) days, showing how the Contractor shall recover the time. Contractor's schedule must have an approved baseline schedule before the schedule may be updated. A narrative that addresses the changes in the schedule from the previously submitted schedule shall be submitted along with the updated schedule in electronic .pdf format and on the written request of University in native electronic copy format of the scheduling software utilized by Contractor. Contractor shall comply with the most recent schedules.

4.6.10 SCHEDULE CHANGES.

4.6.10.1 The Contract Time may only be shortened or extended by a Change Order or Construction Change Directive.

4.6.10.2 Should Contractor, after approval of the complete detailed construction schedule, desire to change Contractor's plan of construction, Contractor shall submit its requested revisions to University and the A/E, along with a written statement of the revisions including a description of the sequence and duration changes for rescheduling the Work, methods of maintaining adherence to intermediate milestones and the completion dates, and the reasons for the revisions. Requested changes to the approved baseline schedule shall include a narrative that addresses the requested changes. If the requested changes are acceptable to University, which acceptance shall not be unreasonably withheld, they shall be incorporated into the schedule in the next reporting period by Contractor. If after Contractor submits a request for change in the schedule, University does not agree with the request, University shall schedule a meeting with Contractor to discuss the differences.

4.6.10.3 The critical path schedule, as the term is used in these General Conditions, shall be based on the current version of Contractor's schedule for the Work and accepted by University just prior to the an asserted change in the Work, asserted delay, suspension, or interruption. If Contractor believes it is entitled to an extension of Contract Time under the Contract Documents, Contractor shall submit a PCO in accordance with Section 7.2 to the A/E and University accompanied by an analysis ("Requested Time Adjustment Schedule") in accordance with the Contract Documents for time extensions. The "Requested Time Adjustment Schedule" shall include "fragnets" that represent the added or changed Work to the schedule. The impact on unchanged activities caused by the changes and/or delays being analyzed shall be included in these fragnets. A "fragnet" as used in these General Conditions and when used in the context of project scheduling is a subset of project activities that are inter-related by predecessor and successor relationships that are tied into the main schedule with identified start and completion points. Each fragnet may or may not be on the critical path. An entire schedule consists of a series of inter-related fragnets.

4.6.11 EXCUSABLE DELAY.

4.6.11.1 If Contractor is unreasonably delayed in the progress of the Work on the critical path schedule by an act or neglect of University; or separate contractors retained by University; or by a Force Majeure Delay (defined below) that University reasonably determines may justify delay beyond the date for Substantial Completion, then the Contract Time shall be extended by Change Order for the period of time caused by such delay. The Contract Price shall not be increased, and the Contract Time shall not be extended for any delays that are concurrent with Contractor delays.

4.6.11.1.1 For purposes of the Contractor's Agreement, a Force Majeure Delay shall mean a delay to the commencement or the progress of the Work by reason of events or causes beyond the control of University, the Contractor, and the Contractor's Subcontractors and Sub-subcontractors of any tier, or anyone directly or indirectly employed by them or anyone for whose acts they may be liable. Notwithstanding anything to the contrary set forth herein, Force Majeure Delays shall not include: (1) labor disputes confined to the Work site or relating solely to the Work that are due to a breach of a collective bargaining agreement by the Contractor or its Subcontractors or Sub-subcontractors of any tier, or anyone directly or indirectly employed by them or anyone for whose acts they may be liable; (2) adverse weather conditions, except as provided in Section 4.6.11.2; (3) a failure of the Contractor or its Subcontractors or Sub-subcontractors of any tier, or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, to comply with any laws, codes or orders of governmental authorities with jurisdiction of the Work; or (4) any financial inability of the Contractor or its Subcontractors or Sub-subcontractors of any tier, or anyone directly or indirectly employed by them, to perform their obligations under the Contract Documents.

4.6.11.1.2 Delays which according to the schedule do not affect any critical path milestone dates or the completion dates shown on the schedule at the time of the delay shall not be the basis for a change in the Contract Time.

4.6.11.1.3 Contractor shall immediately take all steps reasonably possible to lessen the adverse impact of delay. Notwithstanding the foregoing, to the extent any of the causes for delay were caused by Contractor, reasonably foreseeable by Contractor, or avoidable by Contractor, then to such extent the delay shall not be cause for a change in the Contract Price and/or Contract Time. For purposes of this Section, "Contractor" shall include all Subcontractors and others under the responsibility of the Contractor.

4.6.11.1.4 The determination of the total amount of time extension, if any, shall be based upon the current schedule in effect at the inception of the change and/or delay and upon all data relevant to the extension as supported by appropriate substantiating relative data in the project record. Once approved, such data shall be incorporated in the next monthly update of the schedule by Contractor.

4.6.11.2 The Contract Price shall not be increased and the Contract Time shall not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the Contractor's Agreement. The Contract Time as stated in the Contract Documents includes due allowance for days on which Work cannot be performed out of doors. Contractor acknowledges that Contractor may lose days due to weather conditions. The Contract Time may be extended at no cost to University if all of the following are met, which must be established by Contractor:

4.6.11.2.1 That the weather prevented Work from occurring that is on the critical path for the Work based upon a critical path schedule previously submitted to University and to the extent accepted by University;

4.6.11.2.2 There are no concurrent delays for which Contractor is responsible;

4.6.11.2.3 Contractor took all reasonable steps to alleviate the impact of the weather and made reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and

4.6.11.2.4 In connection with the weather event for which delay is claimed by Contractor, the weather was either exceptionally adverse, such as a tornado, severe wind storm, or severe hail storm, or one of the following occurred:

4.6.11.2.4.1 for any day between November 1 and March 31 for which delay is claimed by Contractor, the recorded minimum temperature at the Work site, as verifiably documented by Contractor, fell below the mean minimum temperature for the station closest to the Work site ("Proximate Station") for the applicable month according to the Western Regional Climate Center Website, http//www.wrcc.dri.edu/summary ("WRCCW"), as shown on the *Average of Minimum Temperature* chart on the WRCCW for the Proximate Station, less the mean extreme minimum temperature for the Proximate Station for the applicable month, as shown on the *Minimum of Minimum Temperature Chart* on the WRCCW for the Proximate Station, divided by Two (2);

4.6.11.2.4.2 for any day between November 1 and March 31 for which delay is claimed by Contractor, the recorded maximum temperature at the Work site, as verifiably documented by Contractor, fell below the mean minimum temperature as shown on the *Average of Minimum Temperature* chart on the WRCCW for the Proximate Station;

4.6.11.2.4.3 for any day for which delay is claimed by Contractor, the recorded precipitation at the Work site, as verifiably documented by Contractor, exceeded seventy-five percent (75%) of the daily extreme for the applicable month as shown on the *POR – Daily Precipitation Average and Extreme* chart on the WRCCW for the Proximate Station;

4.6.11.2.4.4 for any day for which delay is claimed by Contractor, the recorded snowfall at the Work site, as verifiably documented by Contractor, exceeded seventy-five percent (75%) of the daily extreme for the applicable month as shown on the *POR – Daily Snowfall Average and Extreme* chart on the WRCCW for the Proximate Station.

4.6.12 COMPENSABLE DELAY, SUSPENSION OR INTERRUPTION.

4.6.12.1 In addition to the other requirements of the Contract Documents, a compensable delay, suspension, or interruption of the Work occurs only when the following conditions are met:

4.6.12.1.1 The delay is caused by University for a reason not permitted by the Contract Documents; and

4.6.12.1.2 Contractor delivers a written notice to the A/E and University within seven (7) days that Contractor knows or should have known of the condition giving rise to the purported compensable delay, suspension, or interruption, and the condition affects the Contract Time as indicated by the last agreed upon critical path schedule.

4.6.12.2 To the extent of the compensable delay, Contractor's total entitlement for all compensable delay damages is the computed result of the following formula: Contract Price divided by Contract Time (in calendar days); the result of which is then multiplied by 0.05; and the result of which is multiplied by the number of calendar days of compensable days allowed under these General Conditions that are beyond the Contract Time. Notwithstanding any other provision of these General Conditions or the Contract Documents, to the extent Contractor is entitled to receive a markup under Sections 7.4.2.5.1 or 7.4.2.5.2 this provision shall be inapplicable, and the markup shall be deemed to include all the compensable delay damages provided by this Section.

4.6.12.3 The length and extent of compensable delay shall be determined, with the use of the Work's critical path schedule by ascertaining the number of additional days added to the Contract Time are needed in order to perform the Work in accordance with the Contract Documents as a result of the delay, suspension, or interruption after receipt of the written notice received by the A/E and University under Section 4.6.12.1.2.

4.6.12.4 Notwithstanding any other provision of these General Conditions, to the extent a non-compensable delay occurs at the same time as a compensable delay, University shall not be responsible for any compensation to Contractor and the Contract Price shall not be increased for the period of the non-compensable delay.

4.6.13 TIME EXTENSION REQUESTS. Contractor shall notify University within seven (7) days of a potential delay and Contractor shall request any and all Contract Time extensions within twenty-one (21) days after Contractor knew or should have known about the delay. Contractor must support any request for a Contract Time extension with a critical path schedule analysis.

4.6.14 LIQUIDATED DAMAGES.

4.6.14.1 Time is of the essence in the Contract Documents. University will suffer damages that are difficult to ascertain for each calendar day the date for Substantial Completion is delayed. Therefore, as agreed damages and not as a penalty, University may offset from any payments due Contractor the sum stated in the Contractor's Agreement, as augmented in Section 4.6.14.2 in the case of continuing delay, for each day Substantial Completion is delayed beyond the date established for Substantial Completion of the Work by the Contract Documents.

4.6.14.2 For each day subsequent to the fourteenth (14^{th}) day after the date established for Substantial Completion of the Work by the Contract Documents, the liquidated damages amount stated in the Contractor's

Agreement shall be increased by ½ percent (0.5%) of the amount stated in the Contractor's Agreement for each day Substantial Completion is delayed beyond the date established for Substantial Completion of the Work by the Contract Documents.

4.6.14.3 The sum for liquidated damages due University by Contractor has been agreed upon by reason of the inconvenience and added costs of administration, engineering, supervision, and other expenses resulting from Contractor's default.

4.6.14.4 To the extent liquidated damages exceed any amounts that would otherwise be due Contractor, Contractor shall be liable for such excess to University.

4.6.14.5 Notwithstanding any other provision of these General Conditions, the availability of liquidated damages to University shall not limit University's right to seek damages or other remedies available under law or equity to the extent such damages or remedies are not based upon delay.

4.6.15 NO WAIVER OF UNIVERSITY'S RIGHTS. Permitting Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof shall in no way operate as a waiver or estoppel on the part of University of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

4.7 DOCUMENTS AND SAMPLES AT THE SITE, CERTIFYING "AS-BUILTS". Contractor shall maintain at the Work site one record copy of the Drawings, Specifications, Addenda, authorized Amendments and Modifications, in good order and marked weekly to record changes and selections made during construction, as well as approved Shop Drawings, Product Data, Samples and similar submittals. These items shall be available to the A/E and shall be delivered to the A/E for submittal to University upon completion of the Work, signed by Contractor, certifying that they show complete and exact "as-built" conditions, stating sizes, kind of materials, piping, conduit locations, and similar matters. All notes of encountered or changed conditions shall be included.

4.8 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

4.8.1 NOT CONTRACT DOCUMENTS. Shop Drawings, Product Data, Samples and other submittals are not Contract Documents. The submittal shall demonstrate, for those portions of the Work for which the submittal is required, the way Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.

4.8.2 PROMPTNESS. Contractor shall coordinate submittals prepared by Subcontractors and Sub-subcontractors, review, approve, and submit to the A/E, Shop Drawings, Product Data, Samples and other submittals required by the Contract Documents with reasonable promptness and according to an agreed submittal schedule in such sequence as to cause no delay in the Work, or the activities of University, or separate contractors.

4.8.3 NOT PERFORM UNTIL A/E APPROVES. Contractor shall not perform any portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples, mock-ups where required or other submittals (including deferred submittals) until the applicable submittal has been approved in writing by the A/E. Contractor shall perform the Work in accordance with the approved submittals. Submittals marked "No-exceptions taken" or its equivalent by the A/E are considered approved for purposes of this Section 4.8.3.

4.8.4 REPRESENTATIONS BY CONTRACTOR. By approving and submitting Shop Drawings, Product Data, Samples, and other submittals, Contractor represents that Contractor has determined and verified materials, field measurements, field construction criteria, manufacturer installation instructions and

procurement and delivery dates related thereto and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

4.8.5 CONTRACTOR'S LIABILITY. Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the A/E's approval of Shop Drawings, Product Data, Samples, or similar submittals unless Contractor has specifically informed the A/E in writing of such deviation at the time of the submittal and the A/E has given written approval to the specific deviation. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or other submittals by the A/E's review and approval.

4.8.6 DIRECT SPECIFIC ATTENTION TO REVISIONS. Contractor shall direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples, or other submittals, except those requested by the A/E and indicated on previous submittals.

4.8.7 INFORMATIONAL SUBMITTALS. Informational submittals upon which the A/E is not expected to take responsive action may be so identified in the Contract Documents.

4.8.8 PROFESSIONAL SERVICES. The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, University and the A/E will specify performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed Design Professional (as that term is defined in Section 4.8.8.1 of these General Conditions), whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Each Design Professional providing such services shall carry professional errors and omissions insurance in an amount of at least Two Million Dollars ($2,000,000.00) per claim/annual aggregate with a deductible or self-insured retention of not greater than One Hundred Thousand Dollars ($100,000.00), unless different amounts are authorized by University in writing. Shop Drawings and other submittals related to the Work designed or certified by such Design Professional, if prepared by others, shall bear such Design Professional's written approval when submitted to the A/E. University and the A/E shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications and approvals performed or provided by such Design Professional, provided University and A/E have specified to the Contractor performance and design criteria that such services must satisfy. Pursuant to this Section 4.8, the A/E will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

4.8.8.1 A "Design Professional" is any and all employees or independent contractors directly or indirectly employed by the Contractor, a Subcontractor or a Sub-subcontractor of any tier to perform any professional design services required by the Contract Documents. The Contractor or its Subcontractors or Sub-subcontractors of any tier employing the Design Professional shall require the Design Professional to agree in writing to be bound by the terms of the Contract Documents insofar as they apply to the design services of the Design Professional in the performance of the Work.

4.8.8.2 The Contractor hereby assigns to University all common law, statutory and other rights that the Contractor may have in the drawings, specifications and other documents prepared by the Design Professional for the Work (the "Design Documents"), including all copyrights. The Contractor shall endeavor to obtain a similar assignment to University by the Design Professional and by the Subcontractors or Sub-subcontractors

of any tier employing the Design Professional of their common law, statutory and other rights (including copyrights) in the Design Documents. At the date of final payment or upon the earlier termination of the Contractor's Agreement, the Contractor shall promptly deliver to University hardcopy originals of all Design Documents and all Design Documents in reproducible (not read only) electronic media.

4.8.8.3 The Contractor shall require and hereby represents and warrants to University that the Design Professional is appropriately registered with and licensed by the State of Utah to perform the services required by the Contract Documents to be performed by the Design Professional.

4.8.8.4 All services provided by the Design Professional shall be performed consistent with the professional skill and care ordinarily provided by other design professionals: (1) with the same or similar license; and (2) providing the same or similar design professional service (A) in the same or similar locality, (B) at the same or similar time and (C) under the same or similar circumstances, provided that, if the nature of the project reasonably requires specialized design expertise, the Design Professional shall perform design professional services consistent with such specialized design expertise.

4.8.8.5 Notwithstanding any approval of University or A/E of any Design Documents, the Contractor shall be responsible for assuring that all Design Documents (whether prepared by a Design Professional employed by the Contractor, a Subcontractor or a Sub-subcontractor of any tier) are technically adequate and accurate and are in accordance with all laws, ordinances, codes, regulations or other requirements of governmental authorities having jurisdiction of the Work applicable to the Work on the day of the issuance of such documents and on the day of the use of such documents on the Work.

4.8.8.6 The Contractor shall be responsible and liable to University for any and all losses, costs, and/or expenses incurred by University arising out of, related to and/or connected with errors or omissions in the services provided hereunder by the Design Professional, to the extent that such errors or omissions were caused by the failure of the Design Professional to perform services consistent with the requirements of Section 4.8.8.4 or by other fault of the Design Professional, whether or not such losses, costs and/or expenses were caused by any negligence or other fault of the Contractor. This responsibility and liability shall survive completion of the Work or termination of the Contractor's Agreement.

4.8.8.7 The Contractor shall indemnify and hold harmless University and the other Indemnified Parties (as defined in Section 4.12) from and against any and all third-party claims, demands, losses, liabilities, judgments, costs, expenses and/or attorney fees arising of, related to and/or connected with errors or omissions in the services provided hereunder by the Design Professional, to the extent that such errors or omissions were caused by the failure of the Design Professional to perform services consistent with the requirements of Section 4.8.8.4 or by other fault of the Design Professional, whether or not such third-party claims, demands, losses, liabilities, judgments, costs, expenses and/or attorney fees were caused by any negligence or other fault of the Contractor. This indemnity is in addition to the indemnity provided in Section 4.12 and shall survive completion of the Work or termination of the Contractor's Agreement.

4.8.8.8 The Contractor's or its Subcontractor's or Sub-subcontractor of any tier's agreement with the Design Professional for design services in the performance of the Work shall state that University and its successors and assigns are intended third-party beneficiaries of such agreement and such agreement with the Design Professional shall require the Design Professional to deliver to University a separate agreement wherein the Design Professional shall expressly contract with University to provide the Design Professional's professional services consistent with the standard of care established by Section 4.8.8.4.

4.8.8.9 The Contractor shall indemnify, defend and hold harmless University and the other Indemnified Parties (as defined in Section 4.12 of these General Conditions) from and against any and all claims, demands, losses, liabilities, judgments, costs, expenses and/or attorney fees caused by any suits or claims of infringement of any patent rights or copyrights for materials, methods or systems depicted upon or required by Design

Documents prepared by the Design Professional. This indemnity is in addition to the indemnity provided in Sections 4.11 and 4.12 of these General Conditions and shall survive completion of the Work or termination of the Contractor's Agreement.

4.9 USE OF SITE.

4.9.1 IN GENERAL. Contractor shall confine its equipment, the storage of materials, and the operations of its workers at the Work site to areas permitted by the Contract Documents, laws, rules, regulations, ordinances, orders, and permits and shall not unreasonably encumber the Work site with materials or equipment. Contractor shall take all reasonable steps to secure the Work site and protect the Work from any damage. Upon completion of the Work, Contractor shall leave the Work site free and clear of all waste materials, rubbish, tools, equipment, and surplus materials. Contractor shall at all times keep the Work site free from spilled liquids and chemicals, toxic or otherwise. If such a spill occurs while Contractor has control of the Work site, Contractor shall be responsible to clean the affected areas on or about the Work site and pay all associated costs, fines, and penalties. Notwithstanding the foregoing, Contractor shall not be responsible for any damage to the Work site or the Work to the extent caused by University or University's agents.

4.9.2 ACCESS TO NEIGHBORING PROPERTIES.

4.9.2.1 Contractor shall not, except as provided in the Contract Documents or with University's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Work site by the owners of such properties and their respective tenants, agents, invitees and guests.

4.9.2.2 Various federal, state, and local agencies and private landowners may own or control lands and facilities either crossed by or adjacent to the Work site. University shall secure and pay for all necessary rights of access to the Work site. Contractor shall comply with all stipulations provided by University and shall maintain a cooperative relationship with all agencies and landowners. Contractor shall not retain on the Work site any person who in the judgment of University prejudices or tends to endanger this cooperation. Contractor shall not enter into any agreement with such agencies or landowners related to the Work without prior approval by University.

4.10 ACCESS TO WORK. Contractor shall provide University and the A/E access to the Work in preparation and progress, at all times and wherever located.

4.11 INTELLECTUAL PROPERTY LICENSES. Contractor shall obtain and pay for all royalties and other license fees for all equipment, property, or processes of Contractor used or purchased in connection with performance of the Work. Contractor shall defend suits or claims for infringement of intellectual property rights and shall hold University and the A/E harmless from loss on account thereof but shall not be responsible for such defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents. However, if Contractor has reason to believe that the required design, process or product is an infringement of any third party's intellectual property right, Contractor shall be responsible for such defense or loss unless such information is promptly furnished to University in writing.

4.12 INDEMNIFICATION. To the fullest extent permitted by law, Contractor shall release, indemnify, hold harmless, and defend the State of Utah, the State of Utah's institutions, agencies (including, but not limited to, University), departments, divisions, authorities, and instrumentalities, boards, commissions, elected or appointed officers, employees, agents and authorized volunteers (collectively "Indemnified Parties") from and against any and all claims, liabilities, demands, actions, damages, losses and expenses of any nature whatsoever, including, but not limited to, attorneys' fees and defense costs (collectively "Liabilities"), and including those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of, related to, or connected with any act or omission in the performance of the Work, including the

Work of all Subcontractors and their employees, provided that any Liabilities are caused in whole or in part by the negligent, intentional, or other wrongful act or omission of Contractor, any Subcontractor, their employees, or anyone directly or indirectly employed or the agent of any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by an Indemnified Party. Without relieving Contractor of any obligation under the Contract, the Indemnified Parties shall have the right, at their option, to fully participate in the investigation, defense and settlement of any Liabilities.

4.12.1 NOT EXCLUSIVE. The foregoing obligations in this Section 4.12 shall not be construed to negate, abridge, or otherwise reduce any other right or obligation of indemnity which would otherwise exist as to any party or person under the Contract Documents.

4.12.2 NOT LIMITED. The foregoing obligations in this Section 4.12 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or Subcontractor under workers' or workmen's compensation acts, disability benefit acts or other employee benefit acts.

ARTICLE 5. SUBCONTRACTORS.

5.1 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK.

5.1.1 SUBCONTRACTING WORK PERMITTED; CONDITIONS.

5.1.1.1 Contractor may subcontract portions of the Work.

5.1.1.2 University reserves the right to reject on reasonable ground any Subcontractor. Contractor shall not contract with any person or entity to whom University has made reasonable objection. Contractor shall not be required to contract with anyone to whom Contractor has made reasonable and timely objection, provided that any additional costs associated with Contractor replacing a Subcontractor objected to by Contractor with a replacement Subcontractor not objectionable to Contractor shall be at no cost to University.

5.1.2 SUBSEQUENT CHANGES. After execution of Contractor's Agreement Subcontractors listed by Contractor in accordance with Utah Code § 63A-5b-605 and Rule R23-1-615 may be changed by Contractor only in accordance with the requirements of Utah Code § 63A-5b-605 and R23-1-615.

5.1.2.1 University shall pay the additional costs for a University-requested change in Subcontractor if all of the following conditions are met:

5.1.2.1.1 If University in writing requests the change of a Subcontractor;

5.1.2.1.2 The original Subcontractor is a responsible subcontractor that meets the requirements of the Contract Documents; and

5.1.2.1.3 The original Subcontractor did not withdraw as a Subcontractor on the Work.

5.1.2.2 In all other circumstances, Contractor shall pay the additional cost for a change in a Subcontractor.

5.1.3 BUSINESS AND LICENSING REQUIREMENTS. All Subcontractors used by Contractor shall have secured, at their own expense, all necessary professional accreditations, registrations, and licenses in the state of Utah.

5.1.4 BONDING OF SUBCONTRACTORS. Subcontractors, as identified by University in the procurement documents, may be required to submit performance and payment bonds to cover the full extent of

their portion of the Work. This provision does not in any way limit the right of Contractor to have Subcontractors at any tier be required to have a performance and/or payment bond at Contractor's expense.

5.1.5 SUBCONTRACTOR DEFAULT INSURANCE. If the Contract Price includes any amount to compensate the Contractor for Subcontractor Default Insurance ("SDI"), then, notwithstanding anything in the Contract Documents to the contrary:

5.1.5.1 University shall be added to the SDI by a financial interest endorsement reasonably acceptable to University at no cost to University;

5.1.5.2 If the Contract Documents provide for Contractor contingency, no Contractor contingency may be expended for any Subcontractor default or for any expenses and/or losses arising out of, connected with and/or related to any Subcontractor default;

5.1.5.3 Contractor shall in no event be entitled to an increase in the Contract Price and/or extension of the Contract Time for a Subcontractor default or for expense, losses and/or delays arising out of, connected with and/or related in any way to a Subcontractor default; and

5.1.5.4 The cost of SDI is included in Contractor's overhead and profit for purposes of Article 7.

5.2 SUBCONTRACTUAL RELATIONS.

5.2.1 CONTRACTOR FULLY RESPONSIBLE. Subcontracting any portion of the Work shall not relieve Contractor of Contractor's obligations or duties under the Contract Documents, Contractor shall be fully responsible and liable to University for the acts and omissions of all Subcontractors at any tier and their employees and agents and Contractor shall maintain complete control over all Subcontractors. Neither the consent of University to a Subcontractor proposed by Contractor, nor anything contained in the Contract Documents shall be deemed to create a contractual relationship between a Subcontractor at any tier and University.

5.2.2 COMPLY WITH CONTRACT DOCUMENTS. By appropriate enforceable agreement Contractor shall require each Subcontractor to be bound to Contractor by the terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities that Contractor, by the Contract Documents, assumes towards University and the A/E.

5.2.3 RIGHTS. Each Subcontractor agreement shall preserve and protect the rights of University under the Contract Documents with respect to that portion of the Work to be performed by the Subcontractor so that subcontracting any portion of the Work shall not prejudice any rights of University under the Contract Documents, and shall allow to the Subcontractor, unless specifically provided otherwise in the Subcontractor agreement, the benefit of all rights and remedies against Contractor that Contractor, by the Contract Documents, has against University.

5.2.4 SUB-SUBCONTRACTORS. Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors and to require such Sub-subcontractors to enter into similar agreements with lower tier Sub-subcontractors that comply with the requirements of Sections 5.2.2 and 5.2.3.

5.2.5 DOCUMENT COPIES. Contractor shall make available to each proposed Subcontractor, prior to execution of the Subcontractor agreement, copies of the Contract Documents to which the Subcontractor shall be bound. Contractor shall require Subcontractors to make copies of applicable portions of the Contract Documents available to their respective proposed Sub-subcontractors.

5.3 CONTINGENT ASSIGNMENT OF SUBCONTRACTS TO UNIVERSITY. Contractor contingently assigns each Subcontractor agreement with a Subcontractor for a portion of the Work to University, provided that the assignment is effective only after termination of the Contractor's Agreement by University for cause pursuant to Section 12.2 or stoppage of the Work by University pursuant to Section 12.5, and only for those Subcontractor agreements that University accepts by notifying the Subcontractor in writing. Contractor shall remain liable for all obligations incurred under assigned Subcontractor agreements prior to University's acceptance of such assignment.

ARTICLE 6. PROTECTION OF PERSONS AND PROPERTY.

6.1 SAFETY OF PERSONS AND PROPERTY.

6.1.1 CONTRACTOR RESPONSIBILITY. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work. Contractor shall seek to minimize the risk of bodily injury, property damage, and environmental harm by taking all reasonable precautions to protect:

6.1.1.1 All persons at and/or in proximity to the Work site;

6.1.1.2 Materials and equipment to be incorporated in the Work, whether in storage on or off the Work site, under the care, custody, or control of Contractor or a Subcontractor;

6.1.1.3 Property and structures located at the Work site and adjacent to the Work site, whether or not such property and structures are part of the Work, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction; and

6.1.1.4 The environment.

6.1.2 SAFETY PROGRAM, PRECAUTIONS. Contractor shall institute and provide to University a project specific safety program at the start of the Work to minimize accidents. The program shall continue to the final completion of the Work and conform to applicable laws, rules, and regulations. including without limitation. the Utah Occupational Safety and Health Rules as published by the Utah Labor Commission - UOSH Division at Utah Administrative Code, R614. Contractor shall post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as Contractor proceeds with the Work, Contractor shall have all workers and all visitors on the Work site wear safety hard hats, as well as all other appropriate safety apparel such as safety glasses and shoes, and obey all safety laws, rules, and regulations. Contractor shall post a sign in a conspicuous location indicating the necessity of wearing hard hats, and Contractor shall loan such hard hats to visitors. Contractor shall maintain a clean and orderly Work site.

6.1.3 COMPLIANCE WITH LAWS. Contractor shall give notices and comply with applicable laws, rules, regulations, ordinances, and orders of public authorities applicable to the safety of persons and property and their protection from damage, injury and loss. In particular, Contractor shall comply with all applicable provisions of federal, state and municipal safety laws, rules and regulations, specifically including, without limitation, building codes, to prevent accidents and injury to persons on, about or adjacent to the Work site.

6.1.4 ERECT AND MAINTAIN SAFEGUARDS. As required by existing conditions at the Work site and proper and safe performance of the Work, Contractor shall erect and maintain safeguards for safety and protection, including effective fences, danger signs, barricades and other warnings against hazards. Contractor shall also promulgate safety regulations and notify owners and users of adjacent sites and/or utilities before performing Work that may impact such adjacent sites and/or utilities.

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

6.1.6 PROMPT REMEDY. Contractor shall promptly remedy any damage and loss (other than damage or loss insured under property insurance required by Section 10.2) to persons, property and/or the environment arising in conjunction with the Work caused in whole or in part by Contractor, Subcontractors, or any person or entity for whose acts Contractor is responsible, without cost or expense to University.

6.1.7 SAFETY DESIGNEE. Contractor shall designate a responsible member of Contractor's organization at the Work site whose duty shall be the prevention of accidents, damage, injury and loss. This person shall be Contractor's superintendent, unless otherwise designated by Contractor in writing to University and the A/E.

6.1.8 LOAD SAFETY. Contractor shall not load or permit any part of the construction or Work site to be loaded so as to endanger its safety and/or the safety of persons at or in the vicinity of the Work site.

6.1.9 OFF-SITE RESPONSIBILITY. In addition to its other obligations under this Article 6, the Contractor shall, at Contractor's sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of the State, University and third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by Contractor or by Contractor's Subcontractors at any tier. The Contractor shall not cause materials, including soil and debris, to be placed or left on streets or ways.

6.1.10 EMERGENCIES. In an emergency affecting safety of persons or property, Contractor shall act, at Contractor's discretion, to prevent threatened damage, injury or loss. Contractor shall promptly notify University of the action taken.

6.2 HAZARDOUS MATERIALS. In the event Contractor encounters at the Work site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB), or any other hazardous waste or substance that may endanger the health of persons performing Work or being at the Work site that is not part of the Work and/or disclosed by the Contract Documents**,** Contractor shall immediately stop Work in the area affected and immediately report the condition to University and the A/E by phone with a follow-up email. Contractor shall resume the Work in the affected area upon written direction provided by University. Except to the extent provided otherwise in the Contract Documents, or if the presence of hazardous materials is due to the fault of Contractor, Contractor shall not be required to perform, without Contractor's consent, any Work relating to asbestos, polychlorinated biphenyl (PCB), or any other hazardous waste or substance.

6.3 HISTORICAL AND ARCHEOLOGICAL CONSIDERATIONS. In the event Contractor discovers any cultural, historical, or archeological material that is either recognized as an item to be protected under federal, state, or local law or regulation, or is an item of obvious value to the State of Utah, Contractor shall cease any Work that would interfere with such discovery and immediately report the condition to University and the A/E by phone with a follow-up email. Contractor shall resume the Work upon the direction of University. Contractor shall ensure cooperation with any University-recognized archaeologist or other cultural/historical expert.

6.4 CONTRACTOR LIABILITY. If Contractor fails in any of its obligations in Sections 6.2 through 6.3, Contractor shall be liable for any damages to University, the State of Utah, or any third party resulting from such noncompliance. Contractor shall also be liable for any mitigation or restoration effort resulting from such noncompliance. To the extent all the following is met, the presence of hazardous material or cultural, historical, or archeological material at the Work site shall qualify as a concealed or unforeseen condition under Section 7.1.5:

6.4.1 The presence of such material is not reasonably foreseeable given the site conditions that Contractor is or should have been aware of;

6.4.2 The presence of such material is not identified in any part of the Contract Documents;

6.4.3 Contractor has undertaken all proper action to mitigate any impact of the discovery of such material on the Contract Time and/or Contract Price;

6.4.4 The discovery of such material increases the Contract Time and/or Contract Price from what is stated in the Contract Documents; and

6.4.5 The requirements of Section 7.1.5 and the Contract Documents are met.

ARTICLE 7. MODIFICATIONS, PRs & PCOs, PRE AND CLAIM PROCESS.

7.1 MODIFICATIONS: IN GENERAL.

7.1.1 TYPES OF MODIFICATIONS AND LIMITATIONS. Changes in the Work may be accomplished after execution of the Contractor's Agreement, and without invalidating the Contract Documents, by ASI, Change Order or Construction Change Directive, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. Contractor must have a written Change Order or Construction Change Directive executed by University under this Article 7 prior to proceeding with any Work for which Contractor intends to request an increase in the Contract Price and/or an extension of the Contract Time.

7.1.2 BY WHOM ISSUED. The A/E or University may issue ASIs not involving an adjustment in the Contract Price or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents. A Change Order or Construction Change Directive shall be issued by University. The A/E shall prepare Change Orders and Construction Change Directives with specific documentation and data for University's approval and execution in accordance with the Contract Documents.

7.1.3 CONTRACTOR TO PROCEED UNLESS OTHERWISE STATED. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in the ASI, Change Order or Construction Change Directive.

7.1.4 ADJUSTING UNIT PRICES. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a proposed Change Order or Construction Change Directive that application of such unit prices to quantities of Work proposed shall cause a substantial inequity to University or Contractor, the applicable unit prices may be equitably adjusted.

7.1.5 CONCEALED OR UNKNOWN CONDITIONS. Contractor must file a written notice with University within seven (7) calendar days of the date that Contractor knew or should have known of a site condition described below or Contractor shall be deemed to waive any right to file any PCO, PRE, or Claim for an increase in the Contract Price and/or extension of the Contract Time related to such condition:

7.1.5.1 If Contractor encounters unknown and reasonably unforeseeable subsurface or otherwise concealed physical conditions, including hazardous or historical/cultural/archeological materials under Article 6, which differ materially from those indicated by the Contract Documents or which would have been revealed by a reasonably thorough site inspection; or

7.1.5.2 If Contractor encounters unknown physical conditions of an unusual nature which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents.

7.1.6 INCREASE IN CONTRACT TIME. To the extent University and/or the State of Utah is damaged by the failure of Contractor to provide the notice required by Section 7.1.5 after the Contractor knows or should have known of such site condition, Contractor shall be liable for liquidated damages attributable thereto, as well as any damages to the State of Utah and/or University that are allowable in addition to liquidated damages.

7.1.7 ALLOWANCES.

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

7.1.7.2 Unless otherwise provided in the Contract Documents:

7.1.7.2.1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the Work site and all required taxes, less applicable trade discounts;

7.1.7.2.2 Allowances shall cover the Contractor's costs of unloading and handling at the Work site, labor, installation costs and other expenses contemplated for allowance items of the Work, including the Contractor's overhead and profit.

7.1.7.2.3 Whenever costs are more than or less than allowances, the Contract Price for the Work shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 7.1.7.2.1 and (2) changes in Contractor's costs under Section 7.1.7.2.2.

7.1.7.3 Materials and equipment under an allowance shall be selected by University with reasonable promptness.

7.2 CONTRACTOR INITIATED REQUESTS.

7.2.1 THE REQUEST FOR INFORMATION ("RFI") PROCESS AND TIME TO FILE. Contractor may file an RFI with the A/E regarding any question the answer to which will assist Contractor in the proper completion of the Work, including, but not limited to, issues related to the Contract Documents, Drawings, and Specifications. The RFI shall be filed with the A/E in a timely manner so as not to prejudice University as to the quality, time, or cost related to the Work.

7.2.2 PROPOSED CHANGE ORDER ("PCO"). Within seven (7) days after Contractor knows or should know of a situation or condition for which Contractor anticipates requesting an increase in the Contract Price and/or extension of the Contract Time, Contractor must file a Proposed Change Order ("PCO") with University, or Contractor shall be deemed to waive any right to claim an increase in the Contract Price and/or extension of the Contract Time related to such situation or condition. The PCO shall include all documentation supporting the PCO available to Contractor at the time of filing and Contractor shall thereafter diligently pursue the supplementation(s) of such documentation and promptly deliver such supplementation(s) to University.

7.2.2.1 One of the following may occur after a PCO is filed with University:

7.2.2.1.1 University, after considering any input by the A/E, may reach an agreement with Contractor and issue a Change Order.

7.2.2.1.2 University, after considering any input by the A/E, may issue a Construction Change Directive.

7.2.2.1.3 If University, after considering any input by the A/E, disagrees with Contractor's PCO, University may seek additional information or verification from Contractor, the A/E, or other sources, and may negotiate with Contractor, may issue a Change Order upon such later agreement, may issue or retract an issued PR, or may issue a Construction Change Directive.

7.2.2.2 If a Construction Change Directive is issued which identifies University's position in regard to a Contract Price and/or Contract Time adjustment or if a PCO is denied by University, Contractor must file a PRE no later than twenty-one (21) days after Contractor's receipt of the Construction Change Directive or such denial of the PCO. Failure to timely file a PRE shall be deemed to waive any right to an increase in the Contract Price and/or extension of the Contract Time related to a Construction Change Directive beyond that identified by University in the Construction Change Directive, if any, or denial of the PCO. Such waiver shall entitle University to convert a Construction Change Directive into a Change Order, whether or not executed by Contractor.

7.2.2.3 If a Construction Change Directive leaves open the determination of an increase in the Contract Price and/or extension of the Contract Time related to a change in the Work, then the time period for commencement of filing the PRE shall not accrue until such time as University has conveyed to Contractor University's position as to increase, if any, in the Contract Price and/or extension, if any, of the Contract Time as a result of the change in the Work.

7.2.2.4 The Contractor must continually cooperate with University in providing data, documentation and efforts to resolve any issues related to a PCO.

7.2.3 SUBSTITUTIONS. The Contractor may make substitutions only with the consent of University, after evaluation by the A/E and in accordance with a Change Order. Substitutions will be considered after the award of the Contractor's Agreement only when a PCO is submitted by the Contractor to substitute a non-specified product for a product specified in the Contract Documents, under the following conditions:

7.2.3.1 The PCO is accompanied by complete data on the proposed substitution substantiating compliance with the design intent and performance requirements of the Contract Documents, including product identification and description, performance and test data, references and samples where applicable, comparison of the proposed substitution with the products specified or named in the Contract Documents, and the impact of the substitution upon the Contract Time.

7.2.3.2. The PCO is accompanied by accurate cost data on the proposed substitution and comparison with the products specified, whether or not modification of the Contract Price is to be a consideration.

7.2.3.3 The Contractor is responsible for any additional costs for the A/E's additional services caused by the evaluation of the proposed substitution and/or the substitution of products.

7.2.3.4 The PCO for substitution by the Contractor shall constitute a certification by the Contractor that the Contractor has investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified; the cost data presented by the Contractor is complete and includes all related costs under the Contract Documents, including the A/E's additional services; the Contractor waives all claims for additional costs related to the substitution which subsequently become apparent; the Contractor will provide the same guarantee or warranty for the substituted product that the Contractor would have provided for the

product specified in the Contract Documents; and the Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be properly completed in all respects.

7.2.3.5 Substitutions will not be considered by the A/E or University if they are intended or implied by submittals of Shop Drawings, Product Data or Samples without a PCO for substitution or when for their implementation they require a substantial revision of the Contract Documents in order to accommodate their use.

7.3 PROPOSAL REQUEST INITIATED BY UNIVERSITY. University may submit a Proposal Request to Contractor seeking information, data, impact on the Contract Price and/or impact on the Contract Time for a change in the Work or other modification to the Contract Documents. The PR shall provide a time limit for Contractor to file a response with the A/E and University. If a proposal is not timely provided by Contractor, University may calculate a Change Order under Section 7.4.2. Upon timely receipt of a proposal, one of the following shall occur:

7.3.1 IF AGREEMENT, CHANGE ORDER ISSUED. University, after considering any input by the A/E, may reach an agreement with the Contractor and issue a Change Order.

7.3.2 IF DISAGREEMENT. If University disagrees with Contractor's proposal, after considering any input from the A/E, University may seek additional information or verification from Contractor or other sources, may negotiate with Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. If a Construction Change Directive is issued that identifies University's position in regard to the increase, if any in the Contract Price and/or extension, if any, of the Contract Time, Contractor must file a PRE within twenty-one (21) days of Contractor's receipt of the Construction Change Directive, or Contractor shall be deemed to waive any right for an increase in the Contract Price and/or extension of the Contract Time as a result of the issuance of the Construction Change Directive beyond that identified by University in the Construction Change Directive, if any. Such waiver shall entitle University to convert the Construction Change Directive into a Change Order, whether or not executed by Contractor. If the Construction Change Directive leaves open the determination of an increase, if any, in the Contract Price and/or extension, if any, of the Contract Time related to the change in the Work, then the time period for commencement of filing the PRE shall not accrue until such time as University has conveyed to Contractor University's position as to the increase, if any, in the Contract Price and/or extension, if any, of the Contract Time resulting from the change in the Work.

7.4 CHANGE ORDERS.

7.4.1 ADJUSTING PRICE BASED UPON AGREEMENT. If a Change Order provides for an adjustment to the Contract Price, the adjustment shall be based on the mutual agreement of Contractor and University, including any terms mandated by unit price agreements or other terms of the Contract Documents.

7.4.2 UNIVERSITY RESOLUTION OF PRICE IN THE ABSENCE OF AN AGREEMENT UNDER SECTION 7.4.1. In the absence of an agreement under Section 7.4.1, the adjustment in Contract Price shall be based on an itemized accounting of costs and savings supported by appropriate data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section shall be limited to the following:

7.4.2.1 All direct and indirect costs of labor; including workers' compensation insurance, social security, and other federal and state payroll-based taxes, and payroll-based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;

7.4.2.2 Costs of materials, on-site temporary facilities, supplies, and equipment (except hand tools) required for or incorporated into the Work;

7.4.2.3 Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from Contractor or others;

7.4.2.4 Costs of permits and other fees, sales, use or similar taxes related to the Work; and

7.4.2.5 Overhead and profit. The markups stated herein for overhead and profit are intended to cover the Contractor's profit and all indirect costs associated with a change in the Work. Items covered by such markups include, but are not limited to: home office expenses, branch office and field office overhead expense of any kind; project management; estimating, engineering; coordinating; expediting; purchasing; billing and invoicing; detailing; legal, accounting, data processing or other administrative expenses; computer and telephone costs (including computer and phone allowances); shop drawings; liability insurance premium, auto insurance premium, performance and payment bond premium and SDI; vehicle costs (including vehicle allowances); ESOP related costs; and warranty expense costs. The cost for the use of small tools is also to be considered covered by such markups. Small tools shall be defined as tools and equipment (power or non-power) with an individual purchase cost of less than Seven Hundred Fifty Dollars ($750).

7.4.2.5.1 The maximum markup percentage to be paid to any contractor (regardless of tier) including Contractor, a Subcontractor and/or Sub-subcontractor on self-performed work shall be a single markup percentage not-to-exceed fifteen percent (15%) of the net increased direct cost of: (A) direct labor and allowable labor burden costs applicable to the change in the Work; (B) the net cost of material and installed equipment incorporated into the change in the Work, and (C) net rental cost of major equipment and related fuel costs necessary to complete the change in the Work;

7.4.2.5.2 With respect to pricing the portion of Change Orders involving work performed by lower tier contractors, including Subcontractors and Sub-subcontractors, the maximum markup percentage allowable to the Contractor, Subcontractor or Sub-subcontractor supervising the lower tier contractor's work shall not exceed seven percent (7%) of the net increase of all approved changes in the Work performed by all contractors combined for any particular Change Order.

7.4.2.5.3 Contractor agrees to include these limitations on Change Order pricing in Contractor's subcontracts with Subcontractors and shall likewise require all of Contractor's Subcontractors to include the same provisions in all sub-subcontracts with their respective Sub-subcontractors of any tier.

7.4.3 **CREDITS**. The amount of credit to be allowed by Contractor to University for a deletion or change in the Work which results in a net decrease in the Contract Price shall be actual net cost as confirmed to University based upon corroboration by an appropriate source, provided, however, the application of the markup percentages referenced in Section 7.4.2.5 for overhead and profit will apply only to additive change orders. In those instances where a change in the Work involves both additive and deductive work, the additions and deductions will be netted and the markup percentage adjustments will be applied to the net additive amount, if any.

7.4.4 **EFFECT OF A CHANGE ORDER.** A Change Order signed by the Contractor constitutes the Contractor's agreement that, when implemented by University, the adjustment in the Contract Price, if any, and/or the adjustment in the Contract Time, if any, for the change in the Work shall fully and finally compensate the Contractor and its Subcontractors and Sub-subcontractors of any tier for any and all additional costs, damages or expenses arising directly or indirectly out of the change in the Work described in the Change Order.

7.4.4.1 All Change Orders shall be conclusively presumed to constitute settlement of all Claims for direct or indirect damages of the Contractor, its Subcontractors and their respective Sub-subcontractors of any tier arising out of the change in the Work. This shall include, but is not limited to, any and all so-called "delay," "equitable adjustment," "impact," "cumulative impact," "acceleration," "constructive acceleration," "inefficiency," "interference," "indirect," "ripple" or "consequential" claims, costs or damages and all direct or

indirect costs pertaining to the Contractor's home office, branch offices, or field site office and all other costs and effects whatsoever relating to the change in the Work.

7.4.4.2 Any statement unilaterally added by the Contractor to a Change Order or contained in any transmittal or separate correspondence wherein the Contractor unilaterally attempts to reserve rights to seek any further increases in the Contract Price and/or further extensions of the Contract Time for a change in the Work that is the subject of the Change Order and/or arising out of, related to and/or connected with the change in the Work described in the Change Order shall be null and void.

7.5 CONSTRUCTION CHANGE DIRECTIVES.

7.5.1 WHEN USED AND CONTRACTOR'S RIGHT TO CHALLENGE. Without invalidating the Contractor's Agreement, University reserves the right to unilaterally issue, in University's sole discretion, a Construction Change Directive that requires Contractor to proceed with a change in the Work. University may order minor changes within the scope of Work without granting an adjustment in the Contract Price or an extension of the Contract Time if such minor changes within the scope of Work are consistent with the intent of the Contract Documents. In order to expedite the Work and avoid or minimize delays in the Work that may affect the Contract Price or Contract Time, the Contract Documents shall be amended as described below. If the Construction Change Directive leaves open the determination of an increase, if any, in the Contract Price and/or extension, if any, of the Contract Time related to the change in the Work, then the Construction Change Directive shall indicate the timeframe(s) in which Contractor shall provide further information to resolve such open issue(s). When University and Contractor agree upon an increase, if any, in the Contract Price and/or extension, if any, in the Contract Time related to a Construction Change Directive, the parties shall execute a Change Order. Additionally, the Construction Change Directive may be converted to a Change Order under Section 7.2.2.2 or Section 7.3.2.

7.5.2 PROCEED WITH WORK. Upon receipt of a Construction Change Directive, Contractor shall promptly proceed with the change in the Work involved.

7.5.3 INTERIM PAYMENTS BY UNIVERSITY. Pending the final determination of the increase in the Contract Price, if any, associated with a Construction Change Directive, University shall pay any undisputed amount to Contractor.

7.6 ASI. The A/E may at any time that is consistent with maintaining the quality, safety, time, budget, and function of the Work, issue to Contractor an ASI after approval from University is obtained.

7.7 PROCEDURE FOR PRELIMINARY RESOLUTION EFFORTS.

7.7.1 REQUEST FOR PRELIMINARY RESOLUTION EFFORT (PRE). If Contractor wishes to raise an issue related to an alleged breach of contract by University or an issue concerning time or money, Contractor shall file a PRE as a prerequisite for any consideration of the issue by University. The labeling of the notice or request shall not preclude the consideration of the issue by University.

7.7.2 TIME FOR FILING. The PRE must be filed in writing with University within twenty-one (21) days of any of the following:

7.7.2.1 Issuance of a Construction Change Directive that states the adjustment in Contract Price and/or Contract Time, if any, if Contractor disagrees with such adjustment;

7.7.2.2 Issuance of a statement of University's position with respect to the adjustment in Contract Price and/or Contract Time, if any, in a previously issued Construction Change Directive that left open the adjustment in Contract Price and/or Contract Time, if Contractor disagrees with such statement;

7.7.2.3 Issuance of a denial of a PCO by University;

7.7.2.4 In the case of a Subcontractor, after the expiration of the time period for the Contractor/Subcontractor PRE process under Section 7.7.5; or

7.7.2.5 Except as provided in Section 7.2.2, when Contractor knows or should have known about any other issue where Contractor seeks an adjustment in the Contract Price, Contract Time and/or other relief from University.

7.7.3 CONTENT REQUIREMENT. The PRE shall be required to include in writing to the extent information is reasonably available at the time of filing of the PRE:

7.7.3.1 A description of the issue;

7.7.3.2 The potential impact on the Work, Contract Price and/or Contract Time; and

7.7.3.3 An indication of the relief sought.

7.7.4 SUPPLEMENTATION. Additional detail of the content requirement under Section 7.7.3 shall be provided later if the detail is not yet available at the initial filing as follows:

7.7.4.1 While the issue is continuing or the impact is being determined, Contractor shall provide a written updated status report every thirty (30) days or as otherwise reasonably requested by University; and

7.7.4.2 After the issue is concluded and/or the impact is determinable, complete information, including any impacts on Contract Price, Contract Time and/or other relief requested, if any, must be provided to University within twenty-one (21) days of the earlier of the date the issue is concluded or the impact is determinable.

7.7.5 SUBCONTRACTORS. Contractor must include the provisions of this Section 7.7.5 in Contractor's subcontract with each Subcontractor and require each Subcontractor to do likewise in each Subcontractor's sub-subcontracts with Sub-subcontractors. At Contractor's discretion, Contractor may allow a Sub-subcontractor at the second tier and beyond to submit a PRE directly to Contractor.

7.7.5.1 In order for a Subcontractor at any tier to be involved with the PRE of University, the following conditions and process shall apply:

7.7.5.1.1 The Subcontractor must have attempted to resolve the issue with Contractor, including the submission of a PRE with Contractor.

7.7.5.1.2 The Subcontractor must file a copy of the PRE with University;

7.7.5.1.3 The PRE to Contractor must meet the time, content, and supplementation requirements of Sections 7.7.2, 7.7.3 and 7.7.4. The triggering event for a Subcontractor to file a PRE shall be the time at which the issue cannot be resolved through negotiation;

7.7.5.1.4 The PRE submitted to Contractor shall only be eligible for consideration in University's PRE process to the extent the issue is reasonably related to the performance of University or an entity for which University is liable;

7.7.5.1.5 Contractor shall resolve the PRE with the Subcontractor within sixty (60) days of its submittal to Contractor or such other time period as subsequently agreed to by the Subcontractor in writing. If Contractor

fails to resolve the PRE with the Subcontractor within such required time period, the Subcontractor may submit in writing the PRE with Contractor and University. In order to be eligible for University's consideration of the PRE, the Subcontractor must submit the PRE within twenty-one (21) days of the expiration of the time period for the Contractor/Subcontractor PRE process. University shall consider the PRE as being submitted by Contractor on behalf of the Subcontractor;

7.7.5.1.6 Upon such PRE being submitted, Contractor shall cooperate with University in reviewing the issue;

7.7.5.1.7 University shall not be obligated to consider any submission which is not in accordance with any provision of this Section 7.7;

7.7.5.1.8 The Subcontractor may accompany Contractor in participating with University regarding the PRE raised by the Subcontractor. University shall not be precluded from meeting with Contractor separately, and it shall be the responsibility of Contractor to keep the Subcontractor informed of any such meetings; and

7.7.5.1.9 Notwithstanding any provision of this Section 7.7.5, a Subcontractor shall be entitled to pursue a payment bond claim.

7.7.6 INFORMATION AND MEETINGS. University may request additional information and may meet with the parties involved with the issue.

7.7.7 CONTRACTOR REQUIRED TO CONTINUE PERFORMANCE. Pending the final resolution of the issue, unless otherwise agreed upon in writing by University, Contractor shall proceed diligently with performance of the Work and University shall continue to make payments of undisputed amounts in accordance with the Contract Documents.

7.7.8 DECISION. University shall issue to Contractor, and any other third party brought into the process by University as being potentially liable to University, a written decision providing the basis for the decision on the issues presented by all of the parties within thirty (30) days of receipt of all the information required under Sections 7.7.3 and 7.7.4.

7.7.9 DECISION FINAL UNLESS CLAIM SUBMITTED. The decision by University shall be final, and not subject to any further administrative or judicial review (not including judicial enforcement) unless a Claim is submitted in accordance with these General Conditions.

7.7.10 EXTENSION REQUIRES MUTUAL AGREEMENT. Any time period specified in Section 7.7 may be extended by mutual agreement of Contractor and University.

7.7.11 IF DECISION NOT ISSUED. If the decision is not issued within the thirty (30) day period, stated in Section 7.7.8 including any agreed to extensions, the issue may be pursued as a Claim.

7.7.12 PAYMENT FOR PERFORMANCE.

7.7.12.1 Except as otherwise provided in the Contract Documents, any final decision where University is to pay additional monies to Contractor, shall not be delayed by any PRE, Claim, or appeal by another party.

7.7.12.2 Payment to Contractor in accordance with any final decision shall be made by University consistent with the Contract Documents.

7.7.12.3 Notwithstanding any other provision of the Contract Documents, payment to Contractor shall be subject to any set-off, claims, or counterclaims of University.

7.7.12.4 Payment to Contractor for a Subcontractor issue submitted by the Contractor shall be paid by Contractor to Subcontractor in accordance with the subcontract between Contractor and Subcontractor.

7.7.12.5 Any payment or performance determined owing by Contractor to University shall be made in accordance with the Contract Documents.

7.8. RESOLUTION OF CLAIM.

7.8.1 CLAIM. If the decision on the PRE is not issued within the required timeframe or if Contractor is not satisfied with the decision, Contractor, or other party brought into the process by University, may submit a Claim in accordance with this Section 7.8 as a prerequisite for any further consideration by University or the right to any judicial review of the issue giving rise to the Claim.

7.8.2 SUBCONTRACTORS. In order for a Subcontractor to have its issue considered in the Claim process by University, the Subcontractor that had its issue considered under Section 7.7.5 may submit the issue as a Claim by filing it with Contractor and University within the same timeframe and with the same content requirements as required of a Claim submitted by Contractor under this Section 7.8.2. University shall consider the Claim as being submitted by Contractor on behalf of the Subcontractor. Under no circumstances shall any provision of these General Conditions or the Contract Documents be construed so as to create any contractual relationship between University and any Subcontractor.

7.8.2.1 Upon such Claim being submitted, the Contractor shall fully cooperate with the Director, the person(s) evaluating the claim and any subsequent reviewing authority.

7.8.2.2 The Director shall not be obligated to consider any submission which is not in accordance with this Section 7.8.2.

7.8.2.3 The Subcontractor may accompany Contractor in participating with the Director, the person(s) evaluating the Claim and any subsequent reviewing authority regarding the Claim. The Director, the person(s) evaluating the Claim, and any subsequent reviewing authority is not precluded from meeting with Contractor separately, and it shall be the responsibility of Contractor to keep the Subcontractor informed of any such meetings and matters discussed.

7.8.2.4 Notwithstanding any provision of this Section 7.8, a Subcontractor shall be entitled to pursue a payment bond claim.

7.8.3 TIME FOR FILING. The Claim must be filed in writing promptly with the Director, but in no case more than twenty-one (21) days after the decision is issued on the PRE under Section 7.7.8 or no more than twenty-one (21) days after the thirty (30) day period under Section 7.7.11 has expired with a decision not issued.

7.8.4 CONTENT REQUIREMENT. The written Claim shall include:

7.8.4.1 A description of the issues in dispute;

7.8.4.2 The basis for the Claim, including documentation and analysis required by the Contract Documents and applicable law and rules that allow for the proper determination of the Claim;

7.8.4.3 A detailed cost estimate for any amount sought, including copies of any related invoices; and

7.8.4.4 A specific identification of the relief sought.

7.8.5 EXTENSION OF TIME TO SUBMIT DOCUMENTATION. The time period for submitting documentation and any analysis to support a Claim may be extended by the Director upon written request of the claimant showing just cause for such extension, which request must be included in the initial Claim submittal.

7.8.6 CONTRACTOR REQUIRED TO CONTINUE PERFORMANCE. Pending the final determination of the Claim, including any judicial review or appeal process, and unless otherwise agreed upon in writing by the Director, Contractor shall proceed diligently with performance of the Contract and University shall continue to make payments of undisputed amounts in accordance with the Contract Documents.

7.8.7 AGREEMENT OF CLAIMANT ON METHOD AND PERSON(S) EVALUATING THE CLAIM. The Director shall first attempt to reach agreement with the claimant on the method and person(s) to evaluate the Claim. If such agreement cannot be made within fourteen (14) days of filing of the Claim, the Director shall select the method and person(s), considering the purposes described in Rule R23-26-1. Unless agreed to by the Director and the claimant, any selected person shall not have a conflict of interest or appearance of impropriety. Any party and the person(s) evaluating the Claim has a duty to promptly raise any circumstances regarding a conflict of interest or appearance of impropriety. If such a reasonable objection is raised, and unless otherwise agreed to by the Director and the claimant, the Director shall take appropriate action to eliminate the conflict of interest or appearance of impropriety. The dispute resolution methods and person(s) may include any of the following:

7.8.7.1 A single expert and/or hearing officer qualified in the field that is the subject of the Claim;

7.8.7.2 An expert panel, consisting of members that are qualified in a field that is the subject of the Claim;

7.8.7.3 An arbitration process which may be binding if agreed to by the parties to the Claim;

7.8.7.4 A mediator; or

7.8.7.5 Any other method that best accomplishes the purposes set forth in Rule R23-26-1.

7.8.8 THE EVALUATION PROCESS, TIMEFRAMES OF EVALUATOR(S), DIRECTOR'S DETERMINATION, ADMINISTRATIVE APPEAL TO THE EXECUTIVE DIRECTOR AND JUDICIAL REVIEW. The Claim shall be evaluated, the timeframe for specific events related to the person(s) evaluating the Claim, the Director's determination, any appeal to the Executive Director and any judicial review shall be subject to the provisions of Rule R23-26-5(8), R23-26-5(9), R23-26-6 and R23-26-8. A copy of these Administrative Rules is available at https://rules.utah.gov.

7.8.9 APPEAL PROCESS PREREQUISITE FOR FURTHER CONSIDERATION OR JUDICIAL REVIEW. The administrative appeal to the Executive Director is a prerequisite for any further consideration by the State of Utah, or to judicial review of the issue giving rise to the Claim. It shall be

considered that the Contractor, or another party brought into the process by University, has not exhausted its administrative remedies if such an administrative appeal is not undertaken.

7.8.10 PAYMENT OF CLAIM.

7.8.10.1 When a stand-alone component of a Claim has received a final determination, and is no longer subject to review or appeal, that amount shall be paid in accordance with the payment provisions of the Contract Documents or judicial order.

7.8.10.2 When the entire Claim has received a final determination, and is no longer subject to review or appeal, the full amount shall be paid within fourteen (14) days of the date of the final determination unless the Work or services have not been completed, in which case the amount shall be paid in accordance with the payment provisions of the Contract Documents to the point that the Work is completed.

7.8.10.3 The final determination date is the earlier of the date upon which the claimant accepted the settlement in writing with an executed customary release document and waived its rights of appeal, or the expiration of the appeal period, with no appeal filed, or the determination made resulting from the final appeal.

7.8.10.4 Any final determination where University is to pay additional monies to Contractor shall not be delayed by any appeal or request for judicial review by another party brought into the process by University as being liable to University.

7.8.10.5 Notwithstanding any other provision of the Contract Documents, payment of all or part of a Claim shall be subject to any set-off, claims, or counterclaims of University.

7.8.10.6 Payment to Contractor for a Subcontractor issue (Claim) deemed filed by Contractor, shall be paid by Contractor to the Subcontractor in accordance with the subcontract between Contractor and the Subcontractor.

7.8.10.7 The execution of a customary release document by the claimant related to any payment may be required as a condition of making the payment. Unless expressly and specifically released in writing by University, settlement of a Claim by University shall not be deemed a waiver of Claims reserved under Section 8.8.3.

7.8.11 ALLOCATION OF COSTS OF CLAIM RESOLUTION PROCESS.

7.8.11.1 In order to file a Claim, a claimant must pay a Fifteen Hundred Dollar ($1,500.00) filing fee to University. When the Claim is a pass-through from a Subcontractor in accordance with Section 7.7.5, the payment of the fee shall be made by the Subcontractor.

7.8.11.2 Unless otherwise agreed to by the parties to the Claim, the costs of resolving the Claim shall be allocated among the parties on the same proportionate basis as the determination of financial responsibility for the Claim.

7.8.11.3 The costs of resolving the Claim that are subject to allocation include the claimant's filing fee, the costs of any person(s) evaluating the Claim, the costs of making any required record of the process, and any additional testing or inspection procured to investigate and/or evaluate the Claim.

7.8.11.4 Each party shall be responsible for its own attorney fees.

7.8.12 ALTERNATIVE PROCEDURES. To the extent otherwise permitted by law, if all parties to a Claim agree in writing, a protocol for resolving a Claim may be used that differs from the process described in this Section 7.8.

7.8.13 IMPACT ON FUTURE SELECTIONS.

7.8.13.1 The presentation of a good faith and non-frivolous issue or Claim shall not be considered by University in University's selection process for a future award of contract; and

7.8.13.2 The submission of a bad faith and frivolous issue or Claim, or the failure by a Contractor to facilitate resolution of a Claim, may be considered in University's evaluation of performance.

7.8.14 REPORT TO BUILDING BOARD. University may report on the Claim to the Utah State Building Board.

7.8.15 UNIVERSITY'S RIGHT TO HAVE ISSUES, DISPUTES OR CLAIMS CONSIDERED. As stated in Rule R23-26-1(6), Sections 7.7 and 7.8 do not limit the right of University to have any of University's issues, disputes or claims considered. University reserves all rights to pursue University's issues, disputes or claims in law or equity including, but not limited to, any or all of the following: damages, delay damages and impacts, losses, liability, patent or latent defects, or failure to perform under the Contract Documents. If the Director appoints an expert or a panel to consider any such issue(s), dispute(s) or claim(s) of University, Contractor shall cooperate with such expert or panel process.

ARTICLE 8. PAYMENTS AND COMPLETION.

8.1 SCHEDULE OF VALUES. With the first Application for Payment, Contractor shall submit to the A/E and University a schedule of values allocated to all the various portions of the Work. The schedule of values shall be submitted on the form approved and provided by University. The schedule of values must consist of a detailed and specific breakdown of values actually associated with the various items of Work and shall in no event be "frontloaded". The A/E shall make recommendations to University regarding the schedule of values including any suggested modifications. When approved, including any approved modifications, by University, it shall be the basis for future Contractor Applications for Payment. Contractor shall be entitled to reasonably reallocate values in the schedule of values with prior written notice to University. Contractor shall not be entitled to payment until receipt and acceptance of the schedule of values.

8.2 APPLICATIONS FOR PAYMENT.

8.2.1 IN GENERAL. The following general requirements shall be met:

8.2.1.1 Contractor shall submit to the A/E an itemized Application for Payment for Work completed in accordance with the schedule of values and that reflects retainage as provided for in the Contractor's Agreement. The Application for Payment shall be on a form approved and provided by University.

8.2.1.2 The Application for Payment shall be supported by such data substantiating Contractor's right to payment as University or the A/E may require.

8.2.1.3 The Application for Payment may include requests for payment pursuant to approved Change Orders or Construction Change Directives.

8.2.1.4 The Application for Payment shall not include requests for payment for portions of the Work performed by a Subcontractor when Contractor does not intend to pay that Subcontractor because of a dispute or other reason.

8.2.1.5 In executing the Application for Payment, Contractor shall attest that Subcontractors involved with prior Applications for Payment have been paid, unless Contractor provides a detailed explanation why such payment has not occurred. University reserves the right to require Contractor to submit a Utah Conditional Waiver and Release Upon Progress Payment form from one or more Subcontractors.

8.2.2 PAYMENT FOR MATERIAL AND EQUIPMENT. Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the Work site for subsequent incorporation into the Work. If approved in advance by University and A/E, payment may similarly be made for materials and equipment suitably stored off-site at a location agreed upon in writing. Payment for materials and equipment stored on or off-site shall be conditioned upon compliance by Contractor with procedures satisfactory to University to establish University's title to such materials and equipment or otherwise protect University's interest, and shall include applicable insurance, storage, and transportation to the Work site for such materials and equipment stored off-site. University may require copies of invoices or other suitable documentation.

8.2.3 WARRANTY OF TITLE. Contractor warrants that title to all Work covered by an Application for Payment shall pass to University no later than the time for payment. Contractor further warrants that upon submittal of an Application for Payment, all Work for which Certificates for Payment have been previously issued and payments received from University shall, to the best of Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances in favor of the Contractor, Subcontractors, or other persons or entities making a claim by reason of having provided labor, materials, and/or equipment relating to the Work.

8.2.4 HOLDBACK BY UNIVERSITY. Notwithstanding anything to the contrary contained in the Contract Documents, University may, as a result of the claims resolution process, withhold any payment to Contractor if and for so long as Contractor fails to perform any of its obligations under the Contract Documents or otherwise is in default under any of the Contract Documents.

8.3 CERTIFICATES FOR PAYMENT.

8.3.1 ISSUED BY A/E. The A/E shall within seven (7) days after receipt of Contractor's Application for Payment, either issue to University a Certificate for Payment, with a copy to the Contractor, for such amount as the A/E determines due or notify Contractor and University in writing of the A/E's reasons for withholding certification in whole or in part as provided in Section 8.4.1. If the A/E fails to act within said seven (7) day period, Contractor may file the Application for Payment directly with University and University shall thereafter have twenty-one (21) days from the date of University's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of Contractor's Applications for Payment shall be Contractor's responsibility, not A/E's.

8.3.2 A/E'S REPRESENTATIONS. The A/E's issuance of a Certificate for Payment shall constitute a representation to University that to the best of the A/E's knowledge, information and belief, based upon the A/E's observations at the site, the data comprising the Application for Payment, and what is reasonably inferable from the observations and data, that the Work has progressed to the point indicated in the Application for Payment and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable prior to completion and to specific qualifications expressed by the A/E. The issuance of a Certificate for Payment shall further constitute a representation that Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment shall not be a representation that the A/E has: (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences or procedures; (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by University to substantiate Contractor's right to payment; (4)

ascertained how or for what purpose Contractor used money previously paid on account of Contract Price; or (5) any duty to make such inquiries.

8.4 DECISIONS TO WITHHOLD CERTIFICATION.

8.4.1 WHEN WITHHELD. The A/E may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect University, if in the A/E's judgment the representations to University required in Section 8.3.2 cannot be made. If the A/E is unable to certify payment in the amount of the Application for Payment, the A/E shall notify Contractor and University as provided in Section 8.3.1. If Contractor and the A/E cannot agree on a revised amount, the A/E shall promptly issue a Certificate for Payment for the amount to which the A/E makes such representations to University. The A/E may also decide not to certify payment or, because of subsequently discovered evidence or observations, may nullify the whole or part of a Certificate for Payment previously issued, to such extent as may be necessary in the A/E's opinion to protect University from loss because of:

8.4.1.1 Defective Work not remedied;

8.4.1.2 Third party claims filed or reasonable evidence indicating probable filing of such claims;

8.4.1.3 Failure of Contractor to make payments properly to Subcontractors or for labor, materials, or equipment;

8.4.1.4 Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Price;

8.4.1.5 Damage to University or another contractor;

8.4.1.6 Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance of the Contract Price would not be adequate to cover actual or liquidated damages for the anticipated delay; or

8.4.1.7 Failure to carry out the Work in accordance with the Contract Documents.

8.4.2 CERTIFICATION ISSUED WHEN REASONS FOR WITHHOLDING REMOVED. When the reasons stated in Section 8.4.1 for withholding certification are removed, certification shall be made for such related amounts.

8.4.3 CONTINUE WORK EVEN IF CONTRACTOR DISPUTES A/E'S DETERMINATION. If Contractor disputes any determination by the A/E or the result of the claims resolution process with regard to any Certification of Payment, Contractor nevertheless shall expeditiously continue to prosecute the Work.

8.4.4 UNIVERSITY NOT IN BREACH. University shall not be deemed to be in breach of Contractor's Agreement by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided University's action or such withholding is consistent with the results of the dispute resolution process.

8.5 PROGRESS PAYMENTS.

8.5.1 IN GENERAL, INTEREST OR LATE PAYMENTS.

8.5.1.1 Except as provided in Section 8.3.1, University shall pay any undisputed amount within twenty-eight (28) days of the date that the Application for Payment was submitted to the A/E. In no event shall University be required to pay any disputed amount.

8.5.1.2 Except as otherwise provided by law, if any payment is late based upon the provisions of the Contract Documents, Contractor shall be paid interest at the rate stated in Utah Code § 15-6-3.

8.5.2 CONTRACTOR AND SUBCONTRACTOR RESPONSIBILITY. Contractor shall promptly and no later than the date established in Utah Code § 15-6-5 pay each Subcontractor, upon receipt of payment from University, out of the amount paid to Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled. Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Sub-subcontractors in a similar manner.

8.5.3 INFORMATION FURNISHED BY A/E OR UNIVERSITY TO SUBCONTRACTOR. The A/E or University shall, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by Contractor and action taken thereon by the A/E and University on account of portions of the Work done by such Subcontractor.

8.5.4 UNIVERSITY AND A/E NOT LIABLE. Neither University or A/E shall have an obligation to pay, monitor, or enforce the payment of money to a Subcontractor, except to the extent as may otherwise be required by law.

8.5.5 CERTIFICATE, PAYMENT OR USE NOT ACCEPTANCE OF DEFECTIVE WORK. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Work by University shall not constitute acceptance of Work that is not in accordance with the Contract Documents.

8.6 PAYMENT UPON SUBSTANTIAL COMPLETION. Upon Substantial Completion of the Work or designated portion thereof and upon application by Contractor and certification by the A/E, University shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents. To the extent allowed by law, University may retain until final completion up to twice the fair market value of the Work that has not been completed in accordance with the Contract Documents, or, in the absence of applicable Contract Documents, generally accepted craft standards.

8.7 PARTIAL OCCUPANCY OR USE.

8.7.1 IN GENERAL. University may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with Contractor and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is Substantially Complete, provided University and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of the warranties required by the Contract Documents. When Contractor considers a portion to be Substantially Complete, Contractor shall prepare and submit a list to the A/E as previously provided for herein. Consent of Contractor to partial occupancy or use shall not be unreasonably withheld. Contractor shall have continuing responsibility to protect the Work site and the Work during such partial occupancy or use and shall be responsible for damage except to the extent caused solely by University during such partial occupancy or use. The stage of progress of the Work shall be determined by written agreement between University and Contractor.

8.7.2 INSPECTION. Immediately prior to such partial occupancy or use, University, Contractor and A/E shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

8.7.3 NOT CONSTITUTE ACCEPTANCE. Except to the extent it is agreed upon in writing by University, partial occupancy or use of a portion of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

8.7.4 INSURANCE. Partial occupancy or use shall not commence until the insurance company or companies providing property insurance under Section 10.2 have provided any required consent to such partial occupancy or use by endorsement or otherwise. University shall take reasonable steps to obtain any required consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

8.8 FINAL PAYMENT.

8.8.1 CERTIFICATE FOR PAYMENT. The A/E's final Certificate for Payment shall constitute a further representation that the conditions listed in Section 8.8.2 as precedent to Contractor's being entitled to final payment have been fulfilled.

8.8.2 CONDITIONS FOR FINAL PAYMENT. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to the A/E the following to the extent required by University:

8.8.2.1 An affidavit that payrolls, bills for material and equipment, and other indebtedness connected with the Work (less amounts withheld by University) have been paid or otherwise satisfied;

8.8.2.2 A current or additional certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and shall not be canceled or allowed to expire until at least twenty-eight (28) days prior written notice, by certified mail, return receipt requested, has been given to University;

8.8.2.3 A written statement that Contractor knows of no reason that the insurance shall not be renewable to cover the period required by the Contract Documents;

8.8.2.4 If requested by the surety in a timely manner or by University, consent of surety, to final payment;

8.8.2.5 Receipt of Record Drawings, Specifications, Addenda, Change Orders and other Modifications maintained at the site; the warranties, instructions, operation and maintenance manuals, and training videos required to be furnished by the Contract Documents;

8.8.2.6 Other data establishing payment or satisfaction of obligations, such as a Utah Waiver and Release Upon Final Payment form from Contractor, Subcontractors and Sub-subcontractors, receipts, other releases and waivers of liens, claims, security interests, or encumbrances arising out of Contractor's Agreement, to the extent and in such form as may be designated by University. If a Subcontractor or Sub-subcontractor refuses to furnish a release or waiver required by University, University may require consent of surety to the final payment. If liens, claims, security interests, or encumbrances remain unsatisfied after payments are made, Contractor shall refund to University all money that University may be compelled to pay in discharging such liens, claims, security interests or encumbrances including all costs and reasonable attorney fees; and

8.8.2.7 A written statement demonstrating how Contractor shall distribute interest earned on retention to Subcontractors as required by Utah Code § 13-8-5.

8.8.3 WAIVER OF CLAIMS: FINAL PAYMENT. The making of final payment shall constitute a waiver of Claims by University, except those arising from:

8.8.3.1 Liens, Claims, security interests, or encumbrances arising out of the Contract Documents and unsettled;

8.8.3.2 Failure of the Work to comply with the requirements of the Contract Documents;

8.8.3.3 Terms of warranties required by the Contract Documents; or

8.8.3.4 Claims arising within the one-year period for correction of the Work and Claims to the extent not barred by Utah Code § 78B-2-225 and/or Utah Code § 78B-4-513.

8.8.4 DELAYS NOT CONTRACTOR'S FAULT. If, after Substantial Completion of the Work, Final Completion is materially delayed through no fault of Contractor or by issuance of Change Orders affecting final completion, University shall, upon application by Contractor and certification by the A/E, and without terminating Contractor's Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. Such payment shall be made under terms and conditions governing final payment. Unless otherwise stated by University in writing, the making of final payment shall constitute a waiver of claims by University as provided in Section 8.8.3 for that portion of that Work fully completed and accepted by University.

8.8.5 WAIVER BY ACCEPTING FINAL PAYMENT. Acceptance of final payment by Contractor or a Subcontractor shall constitute a waiver of Claims by that payee except those Claims previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 9. TESTS AND INSPECTIONS, SUBSTANTIAL AND FINAL COMPLETION, UNCOVERING, CORRECTION OF WORK AND GUARANTY PERIOD.

9.1 TESTS AND INSPECTIONS.

9.1.1 IN GENERAL. Tests, inspections, and approvals of portions of the Work required by the Contract Documents or by laws, rules, regulations, or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by University in writing, University shall contract for such tests, inspections, and approvals with an independent entity, or with the appropriate public authority, and University shall bear all related costs of tests, inspections, and approvals, except as provided below. If any of the Work is required to be inspected or approved by the terms of the Contract Documents or by any public authority, Contractor shall, at least two (2) working days prior to the time of the desired inspection, and following the procedures established by University, request such inspection or approval to be performed. Contractor shall give the A/E timely notice of when and where tests and inspections are to be made so that the A/E may observe such procedures.

9.1.2 FAILURE OF AN INSPECTOR TO APPEAR. Work shall not proceed without any required inspection and the associated authorization by University to proceed unless the following procedures and requirements have been met:

9.1.2.1 The inspection or approval was requested in a timely manner as provided in Section 9.1.1;

9.1.2.2 Contractor received written confirmation from the inspection entity that the inspection was scheduled;

9.1.2.3 Contractor has contacted or attempted to contact the inspector to confirm whether the inspector is able to perform the inspection as scheduled;

9.1.2.4 If the inspector informs Contractor that the inspector is unable to perform the inspection as scheduled or if Contractor is unable to contact the inspector, Contractor shall attempt to contact the A/E or University for instruction; and

9.1.2.5 Contractor has documented the condition of the Work prior to being covered through photos or other means.

9.1.3 NONCONFORMING WORK. If procedures for testing, inspection, or approval under Section 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for University's expenses, including the cost of retesting for verification of compliance if necessary, until University accepts the Work in question as complying with the requirements of the Contract Documents.

9.1.4 CERTIFICATES. Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by Contractor and promptly delivered to the A/E.

9.1.5 A/E OBSERVING. If the A/E is to observe tests, inspections, or approvals required by the Contract Documents, the A/E shall do so with reasonable promptness and, where practicable, at the normal place of testing.

9.1.6 PROMPTNESS. Tests, inspections, and arrangements for approvals conducted pursuant to the Contract Documents shall be made promptly to avoid delay in the Work.

9.2 UNCOVERING OF WORK.

9.2.1 UNCOVER UNINSPECTED WORK. Except as provided in Section 9.2.3, if a portion of the Work is covered prior to an inspector's approval to proceed, it must be uncovered for the inspector's inspection and be replaced at Contractor's expense without change in the Contract Price and/or Contract Time.

9.2.2 OBSERVATION PRIOR TO COVERING. Except as provided in Section 9.2.3, if University or the A/E has requested in writing to observe conditions prior to any Work being covered or if such observation is required by the Contract Documents, and the Work is covered without such observation, Contractor shall be required to uncover and appropriately replace the Work at Contractor's expense without change in the Contract Price and/or Contract Time. If Contractor requests an inspection and University or the A/E, including any inspector of each, does not appear, Contractor shall immediately notify University of such failure to appear, but shall not cover the Work without such inspection.

9.2.3 WHEN AN INSPECTOR FAILS TO APPEAR OR A/E OR UNIVERSITY DID NOT MAKE PRIOR REQUEST. If Work is performed by Contractor without an inspection as provided in Section 9.1.2 or if a portion of the Work has been covered which the A/E or University has not specifically requested to observe prior to its being covered or such observation is not required by the Contract Documents, the A/E or University may request to see such Work and it shall be uncovered by Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, shall, by appropriate Change Order, be charged to University. If such Work is not in accordance with the Contract Documents, Contractor shall pay such costs unless the condition was caused by University or a separate contractor in which event University shall be responsible for payment of such costs.

9.3 INSPECTIONS: SUBSTANTIAL AND FINAL.

9.3.1 SUBSTANTIAL COMPLETION INSPECTION. Prior to requesting a Substantial Completion inspection, Contractor shall prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by University and the A/E to determine if the Work is ready for a Substantial Completion inspection. If University and A/E determine that the initial punchlist indicates that the Work is not Substantially Complete, the initial punchlist shall be returned to Contractor with written comments. If University and A/E determines that the initial punchlist indicates that the Work may be Substantially Complete, the A/E shall promptly organize and perform a Substantial Completion inspection in the presence of University and all appropriate authorities.

9.3.1.1 If the A/E reasonably determines that the initial punchlist prepared by Contractor substantially understates the amount of the Work remaining to be completed and the Work is not Substantially Complete, the A/E shall report this promptly to University, and upon concurrence of University, Contractor shall be assessed the costs of the inspection and punchlist review incurred by the A/E and University.

9.3.1.2 When the Work or designated portion thereof is Substantially Complete, the A/E shall prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion; shall establish responsibilities of University and Contractor for security, maintenance, heat, utilities, damage to the Work, and insurance; and shall fix the time within which Contractor shall finish all items on the punchlist accompanying the Certificate ("Punchlist Completion Date"). The Certificate of Substantial Completion shall require approval by University. If there is a punchlist, Contractor shall proceed promptly to complete and correct items on the punchlist. Failure to include an item on the punchlist does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents.

9.3.1.3 Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof except to the extent as provided otherwise in the Contract Documents or if such warranty is related to an item where the Work is not complete. Written warranties shall state the length of the warranty, which must comply with the Contract Documents.

9.3.1.4 The Certificate of Substantial Completion shall be submitted by the A/E to University and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

9.3.1.5 Except to the extent University otherwise approves in advance and in writing, Contractor shall submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete as-built drawings. Contractor shall also provide or obtain any required approvals for occupancy. Contractor shall be responsible for the guaranty of all Work, whether performed by it or by its Subcontractors and Sub-subcontractors at any tier.

9.3.2 FINAL COMPLETION INSPECTION. Prior to requesting a final inspection, Contractor shall verify all punchlist items are corrected and completed. Once all punchlist items are corrected and completed, Contractor shall notify University and request a final inspection. University shall notify the A/E and perform a final inspection. When all punchlist items are completed, a final Application for Payment shall be provided by Contractor, certified by the A/E, and processed by University.

9.3.3 PUNCHLIST COMPLETION. As compensation to University for administrative costs incurred by University as a result of delay in final project close-out, for each day subsequent to the Punchlist Completion Date that Contractor fails to complete the punchlist and subject to Section 8.8.4, Contractor shall pay to University five percent (5%) of the liquidated damages amount stated in the Contractor's Agreement.

9.4 CORRECTION OF WORK AND GUARANTY PERIOD.

9.4.1 CONTRACTOR CORRECT THE WORK. Contractor shall correct Work rejected by the A/E, an inspector or University, or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. Contractor shall bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for the A/E's and inspector's services and expenses made necessary thereby.

9.4.2 GUARANTY AND CORRECTION AFTER SUBSTANTIAL COMPLETION. If within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Section 9.2.1 or by terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found not to be in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, Contractor shall correct it promptly after receipt of written notice from University to do so, unless University has previously given Contractor a written acceptance of such condition. The period of one year shall be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of Contractor under this Section 9.4.2 shall be operative notwithstanding the acceptance of the Work under the Contract Documents, the issuance of a final certificate of payment, partial or total occupancy and/or termination of Contractor's Agreement. University shall give notice of observed defects with reasonable promptness; however, failure to give such notice shall not relieve Contractor of its obligation to correct the Work. All corrected Work shall be subject to a one-year guaranty period the same in all respects as the original Work, except that such guaranty period shall commence from the time of Substantial Completion of the corrected Work. This guaranty period does not affect University's right to pursue any available remedies against Contractor, including, but not limited to, University's right to pursue a cause of action for defective construction against Contractor within the time period established by Utah Code § 78B-2-225.

9.4.3 REMOVAL OF WORK.

9.4.3.1 Contractor shall promptly remove from the Work site all Work that University and/or the A/E determines as being in nonconformance with the Contract Documents, whether incorporated or not.

9.4.3.2 Contractor shall promptly replace and re-execute any Work not in accordance with the Contract Documents without change in the Contract Price and/or Contract Time.

9.4.3.3 Contractor shall bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, by University or separate contractors destroyed or damaged by such removal or replacement.

9.4.3.4 If Contractor does not remove such rejected Work within a reasonable time, fixed by written notice, University may have the Work removed and stored at the expense of Contractor.

9.4.3.5 If Contractor does not correct the nonconforming Work within a reasonable time, fixed by written notice, University may correct it in accordance with Section 2.2.2 of these General Conditions.

9.4.4 NOT LIMIT OTHER OBLIGATIONS. Nothing contained in this Section 9.4 shall be construed to establish a period of limitation with respect to other obligations that Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Section 9.4.2 relates only to the specific obligation of Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to correct the Work.

9.5 ADDITIONAL WARRANTIES.

9.5.1 IN GENERAL. In addition to any other provisions of this Article 9, the following warranties shall apply:

9.5.1.1 Contractor warrants to University that materials and equipment furnished under the Contract Documents shall be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.

9.5.1.2 Contractor also warrants to University that the Work shall be free from defects not inherent in the quality required or expressly permitted and that the Work shall conform with the requirements of the Contract Documents. Work not conforming to said requirements, including substitutions not implemented by Change Order, Construction Change Directive, or ASI as provided in Article 7, may be considered defective at University's option.

9.5.2 EXCLUSION. Unless due to the negligent or intentional act or omission of Contractor or those under the Contractor's control, or as otherwise stated in the Contract Documents, Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

9.5.3 FURNISH EVIDENCE ON REQUEST. If requested by the A/E or University, Contractor shall furnish satisfactory evidence as to the type and quality of materials and equipment.

9.6 ACCEPTANCE OF NONCONFORMING WORK. If University prefers to accept Work that is not in accordance with the requirements of the Contract Documents, University may do so in writing instead of requiring its removal and correction, in which case the Contract Price shall be reduced as appropriate. Such adjustment shall be effectuated whether or not final payment has been made.

ARTICLE 10. INSURANCE AND BONDS.

10.1 CONTRACTOR'S LIABILITY INSURANCE.

10.1.1 IN GENERAL. The Contractor shall purchase and maintain in a company or companies lawfully authorized to do business in the State of Utah such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by a Sub-subcontractor or anyone directly employed by them, or by anyone for whose acts they may be liable:

10.1.1.1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;

10.1.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;

10.1.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;

10.1.1.4 Claims for damages insured by usual personal injury liability coverage;

10.1.1.5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;

10.1.1.6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;

10.1.1.7 Claims for bodily injury or property damage arising out of completed operations;

10.1.1.8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 4.12; and

10.1.1.9 If the Contract Documents require the Contractor to provide and/or the Contractor provides professional services, claims for damages because of negligent errors or omissions in the performance of professional services.

10.1.2 COVERAGE. Without limiting Contractor's obligations or liabilities hereunder, the Contractor shall, at its sole expense, purchase and maintain the following insurance coverages required by Section 10.1.1 of these General Conditions from insurers authorized to do business in the state of Utah and rated "A-" or better with a financial size category of class VII or larger by the A.M. Best Company. The following insurance coverages required by Section 10.1.1 of these General Conditions shall be procured with the following terms and insurance limits unless otherwise agreed in writing by University and the Contractor:

10.1.2.1 Commercial General Liability Insurance covering all liabilities for personal injury and property damage arising in connection with the Work, with limits of liability of Five Million Dollars ($5,000,000.00) per each occurrence and in the aggregate.

10.1.2.2 Workers Compensation Insurance in compliance with all applicable laws of each jurisdiction in which the Work will be performed.

10.1.2.3 Employers Liability Insurance covering all liabilities for personal injuries of the Contractor's employees, with limits of liability of Five Million Dollars ($5,000,000.00) for each occurrence and in the aggregate.

10.1.2.4 If the Contract Documents require the Contractor to provide and/or the Contractor provides professional services, Professional Liability Insurance with limits of liability of Two Million Dollars ($2,000,000.00) for each claim and in the aggregate with a retroactive or effective date not later than the effective date of the Contractor's Agreement and with a deductible or self-insured retention of not greater than One Hundred Thousand Dollars ($100,000.00) per claim.

10.1.2.5 Automobile Liability Insurance, including coverages of owned, non-owned and hired vehicles covering all liabilities for personal injury and property damage arising from the use of motor vehicles, with combined single limits of liability of Two Million Dollars ($2,000,000.00) for each occurrence and in the aggregate.

10.1.2.6 If the Contractor is unable to obtain the insurance required by this Section 10.1, Contractor may carry excess liability insurance and/or umbrella insurance that, when combined with Contractor's primary coverage in a given category of insurance, brings the total coverage in such category to be not less than the amount required by this Section 10.1 for that category of insurance.

10.1.3 ENDORSEMENTS. The Contractor shall provide the following coverage endorsements for each category of insurance required by this Section 10.1, except in the case of Workers' Compensation Insurance, Employers' Liability Insurance and Professional Liability Insurance:

10.1.3.1 An endorsement including University as an additional insured;

10.1.3.2 An endorsement including a cross liability clause, noting that each of the parties comprising the insured shall be considered as a separate entity, the insurance applies as if a separate policy has been issued to each party, and no "insured-versus-insured" exclusion exists in the policy.

10.1.3.3 An endorsement waiving all expressed or implied rights of subrogation against University and the State of Utah.

10.1.4 TERMS. Except as otherwise expressly provided in Section 10.1.2, the insurance of the Contractor required to be maintained pursuant to this Section 10.1 shall be on the following terms:

10.1.4.1 All insurance shall begin no later than the effective date of the Contractor's Agreement and shall continue until the final completion of the Work and for a period of two (2) years following the final completion of the Work, provided, however, if the Contractor's Agreement is terminated prior to the final completion of the Work, such insurance shall continue for a period of two (2) years following the termination of the Contractor's Agreement.

10.1.4.2 Before performing any of the Work and after each time the policies are renewed or varied, the Contractor shall provide to University certificates of insurance and endorsements consistent with this Section 10.1.4 and Sections 10.1.1, 10.1.2 and 10.1.3 of these General Conditions. If required by University the Contractor shall deliver copies of the insurance policies providing the insurance coverages required by this Section 10.1, and all endorsements thereto.

10.1.4.3 All insurance shall not be varied to the detriment of University, cancelled or allowed to lapse until thirty (30) days' prior written notice has been given to University.

10.1.5 FAILURE TO PROVIDE. Should the Contractor at any time neglect or refuse to provide the insurance required by this Section 10.1, or should such insurance be canceled, University shall have the right, but not the obligation, to procure the same at the cost and expense of the Contractor, and the cost thereof may be deducted by University from any monies then due or thereafter to become due to the Contractor. If University or the other Indemnified Parties are damaged by the failure of the Contractor to purchase or maintain insurance as required by this Section 10.1, the Contractor shall bear all reasonable costs, expenses and damages incurred by University and/or the other Indemnified Parties arising from such failure to purchase or maintain the insurance required by this Section 10.1.

10.1.6 CERTIFICATES. The acceptance of delivery of any Certificates of Insurance or copies of insurance policies required to be purchased and maintained pursuant to the Contract Documents does not constitute approval or agreement by the recipient that the insurance requirements have been met or that those Certificates of Insurance or insurance policies comply with the Contract Documents.

10.1.7 NO LIMITATION. The Contractor shall procure such insurance coverages and such insurance limits for its insurance coverages that the Contractor, in its sole discretion, after consultation with its insurance and risk advisors, determines to be sufficient for Contractor's purposes given the risks of the project. This Section 10.1 sets forth University's minimum insurance requirements; the Contractor may procure additional or broader insurance coverages or greater insurance limits than required by Section 10.1 at Contractor's expense. Nothing in Section 10.1 or elsewhere in the Contract Documents is intended to limit the Contractor's liability to University or the Indemnified Parties to liabilities covered by the insurance coverages required by Section 10.1 or to the minimum insurance limits required of such insurance coverages by Section 10.1.

10.2 "BUILDER'S RISK" INSURANCE.

10.2.1 IN GENERAL. Provided that the Contractor's Agreement is for new buildings, structures, or construction projects, or for the alteration or repair of, or addition to existing buildings, structures, or improvements (an "Eligible Project"), University shall maintain insurance to protect the interest of the Contractor, Subcontractors, or Sub-subcontractors subject to all of the terms, conditions, limitations, exclusions, waivers and/or endorsements stated in the Commercial Property Policy Declarations and Scheduled Forms available on DFCM's website, dfcm.utah.gov ("Builder's Risk Insurance").

10.2.2 DEDUCTIBLE. To the extent that the Builder's Risk Insurance provides for a deductible (including, without limitation, a specific loss deductible, cumulative loss deductible and/or sub-deductible), with respect to any damages or losses to property covered by the Builder's Risk Insurance caused in whole or in part by the negligence, breach of contractual duty or other fault of University (or those for whom University is responsible, including the A/E and the A/E's consultants) or the Contractor (or those for whom the Contractor is responsible, including the Contractor's Subcontractors and Sub-subcontractors of any tier), any deductible applicable to such covered damages or losses to property shall be paid by the party, whether University or the Contractor, legally responsible for the negligence, breach of contractual duty or other fault that caused the losses or damages. If both University and the Contractor are legally responsible in part for the negligence, breach of contractual duty or other fault that caused such losses or damages to property, University and the Contractor shall pay any deductible applicable to such covered damages or losses to property in proportion to their comparative fault. With respect to any damages or losses to property covered by the Builder's Risk Insurance caused by an act of nature, such as the weather or other natural disasters, and not caused in whole or in part by the negligence, breach of contractual duty or other fault of University (or those for whom University is responsible, including the A/E and the A/E's consultants) or the Contractor (or those for whom the Contractor is responsible, including the Contractor's Subcontractors and Sub-subcontractors of any tier), University and Contractor shall each pay half of the amount of any deductible to such covered damages or losses to property.

10.2.3 WAIVER OF SUBROGATION. University and Contractor waive all rights against: (1) each other and the other Indemnified Parties and any of their subcontractors, sub-subcontractors, agents and employees, each of the other; and (2) the A/E, A/E's consultants, separate contractors described in Section 2.2, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by Builder's Risk Insurance obtained pursuant to Section 10.2.1 and maintained during the course of construction, but only to the extent of the actual recovery of insurance proceeds by the injured party, except such rights as they have to proceeds of such insurance held by University as fiduciary. University or Contractor, as appropriate, shall require of the A/E, A/E's consultants, separate contractors described in Section 2.2, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged. The waiver of rights under this Section 10.2.3 shall not include: (1) subject to Section 10.2.2, the right to recover amounts deducted or excluded from the insurance proceeds in the form of deductibles paid by the injured party; and (2) claims arising out of design errors or omissions.

10.2.4 SPECIAL HAZARDS. If the Contractor's Agreement is for an Eligible Project, but Contractor desires insurance coverage for risks other than those covered by the Builder's Risk Insurance, the Contractor may obtain such insurance, however, the cost thereof shall be borne by the Contractor and shall not be included in the Contract Price.

10.2.5 NON-ELIGIBLE PROJECTS. If the Contractor's Agreement is not for an Eligible Project, Contractor shall bear the risk of damage and/or loss to Contractor's materials, equipment and other property,

until acceptance of the Work by University in writing, and no protection from damage and/or loss of the Work (including, without limitation, so called "builders risk", "course of construction", "inland marine" and/or similar property insurance) will be provided by University for the protection of Contractor. Contractor may obtain insurance to cover such risks, however, the cost thereof shall be borne by the Contractor and shall not be included in the Contract Price. Section 10.2.3 shall not apply to Non-Eligible Projects.

10.3 PERFORMANCE BOND AND PAYMENT BOND. The Contractor shall furnish a Performance and Payment Bond naming the Contractor as Principal and University and University's designees as Obligees written on AIA Document A312 (2010) Performance Bond and Labor and Material Payment Bond forms in a penal sum of not less than the Contract Price for the Work as the Contract Price may be modified by Change Order (the "Bonds"). The cost of the Bonds, without mark-up, may be included in the Contract Price. The Contractor shall deliver the Bonds to University at least three (3) days before the commencement of any Work at the Work site. Delivery of the Bonds may be accomplished *via* email. The Bonds shall be procured from a surety authorized to do business in the State of Utah and rated A- or better by the A.M. Best Company at the time of issuance of the Bonds and holding Certificates of Authority as an acceptable surety on federal bonds as listed by the United States Department of Treasury (Circular 570, as amended) in its most recent list at the time of issuance of the Bonds. The penal sum of the Bonds shall be within the maximum specified for such surety in Circular 570, as amended. The attorney-in-fact who executes the Bonds on behalf of the surety shall affix to the Bonds a certified and current copy of his or her power of attorney. If the surety on any of the Bonds furnished by the Contractor is declared a bankrupt or becomes insolvent or its rights to do business are terminated in the State of Utah or it ceases to meet the requirements of this Section 10.3, the Contractor shall within ten (10) calendar days thereafter substitute another bond and surety, both of which must be acceptable to University. Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 11. MISCELLANEOUS PROVISIONS.

11.1 A/E'S RESPONSIBILITIES. These General Conditions are not intended to provide an exhaustive or complete list of the A/E's responsibilities. A separate agreement between University and the A/E incorporates these General Conditions by reference and includes additional design and contract administration responsibilities.

11.2 SUCCESSORS AND ASSIGNS. University and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Contractor shall not assign Contractor's Agreement without the prior written consent of University, nor shall Contractor assign any amount due or to become due or any of Contractor's rights under the Contract Documents, without prior written consent of University.

11.3 WRITTEN NOTICE.

11.3.1 PERSONAL DELIVERY AND REGISTERED OR CERTIFIED MAIL. Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail, return receipt requested, to the last business address known to the party giving notice.

11.3.2 E-MAIL. Notwithstanding any other provision of these General Conditions, written notice shall also be deemed to have been duly served by verified use of an e-mail system by using the known and operative e-mail address of the intended recipient. Service by use of the e-mail system is encouraged when timely notice shall benefit University, the A/E, or Contractor. Notice shall be considered complete and verified upon the sending and confirmation of delivery using the e-mail system, if on the same day notice is also sent by registered

or certified mail, return receipt requested, to the last business address known to the party giving notice, confirming the e-mail delivery.

11.4 RIGHTS AND REMEDIES.

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

11.4.2 NO WAIVER. Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by University, the A/E, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract Documents, nor shall such action or failure to act constitute approval or acquiescence in a breach thereunder, except as any of the above may be specifically agreed to in writing. In no case shall Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions, unless agreed to in writing by University.

11.5 NO DISCRIMINATION, NO SEXUAL HARASSMENT. Pursuant to the laws of the United States and the State of Utah, Contractor, Subcontractors, or anyone for whose act any of them may be liable, shall take affirmative action to not discriminate against any employee or applicant for employment because of race, creed, color, sex, religion, ancestry or national origin. To the extent applicable, said persons shall comply with all provisions of Executive Order No. 11246 dated September 24, 1965 and rules, regulations, orders, instructions, designations and other directives promulgated pursuant thereto. Contractor, Subcontractors, or anyone for whose act any of them may be liable, shall not act in any manner as would violate the laws, regulations, and policies of the United States or the State of Utah prohibiting sexual harassment.

11.6 APPLICABLE LAWS AND ENFORCEMENT. The Contract Documents shall be governed by and construed in accordance with the laws of the State of Utah, excluding any choice of law provisions that would otherwise require application of laws of any other jurisdiction.

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

11.8 VENUE. In case of any dispute that may arise under the Contract Documents, the place of venue shall be in the County of Salt Lake, State of Utah, unless otherwise agreed to by all of the parties in writing.

11.9 SEVERABILITY. The invalidity of any provision or part of a provision of the Contract Documents shall not impair or affect in any manner the validity, enforceability, or effect of the remainder of the Contract Documents.

11.10 CONSTRUCTION OF WORDS. Unless otherwise stated in the Contract Documents, words which have well-known technical or construction industry meanings shall be construed as having such recognized meanings. Unless the context requires otherwise, all other technical words shall be construed in accordance with the meaning normally established by the particular, applicable profession or industry. All other words, unless the context requires otherwise, shall be construed with an ordinary, plain meaning.

11.11 NO THIRD-PARTY RIGHTS. These General Conditions create rights and duties only as between University and Contractor, and University and A/E. Nothing contained herein shall be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and A/E, or as between University, Contractor, or A/E on the one hand, and any other person or entity.

ARTICLE 12. TERMINATION OR SUSPENSION OF THE CONTRACT.

12.1 TERMINATION BY CONTRACTOR FOR CAUSE.

12.1.1 IN GENERAL. If the Work is stopped for a period of sixty (60) days through no act or fault of the Contractor or a Subcontractor, or their agents or employees or any other persons performing portions of the Work under contract with any of the above, the Contractor may terminate the Contractor's Agreement in accordance with Section 12.1.2 for any of the following reasons:

12.1.1.1 Because University has persistently failed to fulfill material obligations of University under the Contract Documents with respect to matters important to the progress of the Work;

12.1.1.2 Issuance of an order of a court or other public authority having jurisdiction which necessitates such termination, except that where the Contractor has standing, the Contractor must cooperate in efforts to stay and/or appeal such order;

12.1.1.3 An act of government, such as a declaration of national emergency, making material unavailable; or

12.1.1.4 Unavoidable casualties or other similar causes.

12.1.2 NOTICE. If one of the reasons for termination in Section 12.1.1 exists, the Contractor may, upon fourteen (14) additional days' written notice to University and A/E, and such condition giving cause for termination still not cured, terminate Contractor's Agreement and recover from University payment for Work properly executed as of the date of termination, including profit and overhead on Work properly completed as of the date of termination, on a percentage completion basis, along with Contractor's reasonable demobilization expenses incurred within seven (7) days of termination, but Contractor shall in no event be entitled to recover consequential damages as a result of such termination or profit and/or overhead on the Work not executed.

12.2 TERMINATION BY UNIVERSITY FOR CAUSE.

12.2.1 IN GENERAL. University may terminate the Contractor's Agreement if Contractor fails to cure any of the following within a period of seven (7) days (or longer if University so approves in writing) after receipt of notice from University specifying the breach or failure:

12.2.1.1 Contractor refuses or fails to supply enough properly skilled workers or proper materials;

12.2.1.2 Contractor fails to make payment to Subcontractors for materials, equipment, or labor;

12.2.1.3 Contractor disregards laws, ordinances, rules, regulations, or orders of a public authority having jurisdiction;

12.2.1.4 Contractor fails to perform the Work such that the Work will be Substantially Completed within the Contract Time or Contractor fails to make progress with the Work as required by the Contract Documents;

12.2.1.5 Contractor fails to perform the Work in accordance with the Contract Documents or is otherwise in breach of a material provision of the Contract Documents;

12.2.1.6 As permissible by law for a reason to terminate, Contractor is adjudged bankrupt;

12.2.1.7 As permissible by law for a reason to terminate, Contractor should make a general assignment for the benefit of creditors;

12.2.1.8 As permissible by law for a reason to terminate, Contractor should have a receiver appointed on account of Contractor's insolvency; or

12.2.1.9 Contractor fails to follow safety requirements and precautions either as expressly provided in the Contract Documents or as consistent with the customary practices in the industry.

12.2.2 UNIVERSITY'S RIGHT TO CARRY OUT THE WORK UPON TERMINATION FOR CAUSE. If Contractor fails to remedy the breach or failure within seven (7) days or other mutually agreed period after notice from University, University may, without prejudice to other remedies available to University and in addition to enforcement of any other of University's rights, terminate the Contractor's Agreement, take possession of the Work site and all materials, finish the Work by whatever reasonable method University may deem expedient, and charge Contractor, or file a claim against Contractor's bankruptcy estate, for any additional costs incurred by University to complete the Work. Contractor shall not be entitled to receive any further payment until the Work is completed, nor shall Contractor be relieved from its obligations and liabilities assumed under the Contractor's Agreement. If University's costs exceed the amount of any payment(s) owed by University to Contractor subject to offset by University, University may bill Contractor for the difference, which Contractor shall pay within twenty-eight (28) days of receipt of University's invoice.

12.2.3 ITEMS REQUIRED TO BE TRANSFERRED OR DELIVERED. University may require Contractor to transfer title and deliver to University, in the manner and to the extent directed by University:

12.2.3.1 Any completed portion of the Work; and

12.2.3.2 Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights as Contractor has specifically produced or specifically acquired for the performance of such part of the Work as has been terminated; and Contractor shall, upon direction of University, protect and preserve property in the possession of Contractor in which University has an interest.

12.2.4 PAYMENT. When University terminates Contractor's Agreement for one or more of the reasons stated in Section 12.2.1, University may withhold payment and/or pursue all available remedies.

12.2.5 UNIVERSITY PROTECTION IF LIENABLE. When the Work is lienable, University may withhold from amounts otherwise due Contractor for such Work such amount as University determines to be necessary to protect the State against loss because of liens.

12.2.6 CREDITS AND DEFICITS. If the unpaid balance of the Contract Price exceeds the full cost of finishing the Work, including compensation for the A/E's services and expenses made necessary thereby, such excess shall be paid to Contractor. If such cost exceeds the unpaid balance of the Contract Price, Contractor shall pay the difference to University and this obligation for payment shall survive the termination of Contractor's Agreement.

12.2.7 IF CONTRACTOR FOUND NOT IN DEFAULT OR EXCUSABLE. If, after notice of termination of Contractor's Agreement under the provisions of Section 12.2, it is determined for any reason that Contractor was not in default under the provisions of Section 12.2, or that the default was excusable under the provisions of Section 12.2, the rights and obligations of the parties shall be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions of Section 12.3.

12.2.8 RIGHTS AND REMEDIES NOT EXCLUSIVE. The rights and remedies of University provided in this Section 12.2 shall not be exclusive and are in addition to any other rights and remedies provided by law or under the Contract Documents.

12.2.9 TIME PERIOD FOR CLAIMS. Any PRE by Contractor for adjustment under this Section 12.2 must be asserted by Contractor, in writing, within twenty-one (21) days from the date of termination; provided that University may, in its sole discretion, receive and act upon any such PRE asserted at any time prior to final payment under Contractor's Agreement.

12.3 TERMINATION FOR CONVENIENCE OF UNIVERSITY.

12.3.1 IN GENERAL. The performance of Work under Contractor's Agreement may be terminated by University in accordance with this Section 12.3 in whole or in part, or from time to time, whenever University shall determine that such termination is in the best interest of University or any person or entity for whom University is acting under Contractor's Agreement. Any such termination shall be effectuated by delivery to Contractor of a notice of termination specifying the extent to which performance of Work is terminated and the date upon which such termination becomes effective.

12.3.2 CONTRACTOR OBLIGATIONS. After receipt of a notice of termination, and except as otherwise directed by University in writing, the Contractor shall:

12.3.2.1 Stop Work under Contractor's Agreement on the date and to the extent specified in the notice of termination;

12.3.2.2 Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work that is not terminated;

12.3.2.3 Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;

12.3.2.4 Assign to University in the manner, at the times, and to the extent directed by University, all of the right, title, and interest of Contractor under the orders and subcontracts so terminated, in which case University shall have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;

12.3.2.5 Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of University, which approval or ratification shall be final for all the purposes of this Section 12.3;

12.3.2.6 Transfer title and deliver to University in the manner, at the times, and to the extent, if any, directed by University:

12.3.2.6.1 The fabricated or unfabricated parts, Work in process, completed Work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and

12.3.2.6.2 The completed or partially completed drawings, information, and other property which, if Contractor's Agreement had been completed, would have been required to be furnished to University;

12.3.2.7 Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by University, any property of the types referred to in Section 12.3.2.6; provided, however, that Contractor:

12.3.2.7.1 Shall not be required to extend credit to any purchaser; and

12.3.2.7.2 Shall dispose of any such property under the conditions prescribed by and at a price or prices approved by University; and provided further that the proceeds of any such transfer of or disposition shall be applied in reduction of any payments to be made by University to Contractor under Contractor's Agreement or shall otherwise be credited against the Contract Price or paid in such other manner as University may direct;

12.3.2.8 Complete performance of such part of the Work as shall not have been terminated by the notice of termination; and

12.3.2.9 Take such action as may be necessary, or as University may direct, for the protection and preservation of the property related to Contractor's Agreement which is in the possession of Contractor in which the State of Utah has or may acquire an interest.

12.3.3 TERMINATION CLAIM. After receipt of a notice of termination, Contractor may submit to University a PRE, in the form and with certification prescribed by University. Such PRE shall be submitted promptly but in no event not later than twenty-one (21) days from the effective date of termination.

12.3.4 AGREED UPON PAYMENT. Subject to the provisions of Section 12.3.3 above, Contractor and University may agree upon the amount to be paid to Contractor by reason of the total or partial termination of Work pursuant to this Section 12.3.

12.3.5 PAYMENT NOT AGREED UPON. In the event Contractor and University fail to agree as provided in Section 12.3.4 upon the whole amount to be paid to Contractor by reason of the termination of Work pursuant to this Section 12.3, University shall pay to the Contractor the amounts determined by University as follows, but without duplication of any amounts agreed upon in accordance with Section 12.3.4:

12.3.5.1 With respect to all Work performed prior to effective date of termination, the total (without duplication of any items) of:

12.3.5.1.1 The cost of such Work including undisputed Claim amounts;

12.3.5.1.2 The cost of terminating, settling and paying claims arising out of the termination of Work under subcontracts or orders as provided in Section 12.3.2.5, exclusive of the amounts paid or payable on account of supplies or materials delivered or services furnished by Subcontractors prior to the effective date of termination under Contractor's Agreement, which amounts shall be included in the cost on account of which payment is made under Section 12.3.5.1.1;

12.3.5.1.3 An amount, as overhead and profit on Section 12.3.5.1.1 above, determined by University to be fair and reasonable;

12.3.5.1.4 The reasonable cost of the preservation and protection of property incurred pursuant to Section 12.3.2.9; and any other reasonable cost incidental to termination of Work, including expenses incidental to the determination of the amount due to Contractor as the result of the termination of Work.

12.3.5.1.5 The total amount to be paid to Contractor under Section 12.3.5.1 above shall not exceed the Contract Price as reduced by the amount of payments otherwise made and as further reduced by the Contract Price of Work not terminated. Except for normal spoilage, and except to the extent that University shall have otherwise expressly assumed the risk of loss in writing, there shall be excluded from the amounts payable to Contractor under Section 12.3.5.1 above, the fair value of property which is destroyed, lost, stolen, or damaged so as to become undeliverable to University, or to a buyer pursuant to Section 12.3.2.7.

12.3.6 DEDUCTIONS. In arriving at the amount due Contractor under this Section 12.3, there shall be deducted:

12.3.6.1 All unliquidated advance or other payments on account theretofore made to the Contractor, applicable to the terminated portion of Contractor's Agreement;

12.3.6.2 Any Claim which University and/or the State of Utah may have against Contractor in connection with Contractor's Agreement; and

12.3.6.3 The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by Contractor or sold, pursuant to the provisions of this Section 12.3, and not otherwise recovered by or credited to University.

12.3.7 PARTIAL TERMINATION. If the termination is partial, Contractor may file with University a PRE for the amounts specified in Contractor's Agreement relating to the continued portion of Contractor's Agreement and such equitable adjustment as may be agreed upon shall be made in such amounts. Any PRE under this Section 12.3.7 must be filed within twenty-one (21) days from the effective date of the partial termination.

12.3.8 PARTIAL PAYMENTS. University may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against costs incurred by Contractor in connection with the terminated portion of Contractor's Agreement whenever, in the opinion of University, the aggregate of such payments shall be within the amount to which Contractor shall be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Section 12.3, such excess shall be payable by Contractor to University upon demand, together with interest at a rate stated in Utah Code § 15-1-1, for the period until the date such excess is repaid to University; provided, however, that no interest shall be charged with respect to any such excess payment attributable to a reduction in Contractor's claim by reason of retention or other disposition of termination inventory until fourteen (14) days after the date of such retention or disposition, or such later date as determined by University by reason of the circumstances.

12.3.9 PRESERVE AND MAKE AVAILABLE RECORDS. Unless otherwise provided for in Contractor's Agreement, or by applicable law, Contractor shall, from the effective date of termination until the expiration of three years after final settlement under Contractor's Agreement, preserve and make available to University at all reasonable times at the office of Contractor, but without charge to University, all books, records, documents, and other evidence bearing on the costs and expenses of Contractor under Contractor's Agreement and relating to the Work terminated hereunder, or, to the extent approved by University, photographs, or other authentic reproductions thereof.

12.3.10 SUSPENSION, DELAY OR INTERRUPTION OF WORK BY UNIVERSITY FOR CONVENIENCE. University may in writing and without cause, order Contractor to suspend, delay, or interrupt the Work, in whole or in part, for such period of time as University may determine to be appropriate for the convenience of University.

12.4 UNIVERSITY'S RIGHT TO STOP THE WORK. If Contractor fails to correct Work or fails to carry out Work as required by the Contract Documents or fails to comply with all required and customary safety precautions; University, in writing, may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of University to stop the Work shall not give rise to a duty on the part of University to exercise this right for the benefit of Contractor or any other person or entity.

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work performed by Owner.
5. Multiple Work Packages.
6. Work under Owner's separate contracts.
7. Future work not part of this Project.
8. Owner's product purchase contracts.
9. Owner-furnished/Contractor-installed (OFCI) products.
10. Owner-furnished/Owner-installed (OFOI) products.
11. Contractor-furnished/Owner-installed (CFOI) products.
12. Contractor's use of site and premises.
13. Coordination with occupants.
14. Work restrictions.
15. Specification and Drawing conventions.
16. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
2. Section 017300 "Execution" for coordination of Owner-installed products.

1.2 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.3 PROJECT INFORMATION

A. Project Identification: 22812 -GSLC REMODEL

1. Project Location: 295 Chipeta Way, SLC UT

B. Owner: University of Utah.

1. Owner's Representative: Eric Bermudez

C. Architect: Studio Long Playing, 331 South Rio Grande St., Suite 307, SLC UT 84101 .

1. Architect's Representative: Baylee Rushton. baylee@studiolparch.com 801.739.5569

D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:

1. Mechanical Engineer: Spectrum Engineering. 324 State St Suite 400, SLC, UT 84111

a. Mechanical Engineer Representative: Ryan Boogaard, P.E. 801.401.8420. Ryan.Boogaard@speceng.com

2. Electrical Engineer: Spectrum Engineering. 324 State St Suite 400, SLC, UT 84111
a. Electrical Engineer Representative: Lance Kobayashi, PE. 801.328.5151. lance.kobayashi@speceng.com

E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.

1. See Section 013100 "Project Management and Coordination." for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:

1. Remodel of approximately 5,950 SF of existing office space on the 4th floor of the Williams building for the Genetic Science Learning Center and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK PERFORMED BY OWNER

A. Cooperate fully with Owner, so work may be carried out smoothly, without interfering with or delaying Work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.

1. Removal of existing Leibert Mechanical units in Storage room 4C050.

2. Data cables.

3. Replacement of light bulbs at main entrance out-of-scope area from elevator lobby.

4. Installation of OFOI equipment

1.6 OWNER'S PRODUCT PURCHASE CONTRACTS

A. Owner has negotiated Product Purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these Product Purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.

1. Contractor's responsibilities are same as if Contractor had negotiated Product Purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

1.7 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

A. The Owner will furnish and install products indicated.

B. Owner-Furnished/Owner-Installed (OFOI) Products:

1. Compacting Shelving units – Contractor to provide new track compatible with existing system, coordinate with owner. Install per manufacturer’s recommendation.

2. See equipment list.

1.8 CONTRACTOR'S USE OF SITE AND PREMISES

A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Limits on Use of Site: Limit use of Project site to Work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
1. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

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

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

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

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

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.10 WORK RESTRICTIONS

A. Comply with restrictions on construction operations.

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

B. On-Site Work Hours: Limit work to between 7 a.m**.** a.m. to 7 p.m. p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.

1. Weekend Hours: Verify with owner.
2. Early Morning Hours: Verify with owner.
3. Hours for Utility Shutdowns: Coordinate with owner.
4. Hours for Core Drilling and other noisy activity: Coordinate with owner.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:

1. Notify Owner not less than two days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.

D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.
   1. Work shall occur outside of standard business hours.
   2. Notify Owner not less than two days in advance of proposed disruptive operations.
   3. Obtain Owner's written permission before proceeding with disruptive operations.

E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Owner's property is not permitted.

F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
   1. Maintain list of approved screened personnel with Owner's representative.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
   3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
   4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.

C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 012300 "Alternates" for products selected under an alternate.
   2. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.2 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.3 ACTION SUBMITTALS

A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

   1. Substitution Request Form: Use DFCM substitution form, or form with similar attributes.
   2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified products, fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design

characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.4 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.5 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.6 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 15 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.

g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
   2. Section 013100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of web-based Project management software.

1.2 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Unifier and or Plan Grid.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
   2. Within time specified in Proposal Request or after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use Unifier and or Plan Grid.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
   6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
   7. Proposal Request Form: Use form provided as part of Unifier.

1.4 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on form provided as part of web-based Project management software.

1.5 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on form provided as part of web-based Project management software. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
   1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

   1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

   1. Identification: Include the following Project identification on the schedule of values:

      a. Project name and location.
      b. Owner's name.
      c. Owner's Project number.
      d. Name of Architect.
      e. Contractor's name and address.
      f. Date of submittal.

2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:

    a. Related Specification Section or division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site.
5. Purchase Contracts: Provide a separate line item in the schedule of values for each Purchase contract. Show line-item value of Purchase contract. Indicate Owner payments or deposits, if any, and balance to be paid by Contractor.
6. Overhead Costs, Proportional Distribution: Include total cost and proportionate share of general overhead and profit for each line item.
7. Overhead Costs, Separate Line Items: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
8. Temporary Facilities: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
9. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
10. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments, as certified by Architect and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Owner/Contractor Agreement. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Payment Application Times: Submit Application for Payment to Architect by the of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.

1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.

D. Application for Payment Forms: Use DFCM payment form as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Sustainable design action plans, including preliminary project materials cost data.
7. Schedule of unit prices.
8. Submittal schedule (preliminary if not final).
9. List of Contractor's staff assignments.
10. List of Contractor's principal consultants.
11. Copies of building permits.
12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
13. Initial progress report.
14. Report of preconstruction conference.
15. Certificates of insurance and insurance policies.
16. Performance and payment bonds.
17. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.

    a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 017700 "Closeout Procedures."

2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Certification of completion of final punch list items.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. Evidence that claims have been settled.
6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
7. Final liquidated damages settlement statement.
8. Proof that taxes, fees, and similar obligations are paid.
9. Waivers and releases.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project, including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Web-based Project management software package.
6. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

D. Contractor to use UNIFIER for all RFI, PCO, CO, Submittals and other CA documentation. Contractor to become familiar with this software. Submittals and other documentation will not be reviewed via email or other software.

E. Deferred submittals are a requirement by DFCM, contractor to note on bid documents which elements are required to be reviewed and submitted for approval prior to installation.

1.2 DEFINITIONS

A. BIM: Building Information Modeling.

B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, cellular telephone numbers, and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, in web-based Project software directory, and in prominent location inbuilt facility. Keep list current at all times.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

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

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled activities of other contractors and direction of Project coordinator to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

    a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    b. Coordinate the addition of trade-specific information to coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    f. Indicate required installation sequences.
    g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms, showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts,

bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.

6. Mechanical and Plumbing Work: Show the following:

    a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

    a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
    b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    c. Panel board, switchboard, switchgear, transformer, busway, generator, and motor-control center locations.
    d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

    a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that, in general, the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make suitable modifications and resubmit.
10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

C. Coordination Drawing Process: Prepare coordination drawings in the following manner:

1. Schedule submittal and review of Fire Sprinkler, Plumbing, HVAC, and Electrical Shop Drawings to make required changes prior to preparation of coordination drawings.
2. Commence routing of coordination drawing files with HVAC Installer, who will provide drawing plan files denoting approved ductwork. HVAC Installer will locate ductwork and piping on a single layer, using orange color. Forward drawings to Plumbing Installer.
3. Plumbing Installer will locate plumbing and equipment on a single layer, using blue color.
4. Fire Sprinkler Installer will locate piping and equipment, using red color. Fire Sprinkler Installer shall forward drawing files to Electrical Installer.
5. Electrical Installer will indicate service and feeder conduit runs and equipment in green color. Electrical Installer shall forward drawing files to Communications and Electronic Safety and Security Installer.

6. Communications and Electronic Safety and Security Installer will indicate cable trays and cabling runs and equipment in purple color. Communications and Electronic Safety and Security Installer shall forward completed drawing files to Contractor.
7. Contractor shall perform the final coordination review. As each coordination drawing is completed, Contractor will meet with Architect to review and resolve conflicts on the coordination drawings.

D. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Submittal Format: Submit or post coordination drawing files using PDF format.

2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in.
c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Owner name.
3. Owner's Project number.
4. Name of Architect.
5. Architect's Project number.
6. Date.
7. Name of Contractor.
8. RFI number, numbered sequentially.
9. RFI subject.
10. Specification Section number and title and related paragraphs, as appropriate.
11. Drawing number and detail references, as appropriate.
12. Field dimensions and conditions, as appropriate.

13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
14. Contractor's signature.
15. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

    1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow three days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

    1. The following Contractor-generated RFIs will be returned without action:

        a. Requests for approval of submittals.
        b. Requests for approval of substitutions.
        c. Requests for approval of Contractor's means and methods.
        d. Requests for coordination information already indicated in the Contract Documents.
        e. Requests for adjustments in the Contract Time or the Contract Sum.
        f. Requests for interpretation of Architect's actions on submittals.
        g. Incomplete RFIs or inaccurately prepared RFIs.

    2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt by Architect of additional information.
    3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

        a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 5 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of web-based Project management software. Include the following:

    1. Project name.
    2. Name and address of Contractor.
    3. Name and address of Architect.
    4. RFI number, including RFIs that were returned without action or withdrawn.
    5. RFI description.
    6. Date the RFI was submitted.

7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
9. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within three days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model CAD drawings will be provided by Architect for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project Record Drawings.
2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

    a. Subcontractors and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

B. Web-Based Project Management Software Package: Use Owner's web-based Project management software package for purposes of hosting and managing Project communication and documentation until Final Completion. The University of Utah uses UNIFIER, contractor to become familiar with this software.

1. Web-based Project management software includes, at a minimum, the following features:

    a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
    b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
    c. Document workflow planning, allowing customization of workflow between project entities.
    d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
    e. Track status of each Project communication in real time, and log time and date when responses are provided.
    f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.

g. Processing and tracking of payment applications.
h. Processing and tracking of contract modifications.
i. Creating and distributing meeting minutes.
j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
k. Management of construction progress photographs.
l. Mobile device compatibility, including smartphones and tablets.

2. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.

3. Use Unifier per University of Utah's requirements.

C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:

1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of seven days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of Record Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Procedures for completing and archiving web-based Project software site data files.
    d. Submittal of written warranties.
    e. Requirements for completing sustainable design documentation.
    f. Requirements for preparing operations and maintenance data.
    g. Requirements for delivery of material samples, attic stock, and spare parts.
    h. Requirements for demonstration and training.
    i. Preparation of Contractor's punch list.
    j. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    k. Submittal procedures.
    l. Owner's partial occupancy requirements.
    m. Installation of Owner's furniture, fixtures, and equipment.
    n. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

C. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

    a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

        1) Review schedule for next period.

    b. Review present and future needs of each entity present, including the following:

        1) Interface requirements.
        2) Sequence of operations.
        3) Status of submittals.

4) Status of sustainable design documentation.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site use.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of Proposal Requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting, where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

B. Related Requirements:
1. Section 014000 "Quality Requirements" for schedule of tests and inspections.
2. Section 012900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.2 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for completing an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine the critical path of Project and when activities can be performed.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for completing an activity as scheduled.

1.3 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file.
2. PDF file.

B. Startup construction schedule.

1. Submittal of cost-loaded startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
3. Total Float Report: List of activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Daily Construction Reports: Submit at weekly intervals.

H. Material Location Reports: Submit at weekly intervals.

I. Site Condition Reports: Submit at time of discovery of differing conditions.

J. Unusual Event Reports: Submit at time of unusual event.

K. Qualification Data: For scheduling consultant.

1.4 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities, and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

1. Use University of Utah’s preferred operating system.

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Temporary Facilities: Indicate start and completion dates for the following as applicable:

a. Securing of approvals and permits required for performance of the Work.
b. Temporary facilities.
c. Construction of mock-ups, prototypes and samples.
d. Owner interfaces and furnishing of items.
e. Interfaces with Separate Contracts.
f. Regulatory agency approvals.
g. Punch list.

3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

4. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
5. Commissioning Time: Include no fewer than 15 days for commissioning.
6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use-of-premises restrictions.
f. Provisions for future construction.
g. Seasonal variations.
h. Environmental control.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Final Completion percentage for each activity.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within 30 days of date established for commencement of the Work.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Testing and inspection.
8. Accidents.
9. Meetings and significant decisions.
10. Unusual events.
11. Stoppages, delays, shortages, and losses.

12. Meter readings and similar recordings.
13. Emergency procedures.
14. Orders and requests of authorities having jurisdiction.
15. Change Orders received and implemented.
16. Construction Change Directives received and implemented.
17. Services connected and disconnected.
18. Equipment or system tests and startups.
19. Partial completions and occupancies.
20. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Concealed Work photographs.
3. Periodic construction photographs.
4. Final Completion construction photographs.

B. Related Requirements:

1. Section 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
3. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Digital Photographs: Submit image files within three days of taking photographs.

1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
2. Identification: Provide the following information with each image description in web-based Project management software site:

a. Name of Project.
b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of location, vantage point, and direction.
g. Unique sequential identifier keyed to accompanying key plan.

1.3 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.4 FORMATS AND MEDIA

A. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

B. File Names: Name media files with date, Project area and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs with maximum depth of field and in focus.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

B. Preconstruction Photographs: Before commencement of the Work, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag construction limits before taking construction photographs.
2. Take photographs to show existing conditions adjacent to property before starting the Work.

C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
1. Piping.
2. Electrical conduit.

D. Periodic Construction Photographs: Take photographs weekly coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Section 013233 "Photographic Documentation" for submitting preconstruction photographs, periodic construction photographs, and Final Completion construction photographs.
5. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
6. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
7. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
9. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
10. Section 018113.43 "Sustainable Design Requirements - ASHRAE 189.1" for sustainable design submittals.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal Schedule: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal Schedule: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule as required to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal Category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled dates for purchasing.
    h. Scheduled date of fabrication.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.
3. Name of Architect.
4. Name of Construction Manager.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.

11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Architect.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

F. Use Unifier for all submittals.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal. Use Unifier.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.
3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.

   a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

G. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.

c. Time period when report is in effect.
d. Product and manufacturers' names.
e. Description of product.
f. Test procedures and results.
g. Limitations of use.

1.7 DELEGATED DESIGN SERVICES AND DEFERRED SUBMITTALS

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. Deferred Submittals: note on drawings required deferred submittals, that will be reviewed by the design team and once complete will be submitted to DFCM for final approval prior to installation.

D. Deferred submittals and delegated design are within the contractor’s duties to the project, the contractor is responsible to provide the correct documentation including engineering and testing to meet the design intent.

1.8 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required.

1. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Architect will return without review submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 013516 - ALTERATION PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes special procedures for alteration work.

1.2 DEFINITIONS

A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.

B. Consolidate: To strengthen loose or deteriorated materials in place.

C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.

D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.

F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.

H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.

I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.

J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.

K. Retain: To keep existing items that are not to be removed or dismantled.

L. Strip: To remove existing finish down to base material unless otherwise indicated.

1.3 COORDINATION

A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.

1. Schedule construction operations in sequence required to obtain best Work results.
2. Coordinate sequence of alteration work activities to accommodate the following:

    a. Owner's continuing occupancy of portions of existing building.
    b. Owner's partial occupancy of completed Work.
    c. Other known work in progress.
    d. Tests and inspections.

3. Detail sequence of alteration work, with start and end dates.
4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
5. Use of elevator and stairs.
6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.

1.4 PROJECT MEETINGS FOR ALTERATION WORK

A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:

    a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    b. Fire-prevention plan.
    c. Governing regulations.
    d. Areas where existing construction is to remain and the required protection.
    e. Hauling routes.
    f. Sequence of alteration work operations.
    g. Storage, protection, and accounting for salvaged and specially fabricated items.
    h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.

i. Qualifications of personnel assigned to alteration work and assigned duties.
j. Requirements for extent and quality of work, tolerances, and required clearances.
k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.

3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.

B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.

a. Alteration Work Subschedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
b. Schedule Updating: Revise Contractor's Alteration Work Subschedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:

1) Interface requirements of alteration work with other Project Work.
2) Status of submittals for alteration work.
3) Access to alteration work locations.
4) Effectiveness of fire-prevention plan.
5) Quality and work standards of alteration work.
6) Change Orders for alteration work.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.5 MATERIALS OWNERSHIP

A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed at Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Alteration Work Subschedule:

1. Submit alteration work subschedule within seven days of date established for commencement of alteration work.

B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.

C. Fire-Prevention Plan: Submit 30 days before work begins.

1.7 QUALITY ASSURANCE

A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.

1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.

a. Construct new mockups of required work whenever a supervisor is replaced.

B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.

C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this

and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

A. Salvaged Materials:

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

B. Salvaged Materials for Reinstallation:

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.

D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 deg F or more above the dew point.

1.9 FIELD CONDITIONS

A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."

B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.

C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed:

D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.

PART 2 - PRODUCTS - (Not Used)

PART 3 - EXECUTION

3.1 PROTECTION

A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.

7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties titled "Owner's Responsibility for Fire Protection."
2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.

a. If combustible material cannot be removed, provide fire blankets to cover such materials.

B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible

materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:

1. Obtain Owner's approval for operations involving use of open-flame or welding or other high-heat equipment. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:

    a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.

C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.

D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

3.3 PROTECTION DURING APPLICATION OF CHEMICALS

A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.

B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.

C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.

D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.

E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

3.4 GENERAL ALTERATION WORK

A. Have specialty work performed only by qualified specialists.

B. Ensure that supervisory personnel are present when work begins and during its progress.

C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs. Comply with requirements in Section 013233 "Photographic Documentation."

D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.

E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.

1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, Commissioning Authority, or authorities having jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a Work result does not require that certain construction activities specified apply exclusively to specific trade(s).

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited

according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" has the same meaning as the term "testing agency."

H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work, to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified is the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within

reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

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

B. Qualification Data: For Contractor's quality-control personnel.

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

1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

F. Reports: Prepare and submit certified written reports and documents as specified.

G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

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

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

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

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

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by Commissioning Authority.

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

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

1.8 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.

2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement of whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement of whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service

performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities be performed by entities who are recognized experts in those operations. Specialists will satisfy qualification requirements indicated and engage in the activities indicated.

1. Requirements of authorities having jurisdiction supersede requirements for specialists.

G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:

1. Provide test specimens representative of proposed products and construction.
2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.

3. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect and Commissioning Authority, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.

1.10 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor will not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.

3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.

1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, commissioning activities, and other Project-required services paid for by other entities.

2. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections, and stating in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

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

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's, Commissioning Authority's, and authorities' having jurisdiction reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

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

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

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

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

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1. For standards referenced by applicable building codes, comply with dates of standards as listed in building codes.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Abbreviations and acronyms not included in this list shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States." The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.

21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
34. ASSP - American Society of Safety Professionals (The); www.assp.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AVIXA - Audiovisual and Integrated Experience Association; (Formerly: Infocomm International); www.soundandcommunications.com.
38. AWEA - American Wind Energy Association; www.awea.org.
39. AWI - Architectural Woodwork Institute; www.awinet.org.
40. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
41. AWPA - American Wood Protection Association; www.awpa.com.
42. AWS - American Welding Society; www.aws.org.
43. AWWA - American Water Works Association; www.awwa.org.
44. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
45. BIA - Brick Industry Association (The); www.gobrick.com.
46. BICSI - BICSI, Inc.; www.bicsi.org.
47. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
48. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
49. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
50. CDA - Copper Development Association; www.copper.org.
51. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
52. CEA - Canadian Electricity Association; www.electricity.ca.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.compositepanel.org.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.

62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csa-group.org.
65. CSI - Construction Specifications Institute (The); www.csiresources.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTA - Consumer Technology Association; www.cta.tech.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.coolingtechnology.org.
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHA - Decorative Hardwoods Association; (Formerly: Hardwood Plywood & Veneer Association); www.decorativehardwoods.org.
72. DHI - Door and Hardware Institute; www.dhi.org.
73. ECA - Electronic Components Association; (See ECIA).
74. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
75. ECIA - Electronic Components Industry Association; www.eciaonline.org.
76. EIA - Electronic Industries Alliance; (See TIA).
77. EIMA - EIFS Industry Members Association; www.eima.com.
78. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
79. EOS/ESD Association; (Electrostatic Discharge Association); www.esda.org.
80. ESTA - Entertainment Services and Technology Association; (See PLASA).
81. ETL - Intertek (See Intertek); www.intertek.com.
82. EVO - Efficiency Valuation Organization; www.evo-world.org.
83. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
84. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
85. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
86. FM Approvals - FM Approvals LLC; www.fmglobal.com.
87. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
88. FRSA - Florida Roofing, Sheet Metal Contractors Association, Inc.; www.floridaroof.com.
89. FSA - Fluid Sealing Association; www.fluidsealing.com.
90. FSC - Forest Stewardship Council U.S.; www.fscus.org.
91. GA - Gypsum Association; www.gypsum.org.
92. GANA - Glass Association of North America; (See NGA).
93. GS - Green Seal; www.greenseal.org.
94. HI - Hydraulic Institute; www.pumps.org.
95. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
96. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
97. HPVA - Hardwood Plywood & Veneer Association; (See DHA).
98. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
99. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
100. IAS - International Accreditation Service; www.iasonline.org.
101. ICBO - International Conference of Building Officials; (See ICC).
102. ICC - International Code Council; www.iccsafe.org.
103. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.

104. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
105. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
106. IEC - International Electrotechnical Commission; www.iec.ch.
107. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
108. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
109. IESNA - Illuminating Engineering Society of North America; (See IES).
110. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
111. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
112. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.org.
113. II - Infocomm International; (See AVIXA).
114. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
115. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
116. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
117. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
118. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
119. ISO - International Organization for Standardization; www.iso.org.
120. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
121. ITU - International Telecommunication Union; www.itu.int/home.
122. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
123. LMA - Laminating Materials Association; (See CPA).
124. LPI - Lightning Protection Institute; www.lightning.org.
125. MBMA - Metal Building Manufacturers Association; www.mbma.com.
126. MCA - Metal Construction Association; www.metalconstruction.org.
127. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
128. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
129. MHIA - Material Handling Industry of America; www.mhia.org.
130. MIA - Marble Institute of America; (See NSI).
131. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
132. MPI - Master Painters Institute; www.paintinfo.com.
133. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
134. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
135. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
136. NADCA - National Air Duct Cleaners Association; www.nadca.com.
137. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
138. NALP - National Association of Landscape Professionals; www.landscapeprofessionals.org.
139. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
140. NBI - New Buildings Institute; www.newbuildings.org.
141. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
142. NCMA - National Concrete Masonry Association; www.ncma.org.
143. NEBB - National Environmental Balancing Bureau; www.nebb.org.
144. NECA - National Electrical Contractors Association; www.necanet.org.
145. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.

146. NEMA - National Electrical Manufacturers Association; www.nema.org.
147. NETA - InterNational Electrical Testing Association; www.netaworld.org.
148. NFHS - National Federation of State High School Associations; www.nfhs.org.
149. NFPA - National Fire Protection Association; www.nfpa.org.
150. NFPA - NFPA International; (See NFPA).
151. NFRC - National Fenestration Rating Council; www.nfrc.org.
152. NGA - National Glass Association (The); (Formerly: Glass Association of North America); www.glass.org.
153. NHLA - National Hardwood Lumber Association; www.nhla.com.
154. NLGA - National Lumber Grades Authority; www.nlga.org.
155. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
156. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
157. NRCA - National Roofing Contractors Association; www.nrca.net.
158. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
159. NSF - NSF International; www.nsf.org.
160. NSI - National Stone Institute; (Formerly: Marble Institute of America); www.naturalstoneinstitute.org.
161. NSPE - National Society of Professional Engineers; www.nspe.org.
162. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
163. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
164. NWFA - National Wood Flooring Association; www.nwfa.org.
165. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
166. PDI - Plumbing & Drainage Institute; www.pdionline.org.
167. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
168. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
169. RFCI - Resilient Floor Covering Institute; www.rfci.com.
170. RIS - Redwood Inspection Service; www.redwoodinspection.com.
171. SAE - SAE International; www.sae.org.
172. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
173. SDI - Steel Deck Institute; www.sdi.org.
174. SDI - Steel Door Institute; www.steeldoor.org.
175. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
176. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
177. SIA - Security Industry Association; www.siaonline.org.
178. SJI - Steel Joist Institute; www.steeljoist.org.
179. SMA - Screen Manufacturers Association; www.smainfo.org.
180. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
181. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
182. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
183. SPIB - Southern Pine Inspection Bureau; www.spib.org.
184. SPRI - Single Ply Roofing Industry; www.spri.org.
185. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
186. SSINA - Specialty Steel Industry of North America; www.ssina.com.
187. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
188. STI - Steel Tank Institute; www.steeltank.com.
189. SWI - Steel Window Institute; www.steelwindows.com.

190. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
191. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
192. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
193. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
194. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
195. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
196. TMS - The Masonry Society; www.masonrysociety.org.
197. TPI - Truss Plate Institute; www.tpinst.org.
198. TPI - Turfgrass Producers International; www.turfgrasssod.org.
199. TRI - Tile Roofing Institute; www.tileroofing.org.
200. UL - Underwriters Laboratories Inc.; www.ul.com.
201. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
202. USAV - USA Volleyball; www.usavolleyball.org.
203. USGBC - U.S. Green Building Council; www.usgbc.org.
204. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
205. WA - Wallcoverings Association; www.wallcoverings.org.
206. WASTEC - Waste Equipment Technology Association; www.wastec.org.
207. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
208. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
209. WDMA - Window & Door Manufacturers Association; www.wdma.com.
210. WI - Woodwork Institute; www.wicnet.org.
211. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.

9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).

4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

C. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

E. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.

1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
3. Indicate methods to be used to avoid trapping water in finished work.

F. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste-handling procedures.
5. Other dust-control measures.

G. Noise and Vibration Control Plan: Identify construction activities that may impact the occupancy and use of existing spaces within the building or adjacent existing buildings, whether occupied by others, or occupied by the Owner. Include the following:

1. Methods used to meet the goals and requirements of the Owner.
2. Concrete cutting method(s) to be used.
3. Location of construction devices on the site.
4. Show compliance with the use and maintenance of quieted construction devices for the duration of the Project.
5. Indicate activities that may disturb building occupants and that are planned to be performed during non-standard working hours as coordinated with the Owner.
6. Indicate locations of sensitive research areas or other areas requiring special attention as identified by Owner. Indicate means for complying with Owner's requirements.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.

B. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches (914 by 1524 mm).

C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Or an office as provided by user.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 017700 "Closeout Procedures."

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.

a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
b. Maintain negative air pressure within work area, using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.

D. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.

E. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

H. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

3.4 SUPPORT FACILITIES INSTALLATION

A. Comply with the following:
   1. Utilize designated area within existing building for temporary field offices.
   2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

   1. Protect existing site improvements to remain, including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

D. Storage and Staging: Use designated areas of Project site for storage and staging needs.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

      a. Provide temporary, directional signs for construction personnel and visitors.

   3. Maintain and touch up signs, so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: Use of elevators is not permitted.

J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

K. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas, so no evidence remains of correction work.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Comply with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 311000 "Site Clearing."

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
1. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction. Provide signage directing occupants to temporary egress.

J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.

1. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
2. Paint and maintain appearance of walkway for duration of the Work.

K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
2. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.

3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
4. Insulate partitions to control noise transmission to occupied areas.
5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
6. Protect air-handling equipment.
7. Provide walk-off mats at each entrance through temporary partition.

M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition in accordance with requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign, stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.6 MOISTURE AND MOLD CONTROL

A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.

B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard and replace stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.

D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use temporary or permanent HVAC system to control humidity within ranges specified for installed and stored materials.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective and require replacing.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove and replace materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.7 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

The Work of This Section Includes: Admin SECTION 016000 - PRODUCT REQUIREMENTS

PART 2 - GENERAL

2.1 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 011000 "Summary" for Contractor requirements related to Owner-furnished products.
2. Section 012300 "Alternates" for products selected under an alternate.
3. Section 012500 "Substitution Procedures" for requests for substitutions.
4. Section 014200 "References" for applicable industry standards for products specified.
5. Section 01770 "Closeout Procedures" for submitting warranties.

2.2 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable Products: In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.

D. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:

1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.

E. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 013300 "Submittal Procedures."

F. Substitution: Refer to Section 012500 "Substitution Procedures" for definition and limitations on substitutions.

2.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Resolution of Compatibility Disputes between Multiple Contractors:

a. Contractors are responsible for providing products and construction methods compatible with products and construction methods of other contractors.

b. If a dispute arises between the multiple contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

2.4 COORDINATION

A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

2.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products, using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

2.6 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 3 - PRODUCTS

3.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

    a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

    a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."

3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."

4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.

   a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.

5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will be considered unless otherwise indicated.

   a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."

6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.

   a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
   b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.

7. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

   a. For approval of products by unnamed manufacturers, comply with requirements in Section 012500 "Substitution Procedures" for substitutions for convenience.

C. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

E. Sustainable Product Selection: Where Specifications require product to meet sustainable product characteristics, select products complying with indicated requirements. Comply with requirements in Division 01 sustainability requirements Section and individual Specification Sections.

1. Select products for which sustainable design documentation submittals are available from manufacturer.

3.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 013300 "Submittal Procedures."

1. Form of Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

PART 4 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner's portion of the Work.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for coordination of , and limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
5. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.2 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.3 PREINSTALLATION MEETINGS

A. Cutting and Patching Conference: Conduct conference at Project site.

1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require

representatives of each entity directly concerned with cutting and patching to attend, including the following:

a. Contractor's superintendent.
b. Trade supervisor responsible for cutting operations.
c. Trade supervisor(s) responsible for patching of each type of substrate.
d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.

2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.4 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

a. Primary operational systems and equipment.
b. Fire separation assemblies.
c. Air or smoke barriers.
d. Fire-suppression systems.
e. Plumbing piping systems.
f. Mechanical systems piping and ducts.
g. Control systems.
h. Communication systems.
i. Fire-detection and -alarm systems.
j. Conveying systems.
k. Electrical wiring systems.
l. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

a. Water, moisture, or vapor barriers.
b. Membranes and flashings.
c. Exterior curtain-wall construction.

d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 013100 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.

B. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb, and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of in occupied spaces and in unoccupied spaces, unless otherwise indicated on Drawings.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.

F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.

G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.

J. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.6 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of Work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 011000 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as practicable, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel and Owner's separate contractors.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products.
2. Refer to Section 011000 "Summary" for other requirements for Owner-furnished, Contractor-installed and Owner-furnished, Owner-installed products

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel and Owner's separate contractors.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel and Owner's separate contractors at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences

conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.10 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.

C. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.

D. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous demolition and construction waste.
   2. Recycling nonhazardous demolition and construction waste.
   3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:
   1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
   2. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building, structure, and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building, structure, and site improvement materials resulting from demolition operations.

C. Disposal: Removal of demolition or construction waste and subsequent salvage, sale, recycling, or deposit in landfill, incinerator acceptable to authorities having jurisdiction, or designated spoil areas on Owner’s property.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 7 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
   1. Material category.
   2. Generation point of waste.
   3. Total quantity of waste in tons.
   4. Quantity of waste salvaged, both estimated and actual in tons.
   5. Quantity of waste recycled, both estimated and actual in tons.
   6. Total quantity of waste recovered (salvaged plus recycled) in tons.
   7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

I. Refrigerant Recovery: Comply with requirements in Section 024119 "Selective Demolition" for refrigerant recovery submittals.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, or individual employed and assigned by General Contractor, with a record of successful waste management coordination of projects with similar requirements. Superintendent may serve as Waste Management Coordinator.

B. Refrigerant Recovery Technician Qualifications: certified by EPA-approved certification program.

C. Refrigerant Recovery Technician Qualifications: Comply with requirements in

D. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.

E. Waste Management Conference(s): Conduct conference(s) at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
   1. Review and discuss waste management plan including responsibilities of each contractor and waste management coordinator.
   2. Review requirements for documenting quantities of each type of waste and its disposition.
   3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
   4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
   5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition site-clearing and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste

generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work in compliance with Section 024119 "Selective Demolition."
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS

2.1 RECYCLING RECEIVERS AND PROCESSORS

A. Subject to compliance with requirements, available recycling receivers and processors include, but are not limited to, the following:
   1. Local recyclers.

2.2 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 75 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials., including the following:
   1. Demolition Waste:
      a. Asphalt paving.
      b. Concrete.
      c. Concrete reinforcing steel.
      d. Brick.
      e. Concrete masonry units.
      f. Structural and miscellaneous steel.
      g. Rough hardware.
      h. Doors and frames.
      i. Door hardware.
      j. Windows.
      k. Glazing.

l. Metal studs.
m. Gypsum board.
n. Acoustical tile and panels.
o. Demountable partitions.
p. Equipment.
q. Cabinets.
r. Plumbing fixtures.
s. Piping.
t. Supports and hangers.
u. Valves.
v. Mechanical equipment.
w. Refrigerants.
x. Electrical conduit.
y. Copper wiring.
z. Lighting fixtures.
aa. Lamps.
bb. Ballasts.
cc. Electrical devices.
dd. Switchgear and panelboards.
ee. Transformers.

2. Construction Waste:
   a. Masonry and CMU.
   b. Metals.
   c. Insulation.
   d. Gypsum board.
   e. Piping.
   f. Electrical conduit.
   g. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Wood pallets.
      8) Plastic pails.
   h. Construction Office Waste: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following construction office waste materials:
      1) Paper.
      2) Aluminum cans.
      3) Glass containers.

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
   1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan.

C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
   1. Distribute waste management plan to everyone concerned within three days of submittal return.
   2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged and recycled.
   2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

E. Waste Management in Historic Zones or Areas: Transportation equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, by 12 inches or more.

3.2 SALVAGING DEMOLITION WASTE

A. Comply with requirements in Section 024119 "Selective Demolition" for salvaging demolition waste.

B. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until installation.
   4. Protect items from damage during transport and storage.
   5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

C. Salvaged Items for Donation: Not permitted on Project site.

D. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area on-site.
   5. Protect items from damage during transport and storage.

E. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

F. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

G. Plumbing Fixtures: Separate by type and size.

H. Lighting Fixtures: Separate lamps by type and protect from breakage.

I. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.

5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor as often as required to prevent overfilling bins.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
   1. Pulverize concrete to maximum 4-inch size.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
   1. Clean and stack undamaged, whole masonry units on wood pallets, reuse masonry as needed.
   2. Pulverize masonry to maximum 4-inch size.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.
   1. Structural Steel: Stack members according to size, type of member, and length.
   2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

G. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

H. Metal Suspension System: Separate metal members, including trim and other metals from acoustical panels and tile, and sort with other metals.

I. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.

J. Conduit: Reduce conduit to straight lengths and store by material and size.

K. Lamps: Separate lamps by type and store according to requirements in 40 CFR 273.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.

3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

D. Paint: Seal containers and store by type.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged or recycled, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. General: Except for items or materials to be salvaged or recycled, remove waste materials and legally dispose of at designated spoil areas on Owner’s property.

C. Burning: Do not burn waste materials.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final Completion procedures.
3. Submittal of Project warranties.
4. Final cleaning.

B. Related Requirements:

1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
2. Section 013233 "Photographic Documentation" for submitting Final Completion construction photographic documentation.
3. Section 017823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
4. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
5. Section 017900 "Demonstration and Training" for requirements to train Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.2 DEFINITIONS

A. List of Incomplete Items: Contractor-prepared list of items to be completed or corrected, prepared for the Architect's use prior to Architect's inspection, to determine if the Work is substantially complete.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cleaning agent.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest-control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items required by other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit testing, adjusting, and balancing records.
5. Submit sustainable design submittals not previously submitted.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.

7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:

1. Submit a final Application for Payment in accordance with Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list will state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit Final Completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, proceeding from lowest floor to highest floor, listed by room or space number.
2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:
    a. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1. Submit by uploading to web-based project software site.

E. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Remove tools, construction equipment, machinery, and surplus material from Project site.
d. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
e. Remove debris and surface dust from limited-access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
f. Clean flooring, removing debris, dirt, and staining; clean in accordance with manufacturer's instructions.
g. Vacuum and mop concrete.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean in accordance with manufacturer's instructions if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA ACR. Provide written report on completion of cleaning.

o. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
p. Clean strainers.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

3.2 CORRECTION OF THE WORK

A. Complete repair and restoration operations required by "Correction of the Work" Article in Section 017300 "Execution" before requesting inspection for determination of Substantial Completion.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory manuals.
2. Emergency manuals.
3. Systems and equipment operation manuals.
4. Systems and equipment maintenance manuals.
5. Product maintenance manuals.

B. Related Requirements:
1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operation and maintenance submittals is acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operation and maintenance manuals in the following format:

1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

E. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.4 FORMAT OF OPERATION AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.5 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.

8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.6 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.7 EMERGENCY MANUALS

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

1.8 SYSTEMS AND EQUIPMENT OPERATION MANUALS

A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.

8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

C. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

D. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.9 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

    a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of maintenance manuals.

1.10 PRODUCT MAINTENANCE MANUALS

A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of Record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints..
2) Submit Record Digital Data Files and one set(s) of plots.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:
1) Submit PDF electronic files of scanned Record Prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and Contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

1.3 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Revisions to routing of piping and conduits.
    d. Revisions to electrical circuitry.
    e. Actual equipment locations.
    f. Duct size and routing.
    g. Locations of concealed internal utilities.
    h. Changes made by Change Order or Construction Change Directive.
    i. Changes made following Architect's written orders.
    j. Details not on the original Contract Drawings.
    k. Field records for variable and concealed conditions.
    l. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Format: Annotated PDF electronic file
2. Identification: As follows:

a. Project name.
b. Date.
c. Designation "PROJECT RECORD DRAWINGS."
d. Name of Architect.
e. Name of Contractor.

1.4 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

B. Format: Submit record specifications as annotated PDF electronic file.

1.5 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store Record Documents in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Instruction in operation and maintenance of systems, subsystems, and equipment.
2. Demonstration and training video recordings.

B. Allowances: Furnish demonstration and training instruction time under the demonstration and training allowance as specified in Section 012100 "Allowances."

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review

methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Systems and equipment operation manuals.
c. Systems and equipment maintenance manuals.
d. Product maintenance manuals.
e. Project Record Documents.
f. Identification systems.
g. Warranties and bonds.
h. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning.
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.
e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.
3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.

F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 017900

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Salvage of existing items to be reused or recycled.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 017300 "Execution" for cutting and patching procedures.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and store.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.5 INFORMATIONAL SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by salvage and demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before Work begins.

C. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

D. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Present in buildings and structures to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

1. Hazardous material remediation is specified elsewhere in the Contract Documents.
2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
3. Owner will provide material safety data sheets for suspected hazardous materials that are known to be present in buildings and structures to be selectively demolished because of building operations or processes performed there.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.9 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video.

1. Inventory and record the condition of items to be removed and salvaged.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 PREPARATION

A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

3.4 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining

construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 6 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Work in Historic Areas: Selective demolition may be performed only in areas of Project that are not designated as historic. In historic spaces, areas, and rooms, or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 024296 "Historic Removal and Dismantling."

D. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

F. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction. and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Stainless steel railings.

1.2 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

   1. Manufacturer's product lines of mechanically connected railings.
   2. Fasteners.
   3. Post-installed anchors.
   4. Handrail brackets.
   5. Shop primer.
   6. Nonshrink, nonmetallic grout.
   7. Anchoring cement.
   8. Metal finishes.

B. Sustainable Design Submittals:

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

D. Samples for Verification: For each type of exposed finish required.

   1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
   2. Fittings and brackets.

E. Delegated Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For delegated design professional engineer.

B. Welding certificates.

C. Mill Certificates: Signed by manufacturers of stainless steel products, certifying that products furnished comply with requirements.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

E. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.

F. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.

2.3 STAINLESS STEEL RAILINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CraneVeyor Corp.
2. Julius Blum & Co., Inc.
3. Tri Tech, Inc.
4. VIVA Railings, LLC.

B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

C. Tubing: ASTM A554, Grade MT 304.

D. Pipe: ASTM A312/A312M, Grade TP 304.

E. Castings: ASTM A743/A743M, Grade CF 8 or CF 20.

F. Plate and Sheet: ASTM A240/A240M or ASTM A666, Type 304.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941/F1941M, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Stainless Steel Railing Components: Type 304 stainless steel fasteners.
4. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide Phillips flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

A. Handrail Brackets: Cast stainless steel, center of handrail 2-1/2 inches (63.5 mm) from face of railing.

B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.

1. For stainless steel railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.

1. Clearly mark units for reassembly and coordinated installation.
2. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately.

1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
2. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water.

1. Provide weep holes where water may accumulate.
2. Locate weep holes in inconspicuous locations.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.

4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #2 welds; good appearance, completely sanded joint, some undercutting and pinholes okay.

I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.

J. Form changes in direction as follows:

1. As detailed.

K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.

M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.

N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.

1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
2. Coordinate anchorage devices with supporting structure.

P. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (13 mm) greater than outside dimensions of post, with metal plate forming bottom closure.

Q. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.

1. Provide socket covers designed and fabricated to resist being dislodged.
2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces.
3. Remove embedded foreign matter and leave surfaces chemically clean.

C. Stainless Steel Pipe and Tubing Finishes:

1. 180-Grit Polished Finish: Uniform, directionally textured finish.
2. 320-Grit Polished Finish: Oil-ground, uniform, fine, directionally textured finish.

D. Stainless Steel Sheet and Plate Finishes:

1. Directional Satin Finish: ASTM A480/A480, No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings.

1. Fit exposed connections together to form tight, hairline joints.
2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
5. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).

B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws, using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches (50 mm) beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches (150 mm) of post.

3.4 ATTACHING RAILINGS

A. Secure wall brackets and railing end flanges to building construction as follows:
   1. For metal stud partitions, use hanger or lag bolts set into studs or fire-treated wood backing between studs. Coordinate with carpentry work to locate backing members.

3.5 CLEANING

A. Clean stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood blocking, cants, and nailers.
   2. Wood furring and grounds.
   3. Plywood backing panels.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) size or greater but less than 5 inches nominal (114 mm actual) size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal (114 mm actual) size or greater in least dimension.

F. Lumber grading agencies, and abbreviations used to reference them, include the following:

   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

   1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
2. Environmental Product Declaration: For each product.
3. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.
5. Product Data: For installation adhesives, indicating VOC content.
6. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.

C. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.
3. Engineered wood products.
4. Power-driven fasteners.
5. Post-installed anchors.
6. Metal framing anchors.
7. Sill sealer gasket/termite barrier.

C. Qualification Statements: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Regional Materials: Manufacture the following wood products within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If transporting materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.

1. Dimension lumber, except treated materials.

B. Certified Wood: Verify the following wood products contain not less than 60 percent certified wood tracked through a chain-of-custody process. Provide certified wood documentation from sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

1. Dimension lumber, except treated materials.

C. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
3. Dress lumber, S4S, unless otherwise indicated.

D. Maximum Moisture Content of Lumber:

1. Boards: 19 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal (38-mm actual) thickness or less; 19 percent for more than 2-inch nominal (38-mm actual) thickness unless otherwise indicated.

E. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. After treatment, redry boards dimension lumber to 19 percent maximum moisture content.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.

3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat all rough carpentry unless otherwise indicated.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Cants.
4. Furring.
5. Grounds.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Concealed Boards: 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
4. Northern species; No. 2 Common grade; NLGA.
5. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1,, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch (13-mm) nominal thickness. Backing at sound rated walls, ref drawings.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches (38 mm) into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329.
2. For pressure-preservative-treated wood, use stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC308 as appropriate for the substrate.

2.7 METAL FRAMING ANCHORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Cleveland Steel Specialty Co.
2. MiTek Industries, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. Tamlyn.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those of products of manufacturers listed. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 (Z180) coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.

1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

E. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches (2438 mm) o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal (38-mm actual) thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. (9.3 sq. m) and to solidly fill space below partitions.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

K. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 INSTALLATION OF WOOD FURRING

A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- (19-by-63-mm actual-) size furring horizontally and vertically at 24 inches (610 mm) o.c.

C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- (19-by-38-mm actual-) size furring vertically at 16 inches (406 mm) o.c.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 064116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS AND WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Upholstery materials
4. Miscellaneous materials.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.2 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

B. Hardware Coordination: Distribute copies of approved hardware schedule specified to manufacturer of architectural cabinets; coordinate Shop Drawings and fabrication with hardware requirements.

1.3 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:
1. Chain-of-Custody Certificates: For certified wood products. Include statement of costs.
2. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
3. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

E. Samples for Initial Selection: For each type of exposed finish.

F. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish required.

a. Provide one sample applied to core material with specified edge material applied to one edge.

2. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches (200 by 250 mm), for each color, pattern, and surface finish.

a. Provide edge banding on one edge.

3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer and Installer.

B. Product Certificates: For the following:

1. Composite wood products.
2. Thermally fused laminate panels.
3. High-pressure decorative laminate.
4. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS AND WOOD PANELING

A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Architectural Woodwork Standards Grade: Custom.

C. Regional Materials: Manufacture wood products within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site. If transporting materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.

D. Certified Wood: Verify wood products contain not less than 60 percent certified wood tracked through a chain-of-custody process. Provide certified wood documentation from sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "WTO Agreement on Technical Barriers to Trade."

E. Type of Construction: See Drawings.

F. Door and Drawer-Front Style: See Drawings.

G. High-Pressure Decorative Laminate: ISO 4586-3, grades as indicated or if not indicated, as required by quality standard.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. (L1) – Formica, Aged Ash 8844
b. (L2) – Wilsonart, Hunter Green D79-60

H. Exposed Surfaces:

1. Plastic-Laminate Grade: VGS.
2. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
3. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

I. Semiexposed Surfaces:

1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, ISO 4586-3.

a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
b. Edges of Thermally Fused Laminate Panel Shelves: PVC or polyester edge banding.

c. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, ISO 4586-3, grade to match exposed surface.

2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
3. Drawer Bottoms: Thermally fused laminate panels.

J. Dust Panels: 1/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers unless located directly under tops.

K. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, ISO 4583-3, grade to match exposed surface.

L. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners.

M. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. As indicated by laminate manufacturer's designations.
2. Match Architect's sample.

2.2 WOOD MATERIALS

A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Wood Moisture Content: 8 to 13 percent.

B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

1. Composite Wood Products: Verify products are made without added urea formaldehyde.

2. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
3. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
4. Softwood Plywood: DOC PS 1, medium-density overlay.
5. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of ISO 4586.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested in accordance with ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of architectural cabinets.

C. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Roseburg.

2.4 UPHOLSTERY MATERIALS (UP1)

A. Fabric Upholstery.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. Maharam, Nico 466564-016 Posh as indicated on drawings (UP1)

B. MATERIALS
1. Cushion Material: Manufacturer's standard as follows:
    a. Fabric Abraision Resistance: ASTM D4157, minimum 300,000 double rubs.
    b. Seatback Cushion Polymer Density: 1.4 lb/cu. ft..
    c. Seat Cushion Polymer Density: 3.0 lb/cu. ft..

C. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. FABRICATION
1. Double stitch seams
2. Center upholstery pattern indicated on the inside and outside seatback and cushion, and in the same location on each seating unit. Match upholstery pattern on cushion and upholstered seat edge
3. Apply upholstery material smooth and even, with undistorted grain lines, and free of ripples, scallops, or puckers.
4. Conceal channeled seams. Channel stitch straight and continuous, with channels parallel to each other and perpendicular to intersecting materials.
5. Staple or sew breathable concealment fabric to underneath side of seat. Secure staples flush with seating frame to prevent snagging concealment fabric.
6. Fabricate removable seat cushion covers with cushion vents and concealed zippers.
7. Fabricate seat cushions and seat frame with integral, concealed, hook-type fasteners to secure cushions in place.
8. Cut welt-cord on bias.

2.5 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Hardware: Provide cabinet hardware and accessory materials associated with architectural cabinets.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Accuride International Inc.
    b. Hardware Resources.
    c. Julius Blum & Co., Inc.
    d. Knape & Vogt Manufacturing Company.

B. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 135 degrees of opening, self-closing.

C. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.

D. Tab pulls: Back mounted, solid metal, 4 inches long, 5/16” (8 mm) in diameter.

E. Catches: Roller catches, ANSI/BHMA A156.9, B03071.

F. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.

G. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.

H. Drawer Slides: ANSI/BHMA A156.9.
   1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Side mount.
      a. Type: Full extension.
      b. Material: Aluminum slides.
      c. Motion Feature: Soft close dampener Self-closing mechanism.
   2. General-purpose drawers more than 3 inches (75 mm) high, but not more than 6 inches (150 mm) high and not more than 24 inches (600 mm) wide, provide 75 lb (34 kg) load capacity.
   3. File drawers more than 6 inches (150 mm) high or more than 24 inches (600 mm) wide, provide 100 lb (45 kg) load capacity.

I. Door Locks: ANSI/BHMA A156.11, E07121.

J. Drawer Locks: ANSI/BHMA A156.11, E07041.

K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
   1. Satin Stainless Steel: ANSI/BHMA 630.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

N. Trash Drawer: Basis of Design – cabinetparts.com – 50 quart wood bottom mount pullout waste container with door mounting brackets.
   1. Waste Bin Color: (1) White - HR-CDM-WBMS50WH
      (1) Gray - HR-CDM-WBMS50G

O. Countertop L-bracket: Basis of Design – Right on Bracket, 3/8” thickness, 15” length. Space brackets as required per manufacturer requirements to accommodate countertop load. Install per manufacturer’s recommendation.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

Adhesives: Do not use adhesives that contain urea formaldehyde.

C. Adhesive for Bonding Plastic Laminate:Unpigmented contact cement. .

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.7 FABRICATION

A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.

B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
2. Trial fit assemblies at manufacturer's shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

B. For fabric upholstery: Ensure that substrate surfaces are smooth and free from protrusions that may damage the fabric.

3.2 INSTALLATION

A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.

B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.

D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm) using concealed shims.

1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches (400 mm) o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

E. Install fabric upholstery according to manufacturer’s instructions and industry best practices.
1. Ensure that fabric textures are in the same direction and seams are properly joined and concealed.
2. Upholster surfaces securely to prevent sagging and wrinkling.

3.3 FIELD QUALITY CONTROL

A. Inspections: Provide inspection of installed Work through AWI's Quality Certification Program certifying that woodwork, including installation, complies with requirements of the Architectural Woodwork Standards for the specified grade.

1. Inspection entity is to prepare and submit report of inspection.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean cabinets on exposed and semiexposed surfaces.

D. Clean installed fabric upholstery using manufacturer-approved methods and cleaning agents.

E. Protect upholstered surfaces from damage during construction activities.

END OF SECTION 064116

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Urethane joint sealants.
   2. Mildew-resistant joint sealants.
   3. Butyl joint sealants.

B. Related Requirements:
   1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Joint sealants.
   2. Joint-sealant backing materials.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

   1. Joint-sealant application, joint location, and designation.
   2. Joint-sealant manufacturer and product name.
   3. Joint-sealant formulation.
   4. Joint-sealant color.

E. Sustainable Design Submittals:

   1. Product Data: For sealants, indicating VOC content.
   2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

E. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

1.7 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (5 deg C).
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

C. VOC Content: Verify sealants and sealant primers comply with the following:
1. Architectural sealants have a VOC content of 250 g/L or less.
2. Sealants and sealant primers for nonporous substrates have a VOC content of 250 g/L or less.
3. Sealants and sealant primers for porous substrates have a VOC content of 775 g/L
or less.
4. Verify sealant complies with the testing and product requirements of the California
Department of Public Health's "Standard Method for the Testing and Evaluation of
Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 URETHANE JOINT SEALANTS

A. Urethane, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Bostik; Arkema.
b. Pecora Corporation.
c. Sherwin-Williams Company (The).
d. Sika Corporation - Building Components.

e. Tremco Incorporated.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. Pecora Corporation.
c. The Dow Chemical Company.
d. Tremco Incorporated.

2.5 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Bostik; Arkema.
b. Everkem Diversified Products, Inc.
c. GSSI Sealants.
d. Pecora Corporation.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Adfast.
b. Alcot Plastics Ltd.
c. Construction Foam Products; a division of Nomaco, Inc.
d. Master Builders Solutions, brand of MBCC Group, a Sika company.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

a. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

a. Metal.
b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.
4. Provide recessed joint configuration of recess depth and at locations indicated on Drawings in accordance with Figure 8C in ASTM C1193.

a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Prepare test and inspection reports.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079200

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical joint sealants.

B. Related Requirements:

1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants, showing full range of available colors for each product exposed to view.

C. Samples for Verification: For each type and color of acoustical joint sealant required.

1. Size: 1/2-inch- (13-mm-) wide sealant joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Acoustical Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

E. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each type of acoustical joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

B. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained between 40 and 95 deg F (4 and 35 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 35 and 100 deg F (2 and 38 deg C).

1.7 WARRANTY

A. Installer's Special Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Manufacturer's Special Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACOUSTICAL JOINT SEALANTS

A. Acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies in accordance with ASTM E90.

1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and

Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. DAP Products Inc.
b. Everkem Diversified Products, Inc.
c. Franklin International.
d. Hilti, Inc.
e. Pecora Corporation.
f. Specified Technologies Inc.

2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.2 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by acoustical joint-sealant manufacturer where required for adhesion of sealant to joint substrates.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where recommended by acoustical joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.

B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written instructions for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.

C. Use acoustical sealant to form an airtight seal at all penetrations and perimeter of sound-rated partitions, floors and ceilings. Comply with Section 09 21 16, Gypsum Board and ASTM C919. Use backer-rod where gaps to be sealed exceed 3/8-inch.

D. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

E. Use sheet caulking to seal the back and sides of all junction boxes (4 gang or smaller) recessed in sound-rated partitions.

F. Apply expanding foam sealant where detailed and where multiple pipes or conduits penetrate sound-rated construction.

3.4 Apply acoustical sealant as a continuous bead along gypsum board face layer at all head and sill conditions of sound-rated partitions and around the perimeter of resilient ceiling

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

SECTION 079513.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor expansion joint covers.
2. Wall expansion joint covers.
3. Ceiling expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Floor expansion joint covers.
2. Wall expansion joint covers.
3. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Samples: For each expansion joint cover assembly and for each color and texture specified, full width by 6 inches (150 mm) long in size.

D. Samples for Initial Selection: For each type of exposed finish.

1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric-seal material.

E. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.
7. Fire-resistance ratings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Expansion joint cover assemblies to withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Fire-Resistance Ratings: Provide expansion joint cover assemblies with fire barriers identical to those of systems tested for fire resistance according to UL 2079 or ASTM E1966 by a qualified testing agency.

1. Hose Stream Test: Wall-to-wall and wall-to-ceiling assemblies to be subjected to hose stream testing.

2.3 FLOOR EXPANSION JOINT COVERS

A. Elastomeric-Seal Floor Joint Cover (FJ1): Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis of design (or similar product): inpro 106 Series Carpet Expansion Joint System.
2. Application: Floor to floor.
3. Installation: Surface mounted.
4. Load Capacity:

    a. Uniform Load: 50 lb/sq. ft. (244 kg/sq. m).
    b. Concentrated Load: 300 lb (136 kg).
    c. Maximum Deflection: 0.0625 inch (1.6 mm).

5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Cover-Plate Design: Plain.
7. Exposed Metal:

    a. Aluminum: Mill.

8. Seal: Preformed santoprene membranes or extrusions.

B. Color: As selected by Architect from manufacturer's full range

2.4 WALL EXPANSION JOINT COVERS

A. Elastomeric-Seal Wall Joint Cover (WJ1): Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis of design (or similar product): inpro 101 recessed expansion joint mount for 5/8" finishes.
2. Application: Wall to wall.
3. Exposed Metal:

    a. Aluminum: Mill.

4. Seal: Preformed elastomeric membranes or extrusions.

    a. Color: As selected by Architect from manufacturer's full range.

B. Acoustic Partition Closure (WJ2): Mass-loaded foam core coated with silicone.

1. Basis of design (or similar product): Emseal QuietJoint SHH.
2. Application: Wall to wall.

3. Seal: Factory applied high-grade silicone.

    a. Color: As selected by Architect from manufacturer's full range.
4. Depth: Standard 2"
5. Fire Resistance Rating: Smoke and Flame Spread Class A, ASTM E-84-12)
6. Sound Transmission Class (STC): 72 (both sides of wall).

2.5 CEILING EXPANSION JOINT COVERS

A. Elastomeric-Seal Ceiling Joint Cover (CJ1): Assembly consisting of elastomeric seal anchored to frames fixed to sides of joint gap.

1. Basis of design (or similar product):
    a. at ATC: inpro 116 Series ATC Ceiling System

2. Application: Ceiling to ceiling.
3.
4. Exposed Metal:

    a. Aluminum: Mill.

5. Seal: Preformed elastomeric membranes or extrusions.

    a. Color: White.

B. Acoustic Partition Closure (CJ2): Mass-loaded foam core coated with silicone.

1. Basis of design (or similar product): Emseal QuietJoint SHH.
2. Application: Wall to wall.

3. Seal: Factory applied high-grade silicone.

a. Color: As selected by Architect from manufacturer's full range.

4. Depth: Standard 2"
5. Fire Resistance Rating: Smoke and Flame Spread Class A, ASTM E-84-12)
6. Sound Transmission Class (STC): 53

2.6 MATERIALS

A. Aluminum: ASTM B221 (ASTM B221M), Alloy 6063-T5 for extrusions; ASTM B209 (ASTM B209M), Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

C. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to comply with performance criteria for required fire-resistance rating.

2.7 ACCESSORIES

A. Manufacturer's standard attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.

    a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches (75 mm) from each end and not more than 24 inches (600 mm) o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Mass-loaded foam: Install in framing to comply with manufacturer’s written instructions. Install with minimum number of end joints.
1. Install material so as to ensure a uniform, flat, plane.
2. Material is to remain free of any metal components, i.e. fasteners, screws, bolts, extrusions, etc.

E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 079513.13

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Interior standard steel doors and frames.

B. Related Requirements:
1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, and finishes.

B. Sustainable Design Submittals:
1. Environmental Product Declaration: For each product.

C. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.

5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

D. Samples for Initial Selection: For hollow-metal doors and frames with factory-applied color finishes.

E. Samples for Verification:

1. Finishes: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).

F. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Egress Door Inspector Qualifications: Inspector for field quality control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Airtec Corporation.
2. Custom Metal Products.
3. DCI Hollow Metal on Demand.
4. Rocky Mountain Metals, Inc.
5. Steelcraft; Allegion plc.
6. Stiles Custom Metal, Inc.
7. West Central Manufacturing, Inc.

2.2 INTERIOR STANDARD STEEL DOORS AND FRAMES, AND HOLLOW METAL WINDOWS

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. At locations indicated in the Door and Frame Schedule.

1. Doors:

   a. Type: As indicated in the Door and Frame Schedule.
   b. Thickness: 1-3/4 inches (44.5 mm).
   c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch (1.0 mm).
   d. Edge Construction: Model 2, Seamless.
   e. Core: Manufacturer's standard.

2. Frames:

   a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).
   b. Frames: Fabricated from same thickness material as adjacent door frame.
   c. Construction: Full profile welded.

3. Exposed Finish: Prime.

2.3 BORROWED LITES

A. Fabricate of metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm).

B. Construction: Full profile welded.

C. Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as metal as frames.

D. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches (610 mm) of frame height above 7 feet (2.1 m).
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

E. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

F. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

G. Glazing: Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding, or by rigid mechanical anchors.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with hairline joints.

1. Provide stops and moldings flush with face of door, and with stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 NAAMM-HMMA 840.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.

D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

D. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-core flush wood doors and transom panels with plastic-laminate-faces.

B. Related Requirements:
   1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:

   1. Door core materials and construction.
   2. Door edge construction
   3. Door face type and characteristics.
   4. Door trim for openings.
   5. Door frame construction.
   6. Factory-machining criteria.
   7. Factory- finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:
   1. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
   2. Details of frame for each frame type, including dimensions and profile.
   3. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   4. Dimensions and locations of blocking for hardware attachment.
   5. Dimensions and locations of mortises and holes for hardware.
   6. Clearances and undercuts.
   7. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

   1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish.
   2. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons, and wrap bundles of doors in plastic sheeting.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.5 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and HVAC system is operating and maintaining temperature and relative humidity at levels designed for building occupants for the remainder of construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors and frames that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of laminate.
b. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
c. Telegraphing of core construction in face laminate exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors and frames.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards."

2.3 SOLID-CORE FLUSH WOOD DOORS AND TRANSOM PANELS WITH PLASTIC-LAMINATE FACES

A. Interior Doors, Solid Core with Plastic-Laminate Faces:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Haley Bros, Inc.
    b. Oshkosh Door Company
    c. Lynden Door, Inc.
    d. Oregon Door

2. Performance Grade: ANSI/WDMA I.S. 1A Standard Duty.
3. ANSI/WDMA I.S. 1A Quality Grade: Premium.
4. Architectural Woodwork Standards Quality Grade: Premium.
5. Plastic-Laminate Faces: High-pressure decorative laminates complying with ISO 4586-3, Grade HGS.
6. Colors, Patterns, and Finishes: Formica, Aged Ash 8844.
7. Exposed Vertical and Top Edges: Plastic laminate that matches faces, applied before faces.
8. Core for Non-Fire-Rated Doors:
    a. ANSI A208.1, Grade LD-2 particleboard.
        1) Blocking: Provide wood blocking in particleboard-core doors as follows:
            a) 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
            b) 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
            c) 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
    b. WDMA I.S. 10 structural composite lumber.
        1) Screw Withdrawal, Door Face: 475 lbf (2110 N).
        2) Screw Withdrawal, Vertical Door Edge: 475 lbf (2110 N).
    c. Either glued wood stave or WDMA I.S. 10 structural composite lumber.
9. Construction:
    a. Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before faces and crossbands are applied.

2.4 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Species compatible with door faces.
2. Profile: Manufacturer's standard shape.

2.5 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
3. Louvers: Factory install louvers in prepared openings.

EXECUTION

2.6 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.7 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Install doors and frames to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches (3.2 mm in 2400 mm).
2. Anchor frames to anchors or blocking built in or directly attached to substrates.

    a. Secure with countersunk, concealed fasteners and blind nailing.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.

    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.

2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:

    a. Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.

5. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

2.8 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

2.9 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames.
2. Fire-rated access doors and frames.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.

C. Product Schedule: For access doors and frames. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing and inspecting agency.

1.4 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

PART 2 - PRODUCTS

2.1 ACCESS DOORS AND FRAMES

A. Interior Flush GFRG Access Doors with exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ACUDOR Products, Inc.
b. Babcock-Davis.
c. Cendrex Inc.

d. Elmdor; Morris Group International, Inc.
e. J. L. Industries, Inc.; Activar Construction Products Group, Inc.

2. Description: Description: Face of door flush with frame, with exposed flange and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: Wall 18”x18”, ceiling 2’x2’.
5. Door Type Concealed-hinge, square corner.
6. Door and Frame Material: Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage, factory primed. Paint on site to match gyp wall and ceiling, color in bathrooms to match selected tile.
7. Latch and Lock: Cam latch, screwdriver operated.
8. Above access panel fiberglass sound barrier (at video production only): STC 29.

2.2 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.

B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

C. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

D. Frame Anchors: Same material as door face.

E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.3 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

2.4 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

SECTION 083473.16 - WOOD SOUND CONTROL DOOR ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Side-hinged, wood sound control door assemblies.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include information indicating compliance with assembly performance requirements, construction details, material descriptions, and finishes.

B. Shop Drawings:

1. Elevations of each type and style of door; details of doors, frames, anchorages, wall-opening conditions, sound control seals, door bottoms, and thresholds; and locations of reinforcements and preparations for hardware.

C. Samples for Verification: For each type of exposed finish not less than 3 by 5 inches (76 by 127 mm).

1. Doors and Frames: Samples approximately 12 by 12 inches (305 by 305 mm).

a. Doors: Include section of vertical-edge, top, and bottom construction; automatic door bottom or gasket; core construction; glazing; and hinge and other applied hardware reinforcement.
b. Frames: Include profile, corner joint, anchors, and seals.

D. Product Schedule: For wood sound control door assemblies. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each sound control door assembly, for tests performed by a qualified testing agency.

B. Field Quality-Control Reports: For sound control door assemblies.

C. Qualification Statements: For manufacturer Installer and field testing and inspecting agency.

D. Sample Warranties: For sound control door assemblies.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sound control door assemblies.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating sound control door assemblies that meet or exceed assembly performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

C. Acoustical Testing Agency Qualifications: An independent agency accredited as an acoustical laboratory in accordance with NIST's National Voluntary Laboratory Accreditation Program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage.

1. Welded Frames: Deliver with two temporary shipping spreader bars each, tack welded across bottom of frames.

B. Upon delivery, remove cardboard and wrappings from doors and frames to promote air circulation.

C. Do not use nonvented plastic or canvas to cover doors and frames to prevent entrapping moisture.

D. Store doors and frames vertically under cover at Project site, spaced with blocking that provides a minimum 1/4-inch (6-mm) space between each stacked unit to permit air circulation between components.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install sound control door assemblies until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of sound control door assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Failure of product materials and workmanship.
    b. Failures of assemblies to have NIC ratings within 5 dB of laboratory STC ratings specified when tested in accordance with ASTM E336, with results calculated in accordance with ASTM E413.
    c. Faulty operation of sound seals.
    d. Deterioration of wood doors, hollow-metal frames, finishes, and other materials beyond normal use or weathering.
    e. Wood doors that are warped (bow, cup, or twist) more than 1/4 inch (6 mm) in a 42-by-84-inch (1068-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76-mm) span.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain sound control door assemblies from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Acoustic Performance: Provide sound control door assemblies with minimum STC ratings indicated on Drawings for the entire assembly, calculated in accordance with ASTM E413 when tested in an operable condition in accordance with ASTM E90.

2.3 SIDE-HINGED, WOOD SOUND CONTROL DOOR ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    1. AMBICO Limited.
    2. Krieger Specialty Products Company.
    3. Overly Door Company.

B. Assemblies: Complete with wood doors, hollow-metal frame, sound seals, and specified hardware and accessories.

C. Wood Doors: Flush design, complying with requirements in WDMA I.S. 1A.

    1. Thickness: 1-3/4 inches (44 mm).
    2. Core: Manufacturer's standard sound control core as required to comply with assembly performance requirements.
    3. WDMA I.S. 1A Performance Grade: Heavy Duty.

4. WDMA I.S. 1A Quality Grade: Premium.
5. Stiles and Rails: Hardwood.

6. High-Pressure Decorative Laminate Faces: ISO 4586-3 in color and pattern: Formica, Aged Ash 8844. .

    a. Vertical Edges: Match door faces.
    b. Top and Bottom Edges: Factory sealed.

7. Glazing Stops: Metallic-coated steel sheet, formed blade stops with mitred corners; prepared for countersunkflat- or oval-head machine screws.

D. Hollow-Metal Frames: NAAMM-HMMA 820, continuously welded frames with corners mitered and reinforced.
    1. Interior Frames: Provide back bend, gypsum board returns.
        a. Metallic-Coated Steel Sheet: In thickness required to support door and comply with assembly performance requirements but not less than 0.079-inch (2.01-mm) nominal thickness.

    2. Hardware Reinforcement: Comply with requirements in BHMA A156.115 for preparing frames for hardware.
    3. Materials:
        a. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B metallic coated by the hot-dip process.

    4. Prime Finish: Apply manufacturer's standard rust-inhibitive primer immediately after cleaning and pretreating metal.

        a. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with requirements in SDI A250.10 for acceptance criteria; recommended in writing by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls in accordance with ASTM A153/A153M, Class B.

    1. Jamb Anchors: Anchors of minimum size and type required by wall construction and assembly performance requirements.

        a. Postinstalled Expansion Anchors: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

    2. Floor Anchors: Metallic-coated steel in thickness matching frame but not less than 0.079-inch (2.01-mm) nominal-thickness.

    3. Ceiling Struts: Not less than 3/8-inch-thick by 2-inch- (9.5-mm-thick by 51-mm-) wide uncoated steel unless otherwise indicated on Drawings.

F. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers.

2.4 HARDWARE

A. Sound Control Door Hardware: Manufacturer's standard sound control system required to comply with assembly performance requirements.

1. Head and Jamb Seals: Provide one of the following:

    a. Neoprene Compression Seals: One-piece units consisting of closed-cell sponge neoprene seal held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.
    b. Silicone Compression Seals: One-piece units consisting of silicone compression bulb and stabilizer flange; attached to door frame adhesively.
    c. Magnetic Seals: One-piece units consisting of closed-cell sponge neoprene seal and resiliently mounted magnet held in place by metal retainer, with retainer cover of same material as door frame; attached to door frame with concealed screws.

2. Automatic Door Bottoms: Neoprene or silicone gasket, held in place by metal housing, that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

    a. Mounting: Mortised or semimortised into bottom of door as required to comply with assembly performance requirements.
3. Cam-Lift Hinges: Manufacturer's standard full-mortise type as required to support weight of door.
4. Thresholds: Flat, smooth, unfluted type recommended in writing by manufacturer; fabricated from aluminum.

    a. Finish: Clear anodic finish.

B. Other Hardware: Comply with requirements in Section 087100 "Door Hardware."

2.5 SOUND CONTROL ACCESSORIES

A. Glass and Glazing: Manufacturer's glazing system complying with assembly performance requirements. Comply with requirements in Section 088000 "Glazing."

2.6 FABRICATION

A. Wood Doors: Factory fit doors to frames with uniform clearances and bevels in accordance with WDMA I.S. 1A unless otherwise indicated. Comply with final door hardware schedules and hardware templates.

1. Glazed Lites: Factory install glazed lites in accordance with requirements of tested assembly and to comply with assembly performance requirements.
2. Locate door hardware as indicated on Drawings.

a. Coordinate measurements of hardware mortises in hollow-metal frames to verify dimensions and alignment before factory machining.

B. Hollow-Metal Frames: Fabricate to tolerances indicated in NAAMM-HMMA 865 and to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal.

1. Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners or provide plug buttons to conceal fasteners.
3. Floor Anchors: Weld anchors to bottom of jambs and fixed mullions with at least four spot welds per anchor.

4. Stud-Wall Jamb Anchors: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and provide minimum quantity as follows:
   a. Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Hollow-Metal Frames: Remove temporary shipping spreader bars installed at factory. Restore exposed finishes by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

3.3 INSTALLATION OF SIDE-HINGED, WOOD SOUND CONTROL DOOR ASSEMBLIES

A. General: Install sound control door assemblies plumb, rigid, properly aligned, and securely fastened in place; comply with manufacturer's written instructions.

B. Hollow-Metal Frames: Set accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. Check squareness, twist, and plumbness of frames as walls are constructed. Shim as necessary to comply with installation tolerances. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

1. Frames Fabricated in Sections: Field splice by welding face joint continuously; grind, fill, and dress; make splice smooth, flush, and invisible on exposed faces.
2. Floor Anchors: Secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Fully fill frames with mineral-fiber insulation.
4. In-Place Gypsum Board Partitions: Secure jambs with countersunk anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above unless frame is anchored to structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.

C. Wood Doors: Fit doors accurately in frames in accordance with manufacturer's written instructions and to comply with assembly performance requirements.

D. Sound Control Seals: Where seals have been factory prefit and preinstalled and subsequently removed for shipping, reinstall seals and adjust in accordance with manufacturer's written instructions.

E. Cam-Lift Hinges: Install in accordance with manufacturer's written instructions.

F. Thresholds: Set thresholds in full bed of sealant complying with requirements in Section 079200 "Joint Sealants."

G. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with manufacturer's written instructions.

1. Secure stops withcountersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (229 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

H. Installation Tolerances:

1. Opening Width: Plus 1/16 inch (1.6 mm) or minus 1/32 inch (0.8 mm), measured from rabbet to rabbet at top, middle, and bottom of frame.
2. Opening Height: Plus 1/16 inch (1.6 mm) or minus 1/32 inch (0.8 mm), measured from head rabbet to top of floor or bottom of frame minus jamb extensions at each jamb and across head.
3. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
4. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
5. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines and perpendicular to plane of wall.
6. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Acoustical Testing: To verify assemblies comply with acoustical performance requirements.

1. Testing Extent: One sound control door assembly chosen at random.
2. Testing Method: ASTM E336, with NIC rating calculated in accordance with ASTM E413.
3. Acceptable Results: NIC rating within 5 dB of laboratory STC rating.

C. Repair or remove and replace installations where testing and inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Inspection Report: Prepared and submitted in writing to Architect and Contractor within 24 hours after testing.

3.5 ADJUSTING AND CLEANING

A. Hollow-Metal Frames:
1. Metallic-Coated Surface Touchup: Immediately after installation, clean abraded areas of doors and frames and repair with galvanizing repair paint in accordance with manufacturer's written instructions.
2. Prime-Coat Touchup: Immediately after installation, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible, rust-inhibitive, air-drying primer.

B. Wood Doors: Immediately after installation, repair damaged areas of factory-applied finishes and touchup in accordance with manufacturer's written instructions.

C. Remove and replace defective work, including defective or damaged sound seals and doors and frames that are warped, bowed, or otherwise defective.

1. Adjust seals to provide contact required to comply with assembly performance requirements.

D. Check and adjust seals, door bottoms, and other hardware items immediately before final inspection.

END OF SECTION 083473.16

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed storefront systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
4. Environmental Product Declaration: For each product.
5. Environmental Product Declaration: For each product.

C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
1. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.
2. Include point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch (300-mm) lengths of full-size components and showing details of the following:

1. Joinery, including concealed welds.
2. Anchorage.
3. Expansion provisions.
4. Glazing.
5. Flashing and drainage.

G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

H. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Certificates:

1. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.

a. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.

B. Test and Evaluation Reports:

1. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by qualified testing agency.

C. Source Quality-Control Submittals:

1. Source quality-control reports.

D. Field Quality-Control Submittals:

1. Field quality-control reports.

E. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.

F. Qualification Statements:
1. For egress door inspector.

a. Submit documentation of compliance with NFPA 101, Section 7.2.1.15.4.
b. Submit copy of DHI's Fire and Egress Door Assembly Inspector (FDAI) certificate.

G. Delegated design engineer qualifications.

H. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrances and storefronts.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Installers: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors.
2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.
3. Egress Door Inspector: Inspector for field quality-control inspections of egress door assemblies shall comply with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

a. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 10 years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design aluminum-framed entrances and storefronts.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches (4.1 m) and to 1/240 of clear span plus 1/4 inch (6.35 mm) for spans greater than 13 feet 6 inches (4.1 m).
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch (3.2 mm).

a. Operable Units: Provide a minimum 1/16-inch (1.6-mm) clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

D. Seismic Performance: Aluminum-framed entrances and storefronts shall withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.

E. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 26.

F. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.3 STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   1. BASIS OF DESIGN: US Aluminum; Series 450SF Center Glazed Storefront or comparable product.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Glazing System: Retained mechanically with gaskets on four sides.
   2. Glazing Plane: Match storefront that has been installed.
   3. Finish: High-performance organic finishFabrication Method: Field-fabricated stick system.
   4. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   5. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

2.4 ENTRANCE DOOR SYSTEMS (D3)

A. BASIS OF DESIGN: US Aluminum; Series 250 Narrow Stile Door or comparable product.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

   1. Door Construction: 1-3/4-inch (44.5-mm) overall thickness, with minimum 0.125-inch- (3.2-mm-) thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

   2. Door Design: As indicated.
   3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

   4. Finish: Match adjacent storefront framing finish.

2.5 ALL GLASS ENTRANCE DOOR SYSTEMS (D4)

A. BASIS OF DESIGN: CRL Blumcraft 150 Entrance Door Panic or comparable product.

B. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-5/16 -inch (44.5-mm) overall thickness, with ½" Monolithic Glass.

2. Door Design: As indicated.

3. Finish: Powder Coated - Match adjacent storefront framing finish.

2.6 ENTRANCE DOOR HARDWARE

A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 087100 "Door Hardware."

B. General: Entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of fittings.

C. Concealed Floor Closers and Top Pivots: Center hung; ANSI/BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.

1. Swing: Single acting.

a. Positive Dead Stop: Coordinated with hold-open angle if any, or at angle selected.

2. Opening-Force Requirements:

a. Egress Doors: Not more than 15 lbf (67 N) to release the latch and not more than 30 lbf (133 N) to set the door in motion and not more than 15 lbf (67 N) to open the door to its minimum required width.

D. Concealed Overhead Holder: ANSI/BHMA A156.8, Grade 1, with dead-stop setting coordinated with concealed floor closer.

E. F. Cylinders: As specified in Section 087100 "Door Hardware."

F. Exit Devices: UL 305. As specified in Section 087100 "Door Hardware."

H. Threshold: Not more than 1/2 inch (12 mm) high.

2.7 GLAZING

A. Glazing: Comply with Section 088000 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

1. Verify sealant has a VOC content of 250 g/L or less.

2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

D. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed storefront manufacturers for this use.

1. Color: Match structural sealant.

2.8 MATERIALS

A. Sheet and Plate: ASTM B209 (ASTM B209M).

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221 (ASTM B221M).

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

F. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

G. Regional Materials: Manufacture products within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If transporting materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.

2.9 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch (25.4 mm) that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil (0.762-mm) thickness per coat.

E. Rigid PVC filler.

2.10 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from interior for vision glass.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior doors, provide compression weather stripping at fixed stops.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.11 ALUMINUM FINISHES

A. High-Performance Organic Finish, Two-Coat PVDF: Fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in color coat.

1. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Color and Gloss: White. Selected by architect from Manufacturer’s range.

2.12 SOURCE QUALITY CONTROL

A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 079200 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF OPERABLE UNITS

A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

3.4 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 088000 "Glazing."

3.5 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

D. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer and framing manufacturer's written instructions and in compliance with local codes.

E. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

F. Allow structural sealant to cure in accordance with manufacturer's written instructions.

G. Clean and protect glass as indicated in Section 088000 "Glazing."

3.6 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.7 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

A. Install entrance doors to produce smooth operation and tight fit at contact points.
   1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.8 ERECTION TOLERANCES

A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:

   1. Plumb: 1/8 inch in 10 feet (3.2 mm in 3 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   2. Level: 1/8 inch in 20 feet (3.2 mm in 6 m); 1/4 inch in 40 feet (6.35 mm in 12.2 m).
   3. Alignment:

      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch (12.7 mm) wide, limit offset from true alignment to 1/16 inch (1.6 mm).
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch (12.7 to 25.4 mm) wide, limit offset from true alignment to 1/8 inch (3.2 mm).
      c. Where surfaces are separated by reveal or protruding element of 1 inch (25.4 mm) wide or more, limit offset from true alignment to 1/4 inch (6 mm).

   4. Location: Limit variation from plane to 1/8 inch in 12 feet (3.2 mm in 3.6 m); 1/2 inch (12.7 mm) over total length.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections: Perform the following tests on representative areas of aluminum-framed entrances and storefronts.

   1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

   2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. (0.45 L/s per sq. m) at a static-air-pressure differential of 1.57 lbf/sq. ft. (75 Pa).

   3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft. (300 Pa), and shall not evidence water penetration.

4. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, each aluminum-framed entrance door located in an exit enclosure, each electrically controlled aluminum-framed egress door, and each aluminum-framed entrance door equipped with special locking arrangements, in accordance with NFPA 101, Section 7.2.1.15.

C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 MAINTENANCE SERVICE

A. Entrance Door Hardware Maintenance:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 084113

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.
b. Fire-rated swinging doors.
c. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames"
2. Division 08 Section "Aluminum-Framed Entrances and Storefronts"
3. Division 08 Section "Flush Wood Doors"
4. Division 08 Section "Access Doors and Frames"
5. Division 08 Section "Overhead Coiling Doors"
6. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
7. Division 28 Section "Access Control" for access control devices installed at door openings and provided as part of a security access system.
8. Division 28 Section "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion detection system.
9. Division 28 Section "Fire Detection and Alarm" for connections to building fire alarm system.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. Thresholds, weather stripping, and cylinders for locks specified in other Sections.

1.3 REFERENCED STANDARDS

A. Provide hardware in accordance with the following standards in addition to those specified in Division 01 Section “References”.

1. American National Standards Institute (ANSI), A117.1: Accessible and Usable Buildings and Facilities, edition as adopted by local Authority Having Jurisdiction (AHJ).

2. Builders Hardware Manufacturer’s Association (BHMA)

    a. ANSI/BHMA A156.2: Bored and Preassembled Locks and Latches, 2011 edition
    b. ANSI/BHMA A156.3: Exit Devices, 2008 edition
    c. ANSI/BHMA A156.4: Door Controls - Closers, 2008 edition
    d. ANSI/BHMA A156.18: Materials and Finishes, 2006 edition
    e. ANSI/BHMA A156.19: Power Assist and Low Energy Power Operated Doors, 2007 edition

3. Door and Hardware Institute (DHI)

    a. Recommended Locations for Architectural Hardware for Flush Wood Doors, 1993 edition
    b. Recommended Locations for Architectural Hardware for Standard Steel Doors and
    Frames, 2004 edition
    c. Installation Guide for Doors and Hardware, 1994 edition
    d. Keying Systems and Nomenclature, 2003 edition
    e. Sequence and Format for the Hardware Schedule, 2001 edition

4. National Fire Protection Association (NFPA)

    a. NFPA 70: National Electrical Code, edition as adopted by local AHJ.
    b. NFPA 80: Standard for Fire Doors and Other Opening Protectives, edition as adopted by local AHJ.
    c. NFPA 252: Standard Methods of Fire Tests of Door Assemblies, edition as adopted by local AHJ.

1.4 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Power, signal, and control wiring. Include the following:

    a. System schematic.
    b. Point-to-point wiring diagram.
    c. Riser diagram.
    d. Elevation of each door.

2. Detail interface between electrified door hardware and fire alarm, access control, security, building control system.
3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets, if requested.

1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

D. Qualification Data: For Installer

E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, and closers as requested.

F. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

G. Warranty: Special warranty specified in this Section.

H. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
2. Content: Include the following information:

    a. Identification number, location, hand, fire rating, and material of each door and frame.
    b. Type, style, function, size, quantity, and finish of each door hardware item.

c. Complete designations of every item required for each door or opening including name and manufacturer.
d. Fastenings and other pertinent information.
e. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
f. Explanation of abbreviations, symbols, and codes contained in schedule.
g. Mounting locations for door hardware.
h. Door and frame sizes and materials.
i. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
    1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

j. List of related door devices specified in other Sections for each door and frame.

3. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

I. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.5 QUALITY ASSURANCE

Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252 and UBC Standard 7-2.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's Security Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to Owner's Representative by registered mail or overnight package service.

1.7 COORDINATION

A. Coordinate layout and installation of recessed hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Coordinate with aluminum entrance door supplier for door hardware installation.

D. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three (3) years from date of Substantial Completion, except as follows:

a. Continuous Hinges: Lifetime of Building
b. Grade 1 Cylindrical Locks: Ten (10) years from date of Substantial Completion.
c. Exit Devices: Three (3) years from date of Substantial Completion.

d. Manual Closers: Thirty (30) years from date of Substantial Completion.
e. Automatic Operators: Two (2) years from date of Substantial Completion.
f. Electrified Hardware Items: One (1) year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE

Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Hinges: Hager
2. Locks and Latches: Schlage, Owner’s Standard
3. Cylinders and Cores: **ASSA, By Owner**
4. Exit Devices: Von Duprin, Owner’s Standard
5. Mechanical Door Closers: LCN, Owner’s Standard
6. Accessories and Trim: Ives
7. Saddle and Panic Thresholds: Pemko
8. Weather Strip and Gasket: Pemko
9. Miscellaneous Hardware: Hager

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:

1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.

2.3 MATERIALS AND FABRICATION

A. General

1. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.

    a. Manufacturer's identification will be permitted on rim of lock cylinders only.

2. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
3. Provide hardware manufactured to conform to published templates generally prepared for machine screw installation. Do not provide hardware that has been prepared for selftapping sheet metal screws, except as specifically indicated.

B. Fasteners

1. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish stainless steel (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
2. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Use through bolts only as indicated in this section unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thrubolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.4 HINGES

A. Acceptable Products:

1. Ives: 5BB1 5BB1HW
2. Hager: BB1279 BB1168
3. Stanley: FBB179 FBB168
4. McKinney: TB2714 T4B3386

B. Requirements:

1. Quantity: Provide the following, unless otherwise indicated:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.

2. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
3. Hinge Weight: As indicated in hardware sets.
4. Hinge Base Metal: Unless otherwise indicated, provide the following:

    a. Exterior Hinges: Stainless steel with stainless-steel pin.
    b. Interior Hinges: Steel with steel pin.
    c. Hinges for Fire-Rated Assemblies: Steel with steel pin.

5. Hinge Options: Where indicated in door hardware sets or on Drawings:

    a. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.

    b. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out-swinging doors.
    c. Corners: Square.

6. Fasteners: Comply with the following:

    a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
    b. Wood Screws: For wood doors and frames.
    c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

2.5 ELECTRIC STRIKES

A. Acceptable Products:

1. Von Duprin: 6200 Series 6000 Series
2. HES: 9000 Series 1006 Series

B. Requirements:

1. Provide electric strikes that are continuous duty rated without the use of external rectifiers.
2. Provide electric strikes with function (fail safe, fail secure) and power requirements as scheduled.

2.6 LOCKS AND LATCHES

A. Grade One Mortise Locks:

1. Acceptable Products:

a. Schlage: L Series Mortise
b. Owner's Standard

2. Requirements:

a. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1 Operational, Grade 1 Security, and manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance. Provide lock case that is multi-function and field reversible for handing without opening case.

1) Occupied Indicator: Provide indicator above cylinder for visibility while operating the lock that identifies the trim as occupied/unoccupied status of the door. Indicator in unoccupied state has a white background with black text and icon. Indicator in the occupied state has a red background with white text and icon.

b. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1 inch (25 mm) throw, constructed of stainless steel.

c. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

2. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.

a. Deadbolt: Shall be constructed of stainless steel and include security roller pins. Shall have a minimum 1 inch throw.
b. Spring Cages: Lock shall have individual external spring cages for each lever.
c. Lever Spindles: Provide lockset with independent, breakaway type lever spindles. Spindles that are continuous through the lock case are not acceptable.
d. Hub Blocking: Provide lockset with a hub blocking plate to resist unauthorized entry.
e. Vandal Resistant Lever: Where scheduled, provide lockset with lever that freely rotates even when locked to resist vandalism and abuse.
f. Thumbturns: Provide thumbturns as enlarged, ADA designated style thumbturns.
g. Visual Indicator: Where scheduled, provide visual indicator showing "Vacant" or "Occupied".

B. Grade 1 Bored Locks

1. Acceptable Product:

a. Schlage: ND Series Rhodes Lever
b. Owner's Standard

2. Provide cylindrical locks exceeding the ANSI/BHMA A156.2 Grade 1 performance standards for strength, security & durability in the categories below:

a. Abusive locked lever torque – minimum 3,100 inch-pounds without gaining access
b. Offset lever pull - minimum 1,600 foot pounds without gaining access Simulates pry-bar attacks
c. Vertical lever impact - minimum 100 impacts without gaining access Simulates sledgehammer-blows to trim, very aggressive abuse
d. Cycle life - minimum 16 million cycles Cycle life speaks to robustness of lock, ensuring operation after 10M cycles (BHMA requirement is 1M).
   1) With no visible lever sag Working after 15M cycles is not the same as working well. No droop and wobble means the lock still works like new after the test.
   2) Without the use of performance aids (i.e. set screws, spacers, etc.) Set screws and spacers are a poor fix for droop and wobble. Both add to installation complexity, and set screws can be tamper targets.
e. Door Prep: Provide lockset to install using a standard ANSI 161 door preparation.
f. Anti-Rotation Plate: Provide lockset with a mechanically interlocked anti-rotation plate. Anti-Rotation teeth or "bite tabs" are not acceptable. Locks without any rotation prevention devices are not acceptable.

g. Lever Return Springs: Provide each lever with two compression type return springs that are easily accessible without dismantling the lock chassis. Locks utilizing tension or torsion lever return springs are unacceptable. Locks with internal springs that require dismantling the lock chassis are unacceptable.
h. Lever Spindles: Provide lock with either milled or 1-piece deep drawn spindles. 2piece interlocking stamped spindles are not acceptable.
i. Multi-Functionality: Provide modular lockset with capability to convert to a new lock function by changing key cams.
j. Vandal Resistant Lever: Where scheduled, provide lockset with lever that freely rotates even when locked to resist vandalism and abuse.

2.7 EXIT DEVICES

A. Acceptable Products:

1. Von Duprin: 98/35A Series

B. Requirements:

1. ANSI Grade: BHMA/ANSI A156.3, Grade 1.
2. Device Construction:

a. Exit device(s) shall have a mechanism case constructed of extruded aluminum or wrought stainless steel, base plates constructed of cold rolled or cast steel, push pad of extruded aluminum with stainless steel covering or wrought stainless steel, and end caps with flush mounted, sloped design. At full-glass doors, provide exit devices with no exposed fasteners or rivets visible through glass. Where required by stile width, provide narrow-stile type device.
b. Latchbolt: Provide Pullman-type deadlocking latch bolts constructed of stainless steel. Where specified provide high security Pullman-type latchbolt that collapses to be square faced under high pull forces. Latch return springs shall be compression type. Tension and Torsion latch return springs are not acceptable.
c. Dogging Mechanism: where dogging or latch-retraction options are not specifically scheduled for non-fire rated doors, provide device with a hex-key activated hook-type dogging mechanism constructed of steel.
d. Plastic or nylon used for the push pad, or parts in the dogging mechanism or latchbolt mechanism are unacceptable.
e. Sound Dampening: Device shall be provided with factory-installed sound dampening materials.
f. Provide device type, function, and trim style as indicated in hardware schedules.

3. Where exit device(s) are provided for fire rated door, provide with fire listing and label indicating “Fire Exit Hardware”. If device is mounted on wood doors, provide sex nuts and bolts.
4. Provide shim kits, filler plates, and other accessories as required for each opening.
5. Unless otherwise indicated in the sets, provide device with roller-type strike.
6. Where scheduled, provide removable mullions by same manufacturer as provided exit devices. Provide mullion stabilizers, key removable option, strike preps, and fire rating as indicated in sets.

2.8 MECHANICAL DOOR CLOSERS

A. General:

1. Valves: Closers shall have separate valves for latch speed, main speed, and back check.
   Valves shall be staked to prevent accidental removal.

2. Provide the appropriate closer body, handing, and brackets to mount closer inside the building on the least-public side of the door.

   a. Where closers are to be mounted parallel arm, provide with heavy duty, fully forged arms.
   b. Where closers are to be mounted regular arm and the opening can otherwise be opened to 180 degrees, provide closer with the appropriate special templating to allow 180 degree door swing. Where a special template is not available for 180 degree swing, provide closer arm with integrated stop.

3. Integrated Stop Closer Arms: Where a closer with integrated stop is required, provide the appropriate closer and arm as follows:

   a. Parallel arm with spring-cushioned stop arm: Provide where door is otherwise able to open to 95 degrees and requires a parallel arm mount closer.
   b. Parallel arm with dead stop arm: Provide where door is obstructed from opening to 95 degrees and requires a parallel arm mount closer.
   c. Regular arm with push side surface-mounted overhead stop: Provide where door closer should mount on pull side of door.

4. Hold Open Arms: Provide closer arms with mechanical hold-opens as scheduled.
5. Provide closers with any special templates, brackets, plates, or other accessories required for interface with header, door, wall, and other hardware. Provide closers with screw packs containing thru-bolts, machine screws, and wood screws.

6. Closers shall be provided with all-weather fluid and shall not require readjustment from 120 degrees F to -30 degrees F. Fluid shall be non-flaming and shall not fuel door or floor covering fires. Upon request, provide data indicating thermal properties of fluid.
7. Closers shall close and latch door when adjusted to meet accessibility requirements for door opening force: 8.5 lbs at exterior doors, 5 lbs at interior doors, and 15 lbs at labeled fire doors.

B. Heavy Duty Door Closers:

1. Acceptable Products:

a. LCN: 4040XP
b. Owner's Standard

2. Requirements:

a. ANSI Grade: BHMA/ANSI A156.4, Grade 1.
b. Closer Construction: Closer shall have cast iron or aluminum alloy body with 11/2 inch steel piston, double heat treated pinion, 5/8 inch bearing journals, and full complement needle or caged ball bearings. Closer shall be adjustable from sizes 1 through 6.
c. Provide closers with spring size adjustment dial for ease of adjusting.
d. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.

2.9 ARCHITECTURAL DOOR TRIM

A. Protection Plates and Edge Guards

1. Acceptable Products:

a. Ives: 8400 Series
b. Rockwood: K1050
c. Don0Jo: 90 Series
d. Trimco: K Series

2. Requirements:

a. Provide .050 inch thick stainless steel protection plates with height as scheduled. Plate shall have four beveled edges and countersunk screws. Provide plate with width as follows:
1) Pairs of Doors: Provide plate to be 1 inch less door width.

2) Single Doors: Provide plate to be 2 inches less door width on push side, pull side mounted plates to be 1 inch less door width.

B. Door Stops and Holders

a. Ives: WS407
b. Rockwood: 405/406
c. Hager: 236W
d. Trimco: 1270

2. Requirements:

a. Provide stops and holders as indicated in the HW sets.
b. Where wall bumpers are scheduled, provide concave rubber bumper where the adjacent lever trim incorporates a push-button. Otherwise, provide convex rubber bumpers.

2.10 MISCELLANEOUS HARDWARE

A. Silencers

1. Acceptable Products:

a. Ives: SR64

2. Requirements:

a. Where indicated on single openings, provide 3 each rubber silencers on lock jamb.
b. Where indicated on paired openings, provide 2 each rubber silencers on header.

2.11 ELECTRONIC ACCESSORIES

A. Power Supplies

1. Acceptable Products:

a. Schlage Electronics: PS900 Series

2. Requirements:

a. Provide power supplies, recommended and approved by the manufacturer of the electrified locking component, for the operation of electrified locks,

electrified exit devices, magnetic locks, electric strikes, and other components requiring a power supply.

b. Provide the appropriate quantity of power supplies necessary for the proper operation of the electrified locking component and/or components as recommended by the manufacturer of the electrified locking components with consideration for each electrified component utilizing the power supply, the location of the power supply, and the approved wiring diagrams. Locate the power supplies as directed by the Architect.

c. Provide a power supply that is regulated and filtered 24 VDC, or as required, and UL class 2 listed.

d. Options: Provide the following options.

1) Provide a power supply, where specified, with the internal capability of charging optional sealed backup batteries 24 VDC, or as required, in addition to operating the DC load.

2) Provide sealed batteries for battery back-up at each power supply where scheduled.

3) Provide a power supply complete requiring only 120VAC to the fused input and shall be supplied in an enclosure.

e. Provide a power supply with emergency release terminals, where required, that allow the release of all devices upon activation of the fire alarm system complete with fire alarm input for initiating “no delay” exiting mode.

B. Electric Power Transfers

1. Acceptable Products:

a. Von Duprin: EPT-10

2. Requirements:

a. Provide edge-mounted electric power transfer with either two 18 gauge wires or ten 24 gauge wires as scheduled.

b. Provide transfer capable of carrying a 16 Amp current for a minimum of .3 seconds..

2.12 FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and locksets (or push-pull units if no latch or locksets).

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

D. The designations used in schedules and elsewhere to indicate hardware finishes are the industryrecognized standard commercial finishes, except as otherwise noted.

1. Brushed Chrome and/or Stainless Steel Appearance

a. Brushed Stainless Steel, no coating: ANSI 630.
b. Satin Chrome, Clear Coated: ANSI 626, ANSI 652.
c. Powder Coated Aluminum finish: ANSI 689.
d. Saddle and Panic Thresholds: Mill Aluminum finish.
e. Weatherstrip and Gasket: Clear Anodized Aluminum finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. Pre-installation conference shall be conducted prior to installation of hardware at Project site. Meet with the, Owner, Contractor, installer, and manufacturer’s representatives. A separate pre-installation conference shall be conducted prior to the installation of electronic security hardware with the electrical contractor Review

catalogs, brochures, templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation, and coordination with other work. Notify participants at least ten, 10 working days before conference.

B. Hardware Installers must have a minimum of five (5) years' experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. All installers to attend review meetings with the hardware distributor.

C. Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

D. Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops/holders. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.

E. Counter sink through bolt of door pull under push plate during installation.

F. Mounting Heights: Mount door hardware units at heights indicated, as follows, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

G. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

H. Furnish wiring diagrams to electrical contractor for use in installing electrical hardware products.

1. Electrical contractor to run all wiring and make all final connections for electrified hardware. Hardware supplier shall be responsible to furnish all wiring diagrams

to operate electrified hardware. Access control material and electrified hardware to interface at junction boxes.

I. Boxed Power Supplies: Locate power supplies as indicated. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.
2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

J. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Architect shall engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

B. Architectural Hardware Consultant shall inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SETS

A. The following schedule of hardware sets shall be considered a guide and the supplier is cautioned to refer to general conditions, special conditions, and the full requirements of this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

B. Where items of hardware are not definitely or correctly specified and are required for completion of the Work, a written statement of such omission, error, conflict, or other discrepancy shall be sent to the Architect, prior to date specified for receipt of bids, for clarification by addendum.

C. Adjustments to the Contract Sum will not be allowed for omissions or items of hardware not clarified prior to bid opening.

HARDWARE GROUP NO. 01

For use on Door #(s):
4S135 4S137 4S139 4S141 4S143 4S147
4S155 4S105 4S120 4S130(NOT INCLUDED IN BID ALT 2)

Provide each SGL door(s) with the following:

3	EA	HINGE	BB1279 4.5 X 4.5	626	HA
1	EA	ENTRY LOCK	L9050P 02N	626	SCH
3	EA	SILENCER	SR64		IVE
1	EA	WALL STOP	236W	630	HA

HARDWARE GROUP NO. 02

For use on Door #(s):
4S142

Provide each SGL door(s) with the following:

3	EA	HINGE	BB1279 4.5 X 4.5	626	HA
1	EA	PRIVACY LOCK	L9440 02N L283-712 L283-722	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS	689	LCN
3	EA	SILENCER	SR64	630	IVE
1	EA	WALL STOP	236W	630	HA

HARDWARE GROUP NO. 03

For use on Door #(s):
4S100A 4S100B 4S100C

Provide each PR door(s) with the following:

6	EA	HINGE	BB1279 4.5 X 4.5	626	HA
2	EA	FLUSH BOLT	555	626	RO
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	CLASSROOM LOCK	L9070P 02N	626	SCH
1	EA	OVERHEAD STOP	90x S	630	GLY
1	EA	ASTRAGAL	357 C	ALUM	PE

HARDWARE GROUP NO. 04

For use on Door #(s):
4S100 4S120A 4S120B

Provide each SGL door(s) with the following:

3	EA	HINGE	BB1168 4.5 X 4.5	626	HA
1	EA	CLASSROOM LOCK	L9070P 02N	626	SCH
1	EA	WALL STOP	236W	630	HA
1	EA	STC SEALS	AS REQUIRED BY DOOR MFG		

HARDWARE GROUP NO. 05

For use on Door #(s):
4S144

Provide each SGL door(s) with the following:

3	EA	HINGE	BB1279 4.5 X 4.5	626	HA
1	EA	CLASSROOM LOCK	L9070P 02N	626	SCH
1	EA	SURFACE CLOSER	4040XP TBWMS	689	LCN
3	EA	SILENCER	SR64		IVE
1	EA	WALL STOP	236W	630	HA

HARDWARE GROUP NO. AL01
For use on Door #(s):
4S115 4S125 4S130BA(BID ALT 2)

Provide each SGL door(s) with the following:

1	EA	CONT HINGE	780-224HD	ALM	HA
1	EA	LADDER PULL	9266-36-20 (BTB)	630	IVE
1	EA	SURFACE CLOSER	4040XP-TBWMS	689	LCN
1	EA	DROP PLATE	4040XP-18PA	689	LCN
1	EA	BLADE STOP SPACER	4040XP-61 (IF REQUIRED)	689	LCN
1	EA	FLOOR STOP	248F	626	HA

HARDWARE GROUP NO# GL01

For use on Door #(s):
4C200

Provide each SGL door(s) with the following:

1	EA	PIVOTS	BY DOOR MANUFACTURER		630	
1	EA	CLOSER	BY DOOR MANUFACTURER		630	
1	EA	PANIC DEVICE	PDU8000-1		630	RO
1	EA	ELECTRIC STRIKE	ESK-1600-SGL	↯	630	HES
1	EA	FLOOR STOP	248F		626	HA
1	EA	REQUEST TO EXIT	SCAN II	↯	WHT	SCH
1	EA	READER	BY SECURITY CONTRACTOR	↯		
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	↯		

HARDWARE GROUP NO# GL02

For use on Door #(s):
4C424

Provide each SGL door(s) with the following:

1	EA	PIVOTS	BY DOOR MANUFACTURER		630	
1	EA	AUTO OPERATOR	SW200 OHC		630	ASSA
1	EA	PANIC DEVICE	PDU8000-1		630	RO
1	EA	ELECTRIC STRIKE	ESK-1600-SGL	↯	630	HES
1	EA	REQUEST TO EXIT	SCAN II	↯	WHT	SCH
2	EA	ACTUATOR	8310-853	↯		LCN
1	EA	FLOOR STOP	248F		626	HA
1	EA	READER	BY SECURITY CONTRACTOR	↯		
1	EA	POWER SUPPLY	BY SECURITY CONTRACTOR	↯		

END OF SECTION 087100

SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.

2. Frosted glass privacy film application.
3. Glazing sealants.
4. Glazing tapes.
5. Miscellaneous glazing materials.

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

C. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
1. Laminated glass.
2. Glass with frosted privacy film.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturers of fabricated glass units.

B. Product Certificates: For glass.

C. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.

1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.

D. Preconstruction adhesion and compatibility test report.

E. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.

B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

1.9 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent (3/1000) within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: Five years from date of Substantial Completion.

C. Frosted Glass Privacy Film – Warranty against peeling, cracking, and discoloration.

1. Warranty Period: Five years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."

B. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

C. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    a. Dreamwalls by Gardner Glass Products.
    b. Kuraray America, Inc.
    c. Pilkington North America; NSG Group.
2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
3. Interlayer Color: Clear unless otherwise indicated.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2.7 Perimeter Spacer: Manufacturer's standard spacer material and construction FROSTED GLASS PRIVACY FILM

A. Basis of Design: 3M Dusted Crystal vinyl film or comparable product.
1. Color: White
2. Provide a high-quality, non-yellowing frosted glass privacy film.
3. Film shall be resistant to scratching, abrasion, and fading.
4. Film shall have a uniform frosted appearance.
5. Film shall provide adequate privacy while allowing light transmission.

2.8 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Pecora Corporation.
b. Sika Corporation.
c. The Dow Chemical Company.
d. Tremco Incorporated.

2.9 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:
   1. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:
   1. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:
   1. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

   1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Minimum required face and edge clearances.
3. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify that surfaces are clean, dry and free from contaminants before applying privacy film.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

C. Clean glass surfaces thoroughly before applying frosted glass privacy film.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- (3-mm-) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 FROSTED GLASS PRIVACY FILM

A. Install film according to manufacturer’s instructions and recommendations.

B. Ensure that film is applied without wrinkles, bubbles, or other defects.

C. Trim excess film neatly along edges.

3.5 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

G. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.6 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.7 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.8 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

E. Clean installed privacy film using non-abrasive materials and mild cleaning solutions recommended by the film manufacturer.

F. Protect installed film from damage during construction activities.

3.9 MONOLITHIC GLASS SCHEDULE

A. Clear Glass Type B: Fully tempered float glass.

1. Minimum Thickness: 6 mm.

B. Clear Glass Type C: Fully tempered float glass.

1. Minimum Thickness: 12 mm

3.10 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type D: Two plies of fully tempered float glass.

3.11 INSULATING-LAMINATED-GLASS SCHEDULE

1. Clear Insulating, Laminated Glass Type D:Overall Unit Thickness: 1”
2. Minimum Thickness of Each Glass Lite: 3/8”, 1/4” with 1/2” airspace

END OF SECTION 088000

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of code-compliance certification for studs and tracks.

B. Evaluation Reports: For embossed, high-strength steel studs and tracks firestop tracks post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association the Steel Stud Manufacturers Association or the Supreme Steel Framing System Association.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Horizontal Deflection: For non-composite wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (239 Pa).

D. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

E. Design Loads: As indicated on architectural Drawings or 5 lbf/sq. ft. (239 Pa) minimum as required by the IBC.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with AISI S220 for conditions indicated.

1. Steel Sheet Components: Comply with AISI S220 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with AISI S220; ASTM A653/A653M, G40 (Z120); or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

    a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: AISI S220.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. CEMCO; California Expanded Metal Products Co.
    b. ClarkDietrich.
    c. SCAFCO Steel Stud Company.
2. Minimum Base-Steel Thickness: As required by performance requirements for horizontal deflection.
3. Depth: As indicated on Drawings.

C. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CEMCO; California Expanded Metal Products Co.
b. MBA Building Supplies.
c. Marino\WARE.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch (38-mm) minimum vertical movement.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich.
3) SCAFCO Steel Stud Company.
4) Steel Construction Systems.

2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) CEMCO; California Expanded Metal Products Co.
2) ClarkDietrich.
3) MBA Building Supplies.
4) SCAFCO Steel Stud Company.

E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CEMCO; California Expanded Metal Products Co.
b. ClarkDietrich.
c. Fire Trak Corp.
d. Metal-Lite.
e. SCAFCO Steel Stud Company.

F. Hat-Shaped, Rigid Furring Channels: ASTM C645.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. ClarkDietrich.
b. Jaimes Industries.
c. Marino\WARE.
d. SCAFCO Steel Stud Company.

2. Minimum Base-Steel Thickness: 0.0179 inch (0.455 mm).
3. Depth: As indicated on Drawings 7/8 inch (22.2 mm).

G. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: As indicated on Drawings.
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

C. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 2-1/2 inches (64 mm).

D. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch (1.367-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Tracks: ASTM C645.

a. Minimum Base-Steel Thickness: 0.0179 inch (0.455 mm).
b. Depth: As indicated on Drawings.

3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.

    a. Minimum Base-Steel Thickness: 0.0147 inch (0.373 mm).
    b. Depth: As indicated on Drawings.

E. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Armstrong Ceiling & Wall Solutions.
    b. Certainteed; SAINT-GOBAIN.
    c. Rockfon; ROCKWOOL International.
    d. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
2. Multilayer Application: As required by horizontal deflection performance requirements unless otherwise indicated.
3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.

E. Direct Furring:
1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.
2. Tile backing panels.

B. Related Requirements:

1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
3. Section 093013 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Gypsum board, Type X.
2. Gypsum ceiling board.
3. Cementitious backer units.
4. Aluminum trim.
5. Joint treatment materials.
6. Acoustical sealant.

B. Shop Drawings: Show locations and installation of control and expansion joints, including plans, elevations, sections, details of components, and attachments to other work.

C. Sustainable Design Submittals:
1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
2. Environmental Product Declaration: For each product.
3. Product Data: For adhesives and sealants, indicating VOC content.
4. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.
5. Laboratory Test Reports: For ceiling and wall materials, indicating compliance with requirements for low-emitting materials.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

C. Verify ceiling and wall materials comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.3 GYPSUM BOARD, GENERAL

A. Regional Materials: Manufacture products within 500 miles (800 km) of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles (800 km) of Project site. If transporting materials by rail or water, multiply the distance transported by rail or water by 0.25 to determine the distance to Project site.

B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Gypsum.
    b. Certainteed; SAINT-GOBAIN.
    c. Continental Building Products Inc.
    d. Georgia-Pacific Gypsum LLC.
    e. National Gypsum Company.
    f. PABCO Gypsum.
    g. USG Corporation.

2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. American Gypsum.
    b. Certainteed; SAINT-GOBAIN.
    c. Georgia-Pacific Gypsum LLC.
    d. National Gypsum Company.
    e. PABCO Gypsum.
    f. USG Corporation.

2. Thickness: 1/2 inch (12.7 mm).
3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C1288 or ASTM C1325, with manufacturer's standard edges.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. C-Cure.
    b. Certainteed; SAINT-GOBAIN.
    c. James Hardie Building Products, Inc.
    d. National Gypsum Company.
    e. USG Corporation.

2. Thickness: 5/8 inch (15.9 mm).
3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.6 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
2. Shapes:

    a. Cornerbead.
    b. Bullnose bead.
    c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    d. L-Bead: L-shaped; exposed long flange receives joint compound.
    e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    f. Expansion (control) joint.
    g. Curved-Edge Cornerbead: With notched or flexible flanges.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Fry Reglet Corporation.
    b. Gordon Incorporated.
    c. Pittcon Industries.
    d. Tamlyn.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221 (ASTM B221M), Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.8 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Verify adhesives have a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

1. Verify sealant has a VOC content of 250 g/L or less.
2. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:
1. Type X: As indicated on Drawings.
2. Ceiling Type: As indicated on Drawings.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

D. Multilayer Application at Sound recording and office control rooms Wall Type B1:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints 24” on each layer. Stagger gypsum board layers (ship lap) at vertical intersections. Provide a ¼” nominal gap around gypsum board at floor and ceiling intersections. Fill the gap with acoustical joint sealant to form an airtight seal.
3. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

E. PENETRATIONS (through Sound-Rated Construction)
1. Seal multiple conduit penetrations airtight with expanding fire foam sealant.
2. Minimize penetrations of insulated wall and ceiling constructions. Penetrate only where necessary and fully seal airtight at the perimeter using acoustical sealant.
3. After the ductwork, conduit or piping has been installed, repair the gypsum board perimeter clearance to the specified tolerance as required. Where the clearance exceeds 3/4-inch, provide a sheet metal sleeve within the partition packed with safing insulation batts and caulk both sides airtight with an acoustical sealant. Where the perimeter clearance exceeds 3/8-inch, use a flexible backing rod to caulk against. Where penetration clearances are 3/8-inch or less, caulk airtight with acoustical sealant at gypsum board.
4. All gypsum board penetrations (including those resulting from wiring, cables, and electrical junction boxes) are to be sealed airtight with acoustical sealant.
5. Where conduit piping 3-inches diameter and less (including mechanical, hydraulic, plumbing, etc.) pass through insulated wall or ceiling construction, provide a clearance of 1/4-inch ± 1/8-inch between the conduit or piping and the structure, unless otherwise shown.
6. Seal other sound-rated conditions with spray-applied (40 pcf) cementitious sealant equal to Monokote Z-146.
7. The back and sides of junction boxes in sound-rated construction must be sealed airtight with sheet caulking. Caulk perimeter face at gypsum board with acoustical sealant.

8. Recessed panel boards, equipment, boxes, etc. with penetration area greater than 25 sq. in. at sound-rated partitions are to be fully enclosed and sealed with 5/8- inch thick gypsum board or 2 psf sheet lead.

3.4 INSTALLATION OF TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. Bullnose Bead: Use at outside corners.
3. LC-Bead: Use at exposed panel edges.
4. U-Bead: Use at exposed panel edges.

3.6 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.

    a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Sustainable Design Submittals:
1. Laboratory Test Reports: For ceiling products, indicating compliance with requirements for low-emitting materials.

C. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

D. Samples for Initial Selection: For components with factory-applied finishes.

E. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- (150-mm-) square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- (150-mm-) long Samples of each type, finish, and color.
3. Clips: Full-size clips.

F. Delegated Design Submittals: For seismic restraints for ceiling systems.

1. Include design calculations for seismic restraints including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Ceiling suspension-system members.
2. Structural members to which suspension systems will be attached.
3. Method of attaching hangers to building structure.

    a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:

    a. Lighting fixtures.
    b. Diffusers.
    c. Grilles.
    d. Speakers.
    e. Sprinklers.
    f. Access panels.
    g. Perimeter moldings.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

3. Hold-Down Clips: Equal to 2 percent of quantity installed.
4. Impact Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Verify ceiling products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design seismic restraints for ceiling systems.

C. Seismic Performance: Suspended ceilings to withstand the effects of earthquake motions determined in accordance with ASCE/SEI 7.

D. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS (AP1 2x2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; Symphony F or comparable product.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

C. Color: White.

D. Light Reflectance (LR): Not less than 0.88.

E. Noise Reduction Coefficient (NRC): Not less than 0.90.

F. Edge/Joint Detail: Narrow reveal sized to fit flange of exposed suspension-system members.

G. Thickness: 1 inch (25 mm).

H. Modular Size: 24 by 24 inches (610 by 610 mm).

2.4 ACOUSTICAL PANELS (AP2 2x4)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; Symphony F or comparable product.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

D. Color: White.

E. Light Reflectance (LR): Not less than 0.88.

F. Noise Reduction Coefficient (NRC): Not less than 0.90.

G. Edge/Joint Detail: Narrow reveal sized to fit flange of exposed suspension-system members.

H. Thickness: 1 inch (25 mm).

I. Modular Size: 24 by 48 inches (610 by 1220 mm).

2.5 ACOUSTICAL PANELS (AP3 High CAC 2x4 with Above ceiling insulation)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; Adagio High CAC or comparable product.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.

D. Color: White.

E. Light Reflectance (LR): Not less than 0.88.

F. Ceiling Attenuation Class (CAC): Not less than 42.

G. Noise Reduction Coefficient (NRC): Not less than 0.90.

H. Above ceiling fiberglass sound barrier: STC 29.

I. Edge/Joint Detail: Narrow reveal sized to fit flange of exposed suspension-system members.

J. Thickness: 1 inch (25 mm).

K. Modular Size: 24 by 48 inches (610 by 1220 mm).

2.6 FELT ACOUSTICAL PANELS (AF1 2x2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide CSI Creative; GRD-PLG-004 or comparable product.

B. Acoustical Panel Standard: Provide manufacturer's standard panels in accordance with ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

C. Color:
   1. Exposed Edge Color: PSH626 Evergreen
   2. Soundcore color: SND122 Briquette

D. Light Reflectance (LR): Not less than 0.88.

E. Noise Reduction Coefficient (NRC): Not less than 0.90.

F. Thickness: 2 inch (50 mm).

G. Modular Size: 24 by 24 inches (610 by 610 mm).

2.7 METAL SUSPENSION SYSTEM (MS1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; EZ Stab Elite Narrow, or equal.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.8 METAL SUSPENSION SYSTEM (MS2)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Certainteed; EZ Stab Elite Narrow, or equal.

B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories in accordance with ASTM C635/C635M and designated by type, structural classification, and finish indicated.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 (Z90) coating designation; with prefinished 9/16-inch- (15-mm-) wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted. Color selected by architect from manufacturer’s full range.

2.9 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Postinstalled expansion anchors.
    b. Corrosion Protection, Carbon Steel: Components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- (2.69-mm-) diameter wire.

C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.

D. Angle Hangers: Angles with legs not less than 7/8 inch (22 mm) wide; formed with 0.04-inch- (1-mm-) thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation; with bolted connections and 5/16-inch- (8-mm-) diameter bolts.

E. Hold-Down Clips: Manufacturer's standard hold-down.

F. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

G. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.

H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.

I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.

1. Fire-Rated Assembly: Install fire-rated ceiling systems in accordance with tested fire-rated design.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. Arrange directionally patterned acoustical panels as follows:

    a. As indicated on reflected ceiling plans.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
5. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m), non-cumulative.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:

1. Periodic inspection during the installation of suspended ceiling grids in accordance with ASCE/SEI 7.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.

1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf (890 N) of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf (1957 N) of tension.
2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.

D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

3.6 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 095426 - WOOD SCREEN WALL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid-wood, grille-screen wall.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For composite wood products, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings:

   1. Include plans, sections, and details, drawn to scale, showing the following:
      a. Method of attaching base and top to building structure.

D. Samples: For each exposed product and for each type, color, and finish specified.

E. Samples for Initial Selection: For units with factory-applied colors and finishes.

   1. Include Samples of accessories involving color and finish selections.

F. Samples for Verification: For the following products:
   1. Wood Screen Wall Grille: 12-inch- (305-mm-) long Sample of each type, color, and finish.
   2. Exposed Molding and Trim: 12-inch- (305-mm-) long Samples of each type, color, and finish.

G. Delegated Design Submittals: For design of seismic restraints and attachment devices.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Product Test Reports: for tests performed by a qualified testing agency.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wood Screen Wall Components: Quantity of eachunit, mounting components, and accessories equal to 2 percent of quantity installed.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by National Voluntary Laboratory Accreditation Program for testing indicated.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of screen wall as shown on Drawings.

a. Demonstrate treatment of exposed field cuts.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3.

Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they are protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

1. Store materials flat and level, raised from the floor.

B. Handle components and accessories in a manner that prevents damage.

1.8 PROJECT CONDITIONS

A. Store and acclimatize wood products in the spaces where they will be installed for a minimum of 72 hours immediately before installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements" to design attachment devices.

B. Seismic Criteria: Provide wood screen wall designed and installed to withstand the effects of earthquake motions in accordance with requirements of authorities having jurisdiction.

C. Certified Wood: Verify wood products contain not less than 60 percent certified wood tracked through a chain-of-custody process. Provide certified wood documentation from sources certified through a forest certification system with principles, criteria, and standards developed using ISO/IEC Guide 59 or the World Trade Organization's "Technical Barriers to Trade."

Adhesives: Do not use adhesives that contain urea formaldehyde.

2.2 SOLID-WOOD, SCREEN BATTENS (S1)

A. Solid-Wood Battents: Manufacturer's standard kiln-dried, solid-wood rails free of knots and without finger joints, cracks, checks, and warp..
   1. Basis-of-Design: Product subject to compliance with requirements, provide Sculptform Timber Click-on Screen or comparable product.
   2. Wood Species: American Oak.
   3. Wood Cut: Manufacturer's standard.
   4. Batten Dimensions: 30 x 130mm
   5. Rail Spacing: Per drawings.
   6. Clip type: Direct Fix, no track
   7. Batten Size: See elevations
   8. Fire Rating: Class 1(A) Fire Rating

Finish: Natural Accent - Natural Tone

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing and substrates to which screen wall attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and with requirements for installation tolerances and other conditions affecting performance of wood screen.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure screen wall area and establish layout of wood screen.

3.3 INSTALLATION OF WOOD SCREEN WALL

A. Install wood components and accessories in accordance with manufacturer's written instructions and to accommodate natural expansion and contraction of wood products resulting from fluctuations in humidity.

B. Treat field-cut edges of wood components in accordance with manufacturer's written recommendations; finish exposed field cuts to match factory finish.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. .

C. Prepare test and inspection reports.

3.5 CLEANING

A. Clean exposed surfaces of screen wall. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace screen components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage, including dented units.

END OF SECTION 095426

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Thermoplastic-rubber base.
   2. Rubber molding accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Product Data: For sealants, indicating VOC content.
   4. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
   5. Laboratory Test Reports: For resilient base and stair products and accessories, indicating compliance with requirements for low-emitting materials.
   6. Environmental Product Declaration: For each product.

C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches (300 mm) long.

D. Samples for Initial Selection: For each type of product indicated.

E. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.

F. Product Schedule: For resilient base and accessory products.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Verify products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 THERMOPLASTIC-RUBBER BASE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Johnsonite; a Tarkett company.
2. Roppe Corporation.

B. Product Standard: ASTM F1861, Type TP (rubber, thermoplastic).

1. Group: I (solid, homogeneous).
2. Style and Location:
   a. Style B, Cove: in locations as called our in drawings.

C. Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (102 mm).

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Colors: Match Architect's sample.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less.

C. Metal Edge Strips: Extruded aluminum with mill finish, nominal 2 inches (50.8 mm) wide, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

SECTION 096543 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linoleum floor tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.
4. Environmental Product Declaration: For each product.

C. Shop Drawings: For each type of linoleum flooring.

1. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

D. Samples: For each exposed product and for each color and pattern specified in manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections.

E. Samples for Initial Selection: For each type of linoleum flooring indicated.

F. Samples for Verification: For each type of linoleum flooring, in manufacturer's standard size, but not less than 6-by-9-inch (152-by-230-mm) sections of each different color and pattern required.

G. Product Schedule: For linoleum flooring. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of linoleum flooring to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for flooring installation and seaming methods indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by flooring manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 65 deg F (18 deg C) or more than 90 deg F (32 deg C).

1. Floor Tile: Store on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive flooring during the following periods:

1. 72 hours before installation.
2. During installation.
3. 72 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Close spaces to traffic during flooring installation.

D. Close spaces to traffic for 72 hours after flooring installation.

E. Install flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For linoleum flooring, as determined by testing identical products according to ASTM E648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 LINOLEUM FLOOR TILE (LN1)

A. Manufacturers:

1. Basis-of-Design: Product subject to compliance with requirements, provide Forbo Flooring Systems Marmoleum or comparable product.
2. Collection: Walton
3. Size: Sheet, 108.27 ft x 78.74 in
4. Thickness: 0.10 inch (2.5 mm).
5. Color: 3371 Cement.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by linoleum flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit products and substrate conditions indicated.

1. Verify adhesives have a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Floor Polish: Provide protective, liquid floor-polish products recommended by linoleum flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to linoleum flooring manufacturer's written instructions to ensure adhesion of flooring.

B. Concrete Substrates: Prepare according to ASTM F710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by linoleum flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by linoleum flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install flooring until materials are the same temperature as space where they are to be installed.

1. At least 72 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by flooring.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for installing flooring.

B. Scribe and cut flooring to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, thresholds, door frames, and nosings.

C. Extend flooring into toe spaces, door reveals, closets, and similar openings.

D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on flooring as marked on substrates. Use chalk or other nonpermanent marking device.

E. Install flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

F. Adhere flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 LINOLEUM FLOOR TILE INSTALLATION

A. Lay out linoleum floor tiles from center marks established with principal walls, discounting minor offsets, so floor tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay floor tiles square with room axis.

B. Match linoleum floor tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed floor tiles.

1. Lay floor tiles in pattern of colors and sizes indicated.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting linoleum flooring.

B. Perform the following operations immediately after completing linoleum flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect linoleum flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from linoleum flooring surfaces before applying liquid floor polish.

1. Apply three coat(s).

E. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover linoleum flooring until Substantial Completion.

END OF SECTION 096543

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Modular carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Sustainable Design Submittals:

1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
3. Laboratory Test Reports: For flooring products, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For carpet tile installation, plans showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Pattern of installation.
4. Pattern type, location, and direction.
5. Pile direction.
6. Transition details to other flooring materials.

D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.
2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- (300-mm-) long Samples.

E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

F. Sustainable Product Certification: Provide ANSI/NSF 140 certification for carpet products.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with the Carpet and Rug Institute's CRI 104.

1.8 FIELD CONDITIONS

A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and

humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

    a. More than 10 percent edge raveling, snags, and runs.
    b. Dimensional instability.
    c. Excess static discharge.
    d. Loss of tuft-bind strength.
    e. Loss of face fiber.
    f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CT1)

A. Basis of Design: Shaw carpet.
1. Style: Collective V Tile, 5T442.
2. Color: Greige, 38105.
3. Pattern: Ashlar.

B. Fiber Type: Ecosolution Q100™ Nylon.

C. Pile Characteristic: Multi-Level Pattern Loop.

D. Density: 7765 oz./cu. yd.

E. Pile Thickness:0.250 inches (mm) for finished carpet tile.

F. Stitches: 9 per inch (mm).

G. Gage: 1/12 inch (mm).

H. Primary Backing/Backcoating: Synthetic by manufacturer.

I. Secondary Backing: Ecoworx tile.

J. Size: 9 by 36 inches.

K. Applied Treatments:

1. Soil-Resistance Treatment: SSP@ Shaw Soil Protection.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

L. Sustainable Design Requirements:
1. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

M. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.
3. Tuft Bind: Not less than 10 lbf (45 N) according to ASTM D1335.
4. Delamination: Not less than 3.5 lbf/in. (0.6 N/mm) according to ASTM D3936.
5. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
6. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 CARPET TILE (CT2)

A. Basis of Design: Shaw carpet.
1. Style:Collective V Tile, 5T442.
2. Color: Warm Grey, 38518.
3. Pattern: Ashlar.

B. Fiber Type: Ecosolution Q100™ Nylon.

C. Pile Characteristic: Multi-Level Pattern Loop.

D. Density: 7765 oz./cu. yd.

E. Pile Thickness:0.250 inches (mm) for finished carpet tile.

F. Stitches: 9 per inch (mm).

G. Gage: 1/12 inch (mm).

H. Primary Backing/Backcoating: Synthetic by manufacturer.

I. Secondary Backing: Ecoworx tile.

J. Size: 9 by 36 inches.

K. Applied Treatments:

1. Soil-Resistance Treatment: SSP@ Shaw Soil Protection.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

L. Sustainable Design Requirements:
1. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

M. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.
3. Tuft Bind: Not less than 10 lbf (45 N) according to ASTM D1335.
4. Delamination: Not less than 3.5 lbf/in. (0.6 N/mm) according to ASTM D3936.
5. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
6. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.3 CARPET TILE (CT3)

A. Basis of Design: Shaw carpet.
1. Style: Color Frame, 5T081
2. Color: Ember, 81870.
3. Pattern: Ashlar.

B. Fiber Type: Ecosolution Q100™ Nylon.

C. Pile Characteristic: Multi-Level Pattern Loop.

D. Density: 7200 oz./cu. yd.

E. Pile Thickness:0.250 inches (mm) for finished carpet tile.

F. Stitches: 10.5 per inch (mm).

G. Gage: 1/12 inch (mm).

H. Primary Backing/Backcoating: Synthetic by manufacturer.

I. Secondary Backing: Ecoworx tile.

J. Size: 24 by 24 inches.

K. Applied Treatments:

1. Soil-Resistance Treatment: SSP@ Shaw Soil Protection.
2. Antimicrobial Treatment: Manufacturer's standard treatment that protects carpet tiles as follows:

a. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.

L. Sustainable Design Requirements:
1. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

M. Performance Characteristics:

1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
2. Dry Breaking Strength: Not less than 100 lbf (445 N) according to ASTM D2646.
3. Tuft Bind: Not less than 10 lbf (45 N) according to ASTM D1335.
4. Delamination: Not less than 3.5 lbf/in. (0.6 N/mm) according to ASTM D3936.
5. Dimensional Tolerance: Within 1/32 inch (0.8 mm) of specified size dimensions, as determined by physical measurement.
6. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
7. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
9.

2.4 +INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

1. Verify adhesives have a VOC content of 50 g/L or less.

2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Metal Edge/Transition Strips: Extruded aluminum with mill finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m), and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
    b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.

B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider, and protrusions more than

1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: As recommended in writing by carpet tile manufacturer.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns monolithic.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097200 - WALL COVERINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Felt Wall Covering
   2. Textured Felt Wall Covering
   3. Textured Laminate Wood Wall Covering
   4. Resin Wall Covering

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

   1. Include: Architect.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
   3. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement seams and termination points.

D. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 10 inches long in size.

   1. Wall-Covering Sample: From same production run to be used for the Work.

      a. Show complete pattern repeat.
      b. Mark top and face of fabric.

E. Samples for Initial Selection: For each type of wall covering.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each wall covering, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Verify wall materials comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 450 or less.

2.2 FELT WALL COVERING (F1, F2, F3 + F4)

A. Basis of Design: CSI Creative Posh Felt Covering Surfaces. Other manufacturers are allowed to provide wall coverings to match basis of design. Product must include a two-layer felt panel as described below.
B. Description: Provide wall coverings in rolls from same production run. Panel Width: As indicated on drawings.
C. Panel Height: As indicated on drawings.
D. Panel Shape: Flat
E. Facing Material: 5/8” Poshfelt.
F. Backing: ½” Soundcore
G. Installation: Adhesive per manufacturer's standard.
H. Finish color at exposed edges: Wrap facing material.
I. Colors:
    1. F1 – PSH626 Evergreen
    2. F2 – PSH617 Evening Gown
    3. F3 – PSH142 Plum Purple
    4. F4 – PSH139 Cayenne
J. Reveals between Panels: Flush reveals.

2.3 TEXTURED FELT WALL COVERING (TF1)

A. Basis of Design: Soelberg Industries - Muto. Other manufacturers are allowed to provide wall coverings to match basis of design.
B. Description: Provide wall coverings in batch from same production run. Panel Width: As indicated on drawings.
C. Panel Height: As indicated on drawings.
D. Panel thickness: ½”
E. Installation: Adhesive per manufacturer’s standard.
F. Colors, Textures, and Patterns: Midnight, Bolla
G. Reveals between Panels: Flush reveals.

2.4 TEXTURED LAMINATE WOOD WALL COVERING (TL1)

A. Basis of Design: Soelberg Industries – 3D Wall Panels. Other manufacturers are allowed to provide wall coverings to match basis of design.
B. Description: Provide wall coverings in batch from same production run. Panel Width: As indicated on drawings.
C. Panel Height: As indicated on drawings.
D. Panel thickness: ¾” MDF Core
E. Installation: Adhesive per manufacturer’s standard.

F. Colors, Textures, and Patterns: Salinas Oak, Fila
G. Reveals between Panels: Flush reveals.

2.5 RESIN WALL COVERING (RP1)

A. Basis of Design: 3Form - Varia. Other manufacturers are allowed to provide wall coverings to match basis of design.
B. Description: Provide wall coverings in batch from same production run. Panel Width: As indicated on drawings.
C. Panel Height: As indicated on drawings.
D. Panel thickness: 3/16”
E. Installation: Adhesive per manufacturer’s standard.
F. Color: Kilt G55 + White Out WO1
G. Finish: Vellum F04
Reveals between Panels: Flush reveals.

2.6 ACCESSORIES

A. Adhesive: Use adhesive as recommended by manufacturer: Basis of design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Painted Surfaces:

a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL LINER

A. Install wall liner, without gaps or overlaps. Form smooth wrinkle-free surface for finished installation. Do not begin wall-covering installation until wall liner has dried.

3.4 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Install wall covering without lifted or curling edges and without visible shrinkage.

C. Install seams vertical and plumb at least 6 inches (152 mm) from outside corners and 6 inches (152 mm) from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

D. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

E. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

F. Coordinate installation of electrical fixtures and equipment.

3.5 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 097200

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Solvent-based finish coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Sustainable Design Submittals:

1. Product Data: For paints and coatings, indicating VOC content.
2. Laboratory Test Reports: For paints and coatings, indicating compliance with requirements for low-emitting materials.
3. Environmental Product Declaration: For each product.

C. Samples: For each type of topcoat product.

D. Samples for Initial Selection: For each type of topcoat product.

E. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

F. Product Schedule: Use same designations indicated on Drawings and in the Interior Painting Schedule to cross-reference paint systems specified in this Section. Include color designations.

1.3 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint Products: 5 percent, but not less than 1 gal. (3.8 L) of each material and color applied.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Behr Paint Company; Behr Process Corporation.
b. Benjamin Moore & Co.
c. PPG Paints; PPG Industries, Inc.
d. Sherwin-Williams Company (The).

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Emissions Requirements: Verify field-applied paints and coatings that are inside the weatherproofing system comply with one of the following:

1. Low-Emitting Materials: Verify VOC emissions comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
2. Verify VOC content does not exceed limits of authorities having jurisdiction and the following:

    a. Flat Coatings: 50 g/L.
    b. Nonflat Coatings: 100 g/L.
    c. Primers, Sealers, and Undercoats: 100 g/L.
    d. Shellacs, Clear: 730 g/L.
    e. Shellacs, Pigmented: 550 g/L.

C. Colors: As indicated in a color schedule.

2.3 PRIMERS

A. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Behr Paint Company; Behr Process Corporation.
    b. Benjamin Moore & Co.
    c. PPG Paints; PPG Industries, Inc.
    d. Sherwin-Williams Company (The).

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, Eggshell: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Behr Paint Company; Behr Process Corporation.
    b. Benjamin Moore & Co.
    c. PPG Paints; PPG Industries, Inc.
    d. Sherwin-Williams Company (The).
2. Gloss and Sheen Level: Manufacturer's standard eggshell finish.

B. Interior, Latex, Satin: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Behr Paint Company; Behr Process Corporation.
    b. Benjamin Moore & Co.
    c. PPG Paints; PPG Industries, Inc.
    d. Sherwin-Williams Company (The).
2. Gloss and Sheen Level: Manufacturer's standard low-sheen finish.

C. Interior, Latex, Semigloss: Pigmented, water-based paint for use on primed/sealed interior plaster and gypsum board, and on primed wood and metals.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

    a. Behr Paint Company; Behr Process Corporation.
    b. Benjamin Moore & Co.
    c. PPG Paints; PPG Industries, Inc.
    d. Sherwin-Williams Company (The).
2. Gloss Level: Manufacturer's standard semigloss finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Wood: 15 percent.
2. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry-Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry-film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry-film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry-film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
3. Allow empty paint cans to dry before disposal.
4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Gypsum Board Substrates:

1. Latex over Latex Sealer System (P1, P2):
   a. Institutional Low-Odor/VOC Latex System MPI INT 9.2M:
      a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 4), MPI #146.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass markerboards and custom printed glass

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
   2. Include electrical characteristics for motorized units.

B. Shop Drawings: For visual display units.

   1. Include plans, elevations, sections, details, and attachment to other work.
   2. Show locations of panel joints.
   3. Include sections of typical trim members.

C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:

   1. Samples of facings for each visual display panel type, indicating color and texture.
   2. Include accessory Samples to verify color selected.

D. Samples for Verification: For each type of visual display unit indicated.

   1. Visual Display Panel: Not less than 8-1/2 by 11 inches (215 by 280 mm), with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
   2. Trim: 6-inch- (150-mm-) long sections of each trim profile.
   3. Accessories: Full-size Sample of each type of accessory.

E. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each visual display unit, for tests performed by manufacturer and witnessed by a qualified testing agency.

C. Sample Warranties: For manufacturer's special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.8 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

    a. Surfaces lose original writing and erasing qualities.
    b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 10 years from date of Substantial Completion.
3. Warranty Period: Life of the building.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

2.2 GLASS WALL PANEL

A. Manufacturers (GW1):

1. Basis-of-Design: Product subject to compliance with requirements, provide Clarus Wall2Wall or comparable product.
2. Glass Wall Panel: Fabricated of ¼" tempered glass
3. Edge Treatment: Smooth polished edge with eased corners.
4. Surface: Glossy.
5. Color: Custom Colordrop print. Coordinate w/ architect on artwork file.
6. Mounting: Adhere to wall with manufacturer recommended adhesive and glazing tape. Use product standard channel and trim.
7. Size: as indicated in drawing

B. Manufacturers (GW2):

1. Basis-of-Design: Product subject to compliance with requirements, provide Clarus Wall2Wall or comparable product.
2. Glass Wall Panel: Fabricated of ¼" tempered glass with steel backing for use with magnets.
3. Edge Treatment: Smooth polished edge with eased corners.
4. Surface: Silk
5. Color: CBC-829 SW Artistic Taupe
6. Mounting: Adhere to wall with manufacturer recommended adhesive and glazing tape. Use product standard channel and trim.
7. Size: as indicated in drawing
8. Accessories: (1) Box Tray marker holder, grey

2.3 GLASS MARKERBOARDS

A. Manufacturers (MB1):

1. Basis-of-Design: Product subject to compliance with requirements, provide Clarus Claroultra or comparable product.
2. Glass Wall Panel: Fabricated of 4mm tempered glass with steel backing for use with magnets.
3. Edge Treatment: Smooth polished edge with eased corners.

4. Surface: Glossy.
5. Color: White
6. Mounting: Z-bar wall bracket
7. Size: 4’ x 6’
8. Accessories: (1) Box Tray marker holder per markerboard, grey

2.4 MATERIALS

A. Clear, low E Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.

B. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.

1. Verify adhesives have a VOC content of 50 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

D. Prime wall surfaces indicated to receive visual display units and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.

3.3 INSTALLATION

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Field-Assembled Visual Display Board Assemblies: Coordinate field-assembled units with grounds, trim, and accessories indicated. Join parts with a neat, precision fit.

1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, as indicated on approved Shop Drawings.
2. Where size of visual display board assemblies or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.

C. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches (400 mm) o.c. Secure tops and bottoms of boards to walls.

D. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

A. Clean visual display units in accordance with manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Corner guards.
   2. Door kick plate, reference door hardware.

B. Related Requirements:
   1. Section 087100 "Door Hardware" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Sustainable Design Submittals:
   1. Product Data: For adhesives, indicating VOC content.
   2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For each type of wall and door protection showing locations and extent.

   1. Include plans, elevations, sections, and attachment details.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

   1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS

A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. American Floor Products Company, Inc.
b. Babcock-Davis.
c. Construction Specialties, Inc.

d. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
e. Nystrom, Inc.

2. Material: Stainless-steel sheet, Type 304.

a. Thickness: Minimum 0.0500 inch (1.3 mm).
b. Finish: Powder coated, White.

3. Wing Size: Nominal 3-1/2 by 3-1/2 inches (90 by 90 mm).
4. Corner Radius: 1/8 inch (3 mm).
5. Height: 48”, u.n.o.
6. Mounting: Adhesive.

2.4 MATERIALS

A. Adhesive: As recommended by protection product manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

3.4 CLEANING

A. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 122200 - CURTAINS AND DRAPES

GENERAL

SUMMARY

Section Includes:

Drapes.
Drapery tracks.

Related Requirements:

ACTION SUBMITTALS

Product Data: For the following:

Drapery Tracks: Include maximum weights of drapes that can be supported.
Fabrics.
Textile treatments.

Shop Drawings:

Drapery Tracks: Show installation and anchorage details and locations of controls.

Motorized Tracks: Indicate dimensions, weights, and required clearances for track and motor and differentiate between manufacturer-installed and field-installed wiring.

Drapes: Show sizes, locations, and details of installation.

Samples: As follows:

Drapery Tracks: 18 inches (450 mm) long, with carriers, controls, and accessories.
Drapery Fabrics: For each color and pattern indicated, full width by 36 inches (1000 mm) long with specified textile treatments applied.
Textile Trims: For each color and pattern indicated, 18 inches (450 mm) long.

INFORMATIONAL SUBMITTALS

Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

Suspended ceiling components.

CLOSEOUT SUBMITTALS

Maintenance Data: For products installed to include in maintenance manuals.

MAINTENANCE MATERIAL SUBMITTALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Drapery Track Carriers: For each size indicated, equal to 5 percent of amount installed, but no fewer than of each size.
Drapery Fabrics: For each fabric, color, and pattern indicated, from the same product run, full-width lengths equal to 5 percent of amount installed, but no fewer than 10 yards of each fabric, color, and pattern.

QUALITY ASSURANCE

Installer Qualifications: For drapes and drapery tracks, fabricator of drapes.

Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

Build mockup at location and in size shown on Drawings.
Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

FIELD CONDITIONS

Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.

Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PRODUCTS

DRAPERY TRACKS

Manually Operated Track:

Basis-of-Design Product: Provide Cascade Architectural – Secura track or comparable product.

Construction: Extruded aluminum, slotted for mounting at interval of not more than 24 inches (610 mm) o.c.

Lengths and Configurations: As indicated on Drawings.
Support Capability: Weight of drape indicated mounted on track length indicated.

Finish: Manufacturer's standard.

Mounting: mount directly to ceiling as specified by manufacturer.

Installation Fasteners: Sized to support track assembly and drape, and fabricated from metal compatible with track, brackets, and supporting construction. Provide two fasteners to fasten each bracket to supporting construction.

Carriers: Rollers with hooks.

End Stops: Manufacturer's standard.

DRAPES

Basis-of-Design Product: Provide Cascade Architectural – Fabricoil or comparable product.

Drapery Fabric: Aluminum coil

Coil size: 5/16”

Roll Pleats: 100 percent fullness.

Orientation: Coil vertical

Width: manufacturers standard

Textile Treatments: Custom powder coated color as selected by architect.

DRAPE FABRICATION

A. Tolerances: Verify field dimensions prior to start of shop fabrication.
B. Fabricate steel and stainless steel components in accordance with manufacturer's requirements and the following:
C. Comply with requirements indicated for metal materials, thickness, design, and details of construction; fabricate metal accurately and without any burrs.
D. Provide welded connections in compliance with American Welding Society (AWS) standards for recommended practice in shop welding.
E. Provide welds located behind finished surfaces that are without distortion or discoloration of exposed side.
F. Provide components that are accurately cut, drilled and/or tapped to receive coiled wire fabric, hardware, fasteners, and accessories.
G. Shop fabricate components in accordance with requirements indicated on drawings and specified performance requirements.
H. Shop fabricate hardware, interconnected parts, and assemblies to eliminate necessity for any field cutting adjustments.
I. Coordinate system requirements, dimensions and spacing of attachment components to ensure required factory drilled holes in supporting framework are properly located.
J. Provide exposed joints that are butt, flush, and hairline.

K. Upon completion of fabrication, clean and prepare applicable coiled wire fabric system in accordance with ASTM A380/A380M.

ACCESSORIES

A. Fasteners: Comply with ASTM F593 for stainless steel or ASTM A307 for carbon steel, sizes to suit installation conditions.
B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

EXECUTION

DRAPERY TRACK INSTALLATION

Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.

EXAMINATION

A. Prior to start of installation, verify that existing conditions are acceptable for installation of coiled wire fabric and attachment systems in accordance with manufacturer's installation instructions.

B. Coordinate with setting diagrams, plans, templates, and drawings to ensure that proper installation of necessary anchors and supporting devices has been completed.

C. Ensure that supporting system for coiled wire fabric has been properly prepared for attachment of framework, hardware, anchors, wire rope, and transfer of calculated loading.

DRAPE INSTALLATION

Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch (6.4 mm).

Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch (25 mm) and not less than 1/2 inch (13 mm).

ADJUSTING

After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.

Steam and dress down drapes as required to produce crease- and wrinkle-free installation.

Remove and replace drapes that are stained or soiled.

END OF SECTION 122200

SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated, single-roller, light blocking shades.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches (250 mm) long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches (250 mm) square. Mark interior face of material if applicable.

F. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of shadeband material.

C. Product Test Reports: For each type of shadeband material, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED, SINGLE-ROLLER SHADES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Hunter Douglas, Inc.
2. Lutron Electronics Co., Inc.
3. MechoShade Systems, LLC.

B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Nickel-plated metal.

a. Loop Length: Full length of roller shade.
b. Limit Stops: Provide upper and lower ball stops.
c. Chain-Retainer Type: Chain tensioner, jamb mounted.

C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

E. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
   a. Color and Finish: As selected by Architect from manufacturer's full range.

F. Installation Accessories:

1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.

a. Shape: L-shaped.
b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).

2. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.

    a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 4 inches (102 mm).

3. Endcap Covers: To cover exposed endcaps.
4. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel.

    a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 6 inches (152 mm).
    b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

5. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.

    a. Closure-Panel Width: 2 inches (51 mm).

6. Side Channels: With light seals and designed to eliminate light gaps at sides of shades as shades are drawn down. Provide side channels with shadeband guides or other means of aligning shadebands with channels at tops.
7. Bottom (Sill) Channel or Angle: With light seals and designed to eliminate light gaps at bottoms of shades when shades are closed.
8. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-blocking fabric (black out shades): Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Type: 73% Vinyl Coating and 27% Fiberglass
3. Thickness:.013”.
4. Roll Width: Width of window, field verify.
5. NFPA701
6. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch (6 mm) per side or 1/2-inch (13-mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

2. At door and frame (4S120) provide jamb mounting at side light, surface mount to door.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances,and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

B. Roller Shade Locations: At windows and doors indicated on drawings.

C. At door and frame (4S120) provide jamb mounting at side light, surface mount to door.

D. All shades to be light blocking, seal joints at channels.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 122413

SECTION 123623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad countertops.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating that product contains no urea formaldehyde.
2. Product Data: For installation adhesives, indicating VOC content.
3. Laboratory Test Reports: For installation adhesives, indicating compliance with requirements for low-emitting materials.
4. Product Data: For composite wood products, indicating that product contains no urea formaldehyde.

C. Shop Drawings: For plastic-laminate-clad countertops.

1. Include plans, sections, details, and attachments to other work. Detail fabrication and installation, including field joints.
2. Show locations and sizes of cutouts and holes for items installed in plastic-laminate-clad countertops.

D. Samples: Plastic laminates in each type, color, pattern, and surface finish required in manufacturer's standard size.

E. Samples for Initial Selection: For plastic laminates.

F. Samples for Verification: As follows:

1. Plastic Laminates: For each type, color, pattern, and surface finish required, 8 by 10 inches (200 by 250 mm) in size.
2. Fabrication Sample: For each type and profile of countertop required, provide one sample applied to core material with specified edge material applied to one edge.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and fabricator.

B. Product Certificates: For the following:

1. Composite wood products.
2. High-pressure decorative laminate.
3. Adhesives.

C. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.

B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

C. Keep surfaces of countertops covered with protective covering during handling and installation.

1.6 FIELD CONDITIONS

A. Environmental Limitations without Humidity Control: Do not deliver or install countertops until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements. Only in rooms 1-160Q, 1-160, 1-160P along east wall.
   1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

B. Grade: Custom.

C. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGF.

   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      a. (L1) – Formica, Aged Ash 8844
      b. (L2) – Wilsonart, Hunter Green D79-60

D. Edge Treatment: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.

E. Core Material: Fire-retardant MDF.

F. Core Thickness: 3/4 inch (19 mm).

2.2 WOOD MATERIALS

A. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

   1. Composite Wood Products: Verify products are made without added urea formaldehyde.
   2. MDF: Medium-density fiberboard, ANSI A208.2, Grade 130.

2.3 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products in accordance with test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant MDF: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less in accordance with ASTM E84.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Roseburg.

2.4 MISCELLANEOUS MATERIALS

A. Adhesives: Do not use adhesives that contain urea formaldehyde.

B. Adhesive for Bonding Plastic Laminate: As selected by fabricator to comply with requirements.

1. Adhesive for Bonding Edges: Hot-melt adhesive.

C. Installation Adhesive:

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.5 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch (25 mm) over base cabinets. Ease edges to radius indicated in drawings.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and

installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

D. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of cutouts by saturating with varnish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.

B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

3.2 INSTALLATION

A. Grade: Install countertops to comply with same grade as item to be installed.

B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

1. Secure field joints in countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten in accordance with manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical-treatment manufacturer's written instructions, including those for adhesives used to install woodwork.

F. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches (3-mm-in-2400-mm) variation from a straight, level plane.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.

B. Clean countertops on exposed and semiexposed surfaces.

C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches (1220 mm) o.c. Remove protection at Substantial Completion.

END OF SECTION 123623.13

SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.

1.2 ACTION SUBMITTALS

A. Product Data: For countertop materials.

B. Sustainable Design Submittals:
1. Product Data: For adhesives, indicating VOC content.
2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

D. Samples for Initial Selection: For each type of material exposed to view.

E. Samples for Verification: For the following products:

1. Countertop material, 6 inches (150 mm) square.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS (SS1)

A. Solid Surface Material: Homogeneous-filled plastic resin complying with ISFA 2-01.

1. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal:

    a. Wilsonart LLC.
2. Type: Provide Standard type unless Special Purpose type is indicated.
3. Colors and Patterns: Frosty White Mirage, 1573MG.

2.2 FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."

1. Grade: Custom.

B. Configuration:

1. Front: Straight, slightly eased at top.
2. Backsplash: Straight, slightly eased at corner.
3. End Splash: Matching backsplash.

C. Countertops:

1. 1/2-inch- (12.7-mm-) thick, solid surface material with front edge built up with same material.

D. Backsplashes: 1/2-inch- (12.7-mm-) thick, solid surface material.

E. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

F. Joints:

1. Fabricate countertops without joints.

G. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.

a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch (5 mm) into fixture opening.

2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Verify adhesives have a VOC content of 70 g/L or less.
2. Verify adhesive complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level to a tolerance of 1/8 inch in 8 feet (3 mm in 2.4 m), 1/4 inch (6 mm) maximum. Do not exceed 1/64-inch (0.4-mm) difference between planes of adjacent units.

B. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.

C. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.

E. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.

    1. Seal edges of cutouts in particleboard subtops by saturating with varnish.

F. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION 123661.16

SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pipes, fittings, and specialties.
   2. Specialty valves.
   3. Sprinklers.
   4. Alarm devices.

1.3 DEFINITIONS

A. 175 psig Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

B. AHJ: Authority Having Jurisdiction.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
   2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.

B. Shop Drawings: For wet-pipe sprinkler systems.
   1. Include plans, elevations, sections, and attachment details.
   2. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Domestic water piping.
   2. Compressed air piping.
   3. HVAC Ductwork.
   4. Equipment Flues.
   5. Drain, Waste, and Vent Piping.
   6. Items penetrating finished ceiling including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Acoustical Treatments

B. Qualification Data: For qualified Installer.

C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

D. Welding certificates.

E. Fire-hydrant flow test report.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

1.9 FIELD CONDITIONS

A. Interruption of Existing Work Functions: Do not interrupt work functions in the existing building unless notification and acceptance by Owner has been received:
1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of work functions.
2. Do not proceed with interruption without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Project scope:
1.
2. Existing construction: modify existing wet pipe fire suppression system with new quick response heads on flexible drops.
3.
4. Sprinkler heads are to be quick response, recessed type, white in color in all areas.

5.
6. Sprinkler heads should be centered on one half of all 2x4 acoustical tiles and centered on all 2x2 acoustical tiles in all areas.
7. Coordination with other trades is important. Sprinkler locations, types, and colors not complying with above and not approved by the architect in writing and installed shall be removed and surfaces repaired at no cost by the fire sprinkler contractor.

B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
1. NFPA 13, 2010 Edition unless otherwise directed by AHJ.
2. Local codes or ordinances.

C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

D. Delegated Design: Engage a qualified professional engineer or NICET Level III technician to design wet-pipe sprinkler systems.
1. Perform a water flow test near the site and publish results to architect and EOR for review. Information that should be included in the published results includes, but is not limited to, the following:
a. Date.

b. Time.
c. Performed by, name and firm.
d. Water utility and name of contact/witness.
e. Location of Residual Fire Hydrant R.
f. Location of Flow Fire Hydrant F.
g. Static Pressure at Residual Fire Hydrant R psig.
h. Measured Flow at Flow Fire Hydrant F gpm.
i. Residual Pressure at Residual Fire Hydrant R psig.

2. Sprinkler system design shall be approved by authorities having jurisdiction.
   a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
   b. Sprinkler Occupancy Hazard Classifications:
      1) Building Service Areas: Ordinary Hazard, Group 1.
      2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      3) General Storage Areas: Ordinary Hazard, Group 1.
      4) Laundries: Ordinary Hazard, Group 1.
      5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      6) Office and Public Areas: Light Hazard.
      7) Other areas not meeting the space classifications above shall be brought to the attention of the architect for review and classification.
3. Minimum Density for Automatic-Sprinkler Piping Design:
   a. 0.05 gpm over 400-sq. ft.Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
   d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
   e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
   f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
4. Maximum Protection Area per Sprinkler: According to UL listing.

E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

2.2 STEEL PIPE AND FITTINGS

A. Schedule 40, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; Pipe ends may be factory or field formed to match joining method.

B. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

C. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.

D. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

E. Malleable- or Ductile-Iron Unions: UL 860.

F. Cast-Iron Flanges: ASME 16.1, Class 125.

G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.

H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

I. Grooved-Joint, Steel-Pipe Appurtenances:
1. Pressure Rating: 175-psig minimum.
2. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 SPECIALTY VALVES

A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

B. Pressure Rating:
1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.

C. Body Material: Cast or ductile iron.

D. Size: Same as connected piping.

E. End Connections: Flanged or grooved.

F. Automatic (Ball Drip) Drain Valves:
1. Standard: UL 1726.
2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

2.4 SPRINKLER PIPING SPECIALTIES

A. Branch Outlet Fittings:
1. Standard: UL 213.
2. Pressure Rating: 175-psig minimum

3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
4. Type: Mechanical-tee and -cross fittings.
5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
7. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum
3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded or grooved.

C. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
2. Pressure Rating: 175-psig minimum
3. Body Material: Cast- or ductile-iron housing with sight glass.
4. Size: Same as connected piping.
5. Inlet and Outlet: Threaded.

D. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
3. Pressure Rating: 175-psig minimum300 psig.
4. Size: Same as connected piping, for sprinkler.

2.5 SPRINKLERS

A. Acceptable Manufacturers:
1. Reliable Automatic Sprinkler Co.
2. Tyco Fire & Building Products LP.
3. Victaulic Company.
4. Viking Corporation.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

C. Pressure Rating for Residential Sprinklers: 175-psig maximum.

D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.

E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum

F. Automatic Sprinklers with Heat-Responsive Element:
1. Nonresidential Applications: UL 199.

2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

G. Sprinkler Finishes: as directed by architect.

H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: one piece, with minimum 0.51-inch vertical adjustment.
2. Sidewall Mounting: one piece, with minimum 0.5-inch vertical adjustment.

I. Sprinkler Guards:
1. Standard: UL 199.
2. Type: Wire cage with fastening device for attaching to sprinkler.

2.6 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Operated Alarm Bell:
1. Standard: UL 464.
2. Type: Vibrating, metal alarm bell.
3. Size: 6-inch minimum diameter.
4. Finish: Red-enamel factory finish, suitable for outdoor use.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

C. Sprinkler Alarm Horn Strobe and Sign Combination
1. The device shall consist of a weatherproof 24 V strobe horn, weatherproof backbox and red non corrosive sign with white lettering identifying it as a sprinkler alarm with instructions to contact the fire department or 911. The strobe horn shall be cULus Listed. Sprinkler Alarm Strobe Horn shall be model SASH12/24.

D. Water-Flow Indicators:
1. Standard: UL 346.
2. Water-Flow Detector: Electrically supervised.
3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
4. Type: Paddle operated.
5. Pressure Rating: 250 psig.
6. Design Installation: Horizontal or vertical.

E. Valve Supervisory Switches:
1. Standard: UL 346.

2. Type: Electrically supervised.
3. Components: Single-pole, double-throw switch with normally closed contacts.
4. Design: Signals that controlled valve is in other than fully open position.
5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application

2.7 NPS 1/2NPS 1/2PRESSURE GAGES

A. Standard: UL 393.

B. Dial Size: 3-1/2- to 4-1/2-inch diameter.

C. Pressure Gage Range: 0- to 250-psig minimum.

D. Label: Include "WATER" label on dial face.

2.8 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Standard: UL 405.

B. Type: Exposed, projecting, for wall mounting.

C. Pressure Rating: 175 psig minimum.

D. Body Material: Corrosion-resistant metal.

E. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

F. Caps: Brass, lugged type, with gasket and chain.

G. Escutcheon Plate: Round, brass, wall type.

H. Outlet: Back, with pipe threads.

I. Number of Inlets: Two .

J. Escutcheon Plate Marking: Similar to "AUTO SPKR ."

K. Finish: Rough brass or bronze unless otherwise directed by owner or AHJ.

L. Outlet Size: NPS 4.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
   1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
   2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.

C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.

N. Fill sprinkler system piping with water.

O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
   1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

K. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:
   1. Install valves in vertical position for proper direction of flow, in main supply to system.
   2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
   3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.

B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.7 FIRE DEPARTMENT CONNECTION EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.8 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install wall-type fire-department connections.

B. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

3.9 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
   4. Energize circuits to electrical equipment and devices.
   5. Coordinate with fire-alarm tests. Operate as required.
   6. Verify that equipment hose threads are same as local fire department equipment.

B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.12 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain the system.

END OF SECTION 211313

SECTION 220517- SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-seal systems.
   3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
   1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
   2. Pressure Plates: Carbon steel.
   3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
   1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:
   1. Exterior Concrete Walls above Grade: Galvanized-steel-pipe sleeves.
   2. Exterior Concrete Walls below Grade:
      a. Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   3. Concrete Slabs-on-Grade:
      a. Galvanized-steel-pipe sleeves with sleeve-seal system.
         1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
   4. Concrete Slabs above Grade:
      a. PVC-pipe sleeves.
   5. Interior Partitions:
      a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
      b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220518- ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Escutcheons.
   2. Floor plates.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
   1. Escutcheons for New Piping:
      a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519- METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-Standard: ASME B40.200.

A. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch (76-mm) nominal diameter.

B. Dial: Non-reflective aluminum with permanently etched scale markings and scales in deg F and deg C.

C. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

D. Connector Size: 1/2 inch (13 mm), with ASME B1.1 screw threads.

E. Stem: 0.25 or 0.375 inch (6.4 or 9.4 mm) in diameter; stainless steel.

F. Window: Plain glass or plastic.

G. Ring: Stainless steel.

H. Element: Bimetal coil.

I. Pointer: Dark-colored metal.

J. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 9-inch (229-mm) nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
8. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Plastic; 9-inch (229-mm) nominal size unless otherwise indicated.
3. Case Form: Adjustable angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue or red organic liquid.
5. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum, brass, or stainless steel and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
8. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.

6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Standard: ASME B40.100.
2. Case: Liquid-filled type(s); cast aluminum or drawn steel; 6-inch (152-mm) nominal diameter.
3. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
4. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
5. Movement: Mechanical, with link to pressure element and connection to pointer.
6. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
7. Pointer: Dark-colored metal.
8. Window: Glass or plastic.
9. Ring: Brass.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

2.6 METERING

A. Meters capable of the following:
1. Recording daily water consumption.
2. Communicating data remotely.
3. Electronic data storage for five years.
4. Reports showing daily, monthly, and annual water consumption.

5. Alarming capability in accordance with Water User Efficiency Plan for Operation.

B. Meter potable and reclaimed water sources to the building and onsite non-potable water sources individually.

C. Submeter the following:
1. Automatically controlled irrigation systems.
2. Tenant spaces.
3. Makeup-water lines to onsite water collection systems.
4. Makeup-water lines to ornamental water features.
5. Makeup-water lines to indoor and outdoor pools.
6. Makeup-water lines to and blowdown lines from cooling towers.
7. Makeup-water lines to steam boilers.
8. Makeup-water lines to evaporative coolers.
9. Makeup-water lines to open-loop fluid coolers.
10. Makeup-water lines to open-loop chillers.
11. Makeup-water lines to closed-loop systems.
12. Roof spray systems.
13.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlets and outlets of each domestic water heat exchanger.
   3. Inlet and outlet of each domestic hot-water storage tank.
   4. Inlet and outlet of each remote domestic water chiller.
   5.

K. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.
   4.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

A. Thermometers at inlet and outlet of each domestic water heater shall be one of the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Industrial-style, liquid-in-glass type.

B. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Industrial-style, liquid-in-glass type.

C. Thermometers at inlet and outlet of each domestic hot-water storage tank shall be one of the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Industrial-style, liquid-in-glass type.

D. Thermometers at inlet and outlet of each remote domestic water chiller shall be one of the following:
   1. Liquid-filled, bimetallic-actuated type.
   2. Industrial-style, liquid-in-glass type.

E. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F and 0 to 150 deg C.

C.

3.4 PRESSURE-GAGE SCHEDULE

A. Pressure gages at discharge of each water service into building shall be the following:
   1. Liquid-filled, direct-mounted, metal case.
   2. Sealed, direct-mounted, plastic case.

B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
   1. Liquid-filled, direct-mounted, metal case.
   2. Sealed, direct-mounted, plastic case.

C. Pressure gages at suction and discharge of each domestic water pump shall be the following:
   1. Liquid-filled, direct-mounted, metal case.
   2. Sealed, direct-mounted, plastic case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 160 psi and 0 to 1100 kPa.

B. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

END OF SECTION 220519

SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

B. Related Sections:
   1. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. RS: Rising stem.

G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set angle, gate, and globe valves closed to prevent rattling.
   4. Set ball and plug valves open to minimize exposure of functional surfaces.
   5. Set butterfly valves closed or slightly open.
   6. Block check valves in either closed or open position.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valve Actuator Types:
   1. Handlever: For quarter-turn valves NPS 6 and smaller.

E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
   1.
   2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
   3. Butterfly Valves: With extended neck.

F. Valve-End Connections:
   1. Solder Joint: With sockets according to ASME B16.18.
   2. Threaded: With threads according to ASME B1.20.1.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Conbraco Industries, Inc.; Apollo Valves.
      b. Crane Co.; Crane Valve Group; Crane Valves.
      c. NIBCO INC.
      d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
   2. Description:
      a. Standard: MSS SP-110.
      b. SWP Rating: 150 psig.
      c. CWP Rating: 600 psig.
      d. Body Design: Two piece.
      e. Body Material: Bronze.
      f. Ends: Threaded.
      g. Seats: PTFE or TFE.
      h. Stem: Bronze.
      i. Ball: Chrome-plated brass.
      j. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:
   1. Shutoff Service: Ball valves.
   2. Throttling Service: Ball valves.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze with bronze trim.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Metal pipe hangers and supports.
   2. Trapeze pipe hangers.
   3. Thermal-hanger shield inserts.
   4. Fastener systems.
   5. Pipe positioning systems.
   6. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
   1. Trapeze pipe hangers.
   2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
   3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
   4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Stainless-Steel Pipe Hangers and Supports:
   1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
   2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
   3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:
   1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
   2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Non-staining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
   1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
   2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:
1. Attach clamps and spacers to piping.
   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
   3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
   4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
   5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
   6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
   7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
   8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
   9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
   2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
   2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
   5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
   6. C-Clamps (MSS Type 23): For structural shapes.
   7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
      a. Light (MSS Type 31): 750 lb.
      b. Medium (MSS Type 32): 1500 lb.
      c. Heavy (MSS Type 33): 3000 lb.
   8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
   9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
   2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
   3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
   2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
   3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220553- IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:
1. Material and Thickness: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
6. Fasteners: Stainless-steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: White.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

J. Pipe Label Color Schedule:
1. Low-Pressure Compressed Air Piping:
   a. Background: Safety blue.
   b. Letter Colors: White.

2. High-Pressure Compressed Air Piping:
    a. Background: Safety blue.
    b. Letter Colors: White.
3. Domestic Water Piping
    a. Background: Safety green.
    b. Letter Colors: White.
4. Sanitary Waste and Storm Drainage Piping:
    a. Background Color: Safety black.
    b. Letter Color: White.

END OF SECTION 220553

SECTION 220719 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:
   1. Domestic hot-water piping.
   2. Domestic recirculating hot-water piping.
   3. Sanitary waste piping exposed to freezing conditions.
   4. Storm-water piping exposed to freezing conditions.
   5. Roof drains and rainwater leaders.
   6. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:
   1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
   2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Special-Shaped Insulation: ASTM C 552, Type III.
   2. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
   3. Preformed Pipe Insulation with Factory-Applied: Comply with ASTM C 552, Type II, Class 2.

4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. PVC Jacket Adhesive: Compatible with PVC jacket.
1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 SEALANTS

A. Joint Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F.
4. Color: White or gray.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: Aluminum.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.
   5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
   2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
   3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White Color-code jackets based on university system. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
    a. Same material, finish, and thickness as jacket.
    b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    c. Tee covers.
    d. Flange and union covers.
    e. End caps.
    f. Beveled collars.
    g. Valve covers.
    h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

D. Underground Direct-Buried Jacket: 125-mil-thick vapor barrier and waterproofing membrane consisting of a rubberized bituminous resin reinforced with a woven-glass fiber or polyester scrim and laminated aluminum foil.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches.
2. Thickness: 11.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches.
2. Thickness: 6.5 mils.
3. Adhesion: 90 ounces force/inch in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
2. Thickness: 6 mils.

3. Adhesion: 64 ounces force/inch in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
2. Thickness: 3.7 mils.
3. Adhesion: 100 ounces force/inch in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

C. Wire: 0.080-inch nickel-copper alloy.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers,:
1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures,:
1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable

insulation cover. For below-ambient services, provide a design that maintains vapor barrier.

6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.

2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install cut sections of polyolefin pipe and sheet insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.
   1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of

threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Hot and Recirculated Hot Water piping up to 1-1/4": Insulation shall be one of the following:
1. Flexible Elastomeric: 1-1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
3. Polyolefin: 1-1/2 inch thick.

B. Domestic Hot and Recirculated Hot Water piping greater than 1-1/4": Insulation shall be one of the following:
1. Flexible Elastomeric: 2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
3. Polyolefin: 2 inch thick.

C. Domestic Cold Water piping up to 1-1/4": Insulation shall be one of the following:
1. Flexible Elastomeric: 3/4 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
3. Polyolefin: 3/4 inch thick.

D. Domestic Cold Water piping greater than 1-1/4": Insulation shall be one of the following:
1. Flexible Elastomeric: 1-1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
3. Polyolefin: 1-1/2 inch thick.

E. Roof Drain Piping: Insulation shall be one of the following:
1. Flexible Elastomeric: 1-1/2 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3. Polyolefin: 1-1/2 inch thick.

F. Piping Exposed to Ambient Conditions: Insulation shall be one of the following:
1. Flexible Elastomeric: 3 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch thick.
3. Polyolefin: 3 inch thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:
1. White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

D. Piping, Exposed:
1. PVC, Color-Coded by System: 20 mils thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

3.16 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified by architect.

B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Aboveground domestic water pipes, tubes, and fittings inside buildings.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
   1. Notify Owner no fewer than two days in advance of proposed interruption of water service.
   2. Do not interrupt water service without Owner's written permission.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
   1. Store PEX tubing in cartons or under cover to avoid dirt or foreign material from entering the tubing.
   2. Do not expose PEX tubing to direct sunlight for more than 30 days. If construction delays are encountered, cover the tubing to prevent exposure to direct sunlight.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61.

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

D. Copper Unions:
   1. MSS SP-123.
   2. Cast-copper-alloy, hexagonal-stock body.
   3. Ball-and-socket, metal-to-metal seating surfaces.
   4. Solder-joint or threaded ends.

E. Copper Pressure-Seal-Joint Fittings:
   1. Fittings for NPS 2 (DN 50) and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
   2. Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

F. Copper Push-on-Joint Fittings:
   1. Description:
      a. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
      b. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 CPVC PIPING

A. CPVC Pipe: ASTM F 441/F 441M, Schedule 40.
   1. CPVC Socket Fittings: ASTM F 438 for Schedule 40.
   2. CPVC Threaded Fittings: ASTM F 437, Schedule 80.

B. CPVC Piping System: ASTM D 2846/D 2846M, SDR 11, pipe and socket fittings.

C. CPVC Tubing System: ASTM D 2846/D 2846M, SDR 11, tube and socket fittings.

2.4 PEX TUBE AND FITTINGS

A. PEX Distribution System: ASTM F 877, SDR 9 tubing.Fittings in "Fittings for PEX Tube" Paragraph below are available in NPS 3/8 to NPS 1 (DN 10 to DN 25).

B. PEX Fittings: elbows, adapters, couplings, plugs, tees and multi-port tees (1/2 inch through 3 inch nominal pipe size): ASTM F1960 cold-expansion fitting manufactured from the following material types:
   1. UNS No. C69300 Lead-free (LF) Brass.
   2. 20% glass-filled polysulfone as specified in ASTM D 6394.
   3. Unreinforced polysulfone (group 01, class 1, grade 2) as specified in ASTM D 6394.
   4. Polyphenylsulfone (group 03, class 1, grade 2) as specified in ASTM D 6394.
   5. Blend of polyphenylsulfone (55-80%) and unreinforced polysulfone (rem.) as specified in ASTM D 6394.
   6. Reinforcing cold-expansion rings shall be manufactured from the same source as PEX piping manufacturer and marked "F1960".

C. Pre-Insulated Piping (1/2 inch (16mm) through 2 inch (50mm) nominal pipe size): PEX piping, with a closed-cell polyethylene foam insulation.

D. Multi-Port Tees: Multiple-outlet fitting complying with ASTM F 877 (CAN/CSA B137.5); with ASTM F 1960 inlets and outlets.
   1. Engineered polymer branch multi-port tee.
   2. Engineered polymer flow-through multi-port tee.
   3. Engineered polymer commercial branch multi-port tee.
   4. Engineered polymer commercial branch multi-port elbow.
   5. Engineered polymer commercial flow-through multi-port tee.

E. Manifolds: Multiple-outlet assembly complying with ASTM F 877 (CAN/CSA B137.5); with ASTM F 1960 outlets.
   1. Engineered polymer valved manifold.
   2. Engineered polymer valveless manifold.
   3. Lead - free copper branch manifold.
   4. Lead-free copper valved manifold.

F. PEX-to-Metal Transition Fittings:
   1. Manufacturers: Provide fittings from the same manufacturer of the piping.

2. Threaded Brass to PEX Transition: one-piece brass fitting with male or female threaded adapter and ASTM F 1960 cold-expansion end, with PEX reinforcing cold-expansion ring.
3. Brass Sweat to PEX Transition: one-piece brass fitting with sweat adapter and ASTM F 1960 cold-expansion end, with PEX-a reinforcing cold-expansion ring.
4. PEX to Flange Transition: two-piece brass fitting with lead-free ProPEX adapter and steel flange conforming to ASME B 16.5.

G. PEX-to-Thermoplastic Transition Fittings: CPVC to PEX Transition: Thermoplastic fitting with one spigot or socket end and one ASTM F 1960 cold-expansion end, with PEX reinforcing cold-expansion ring.

H. VALVES
1. PEX-to-PEX, Lead Free (LF) Brass Ball Valves (1/2 inch (16 mm) through 2 inch (50 mm) nominal pipe size)
   a. Manufacturers: Provide ball valve(s) from the same manufacturer as the piping system.
   b. Full-port ball valve: two-piece, ASTM F1960 cold-expansion ends, with PEX reinforcing cold-expansion ring.
   c. LF brass valve with a positive stop shoulder manufactured from C69300 brass.
   d. In compliance with: 250 CWP, ANSI/NSF 359, ANSI/NSF 14/61, cNSF-us-pw_G lead free 0.25% Lead max., ASTM F1960, ASTM F 877 (CAN/CSA B137.5).

2.5 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.
   a.

2.6 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:
1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.'

2.7 TRANSITION FITTINGS

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Cascade Waterworks Manufacturing.
      b. Dresser, Inc.; Piping Specialties Products.
      c. Ford Meter Box Company, Inc. (The).
      d. JCM Industries.
      e. Romac Industries, Inc.
      f. Smith-Blair, Inc.; a Sensus company.
      g. Viking Johnson.

2.8 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
      b. Central Plastics Company.
      c. Hart Industries International, Inc.
      d. Jomar International.
      e. Matco-Norca.
      f. McDonald, A. Y. Mfg. Co.
      g. Watts; a division of Watts Water Technologies, Inc.
      h. Wilkins; a Zurn company.
   2. Standard: ASSE 1079.
   3. Pressure Rating: 250 psig at 180 deg F.
   4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. 175 psig minimum150 psigDielectric Nipples:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elster Perfection Corporation.
      b. Grinnell Mechanical Products; Tyco Fire Products LP.
      c. Matco-Norca.
      d. Precision Plumbing Products, Inc.
      e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install shutoff valve immediately upstream of each dielectric fitting.

C. Install domestic water piping level without pitch and plumb.

D. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

M. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 230519 "Meters and Gages for Hydronic Piping."

N. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

O. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 230519 "Meters and Gages for Hydronic Piping."

3.2 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.3 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. NPS 1-1/2NPS 2Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

3.5 NPS 2-1/2 to NPS 4HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. "Hangers and Supports for Plumbing Piping and Equipment."
   1. Vertical Piping: MSS Type 8 or 42, clamps.
   2. Individual, Straight, Horizontal Piping Runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   3. 100 Feet100 Feet100 FeetBase of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
   2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
   3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.

F. NPS 2-1/2108 inches1/2-inchNPS 3 to NPS 510 feet1/2-inchInstall supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 230553 "Identification for Mechanical Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Piping Inspections:
    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:
1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
   1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
   2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
      a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
      b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
   1. Hard copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
   2. NPS 2NPS 2-1/2Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
   3. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221116 - DOMESTIC WATER PIPING

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SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Vacuum breakers.
   2. Backflow preventers.
   3. Water pressure-reducing valves.
   4. Balancing valves.
   5. Temperature-actuated, water mixing valves.
   6. Strainers.
   7. Outlet boxes.
   8. Hose stations.
   9. Hose bibbs.
   10. Wall hydrants.
   11. Ground hydrants.
   12. Post hydrants.
   13. Drain valves.
   14. Water-hammer arresters.
   15. Air vents.
   16. Trap-seal primer valves.
   17. Trap-seal primer systems.
   18. Specialty valves.
   19. Flexible connectors.
   20. Water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
   1. Standard: ASSE 1001.
   2. Size: NPS 1/4 to NPS 3, as required to match connected piping.
   3. Body: Bronze.
   4. Inlet and Outlet Connections: Threaded.

B. Hose-Connection Vacuum Breakers:
   1. Standard: ASSE 1011.
   2. Body: Bronze, nonremovable, with manual drain.
   3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.

C. Pressure Vacuum Breakers :
   1. Standard: ASSE 1020.
   2. Operation: Continuous-pressure applications.
   3. Pressure Loss: 5 psig maximum, through middle third of flow range.
   4. Accessories:
      a. Valves: Ball type, on inlet and outlet.

D. Laboratory-Faucet Vacuum Breakers:
   1. Standard: ASSE 1035.
   2. Size: NPS 1/4 or NPS 3/8 matching faucet size.
   3. Body: Bronze.
   4. End Connections: Threaded.
   5. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers :

1. Standard: ASSE 1056.
2. Operation: Continuous-pressure applications.
3. Accessories:
    a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:
1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Body: Bronze.

B. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check, Backflow-Prevention Assemblies:
1. Standard: ASSE 1015.
2. Operation: Continuous-pressure applications unless otherwise indicated.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
    a. ValvesNPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. ValvesNPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

D. Beverage-Dispensing-Equipment Backflow Preventers:
1. Standard: ASSE 1022.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/4 or NPS 3/8.
4. Body: Stainless steel.
5. End Connections: Threaded.

E. Dual-Check-Valve Backflow Preventers:
1. Standard: ASSE 1024.

2. Operation: Continuous-pressure applications.
3. Body: Bronze with union inlet.

F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:
1. Standard: ASSE 1032.
2. Operation: Continuous-pressure applications.
3. Size: NPS 1/4 or NPS 3/8.
4. Body: Stainless steel.
5. End Connections: Threaded.

G. Reduced-Pressure-Detector, Fire-Protection, Backflow-Preventer Assemblies:
1. Standard: ASSE 1047 and is FM Global approved or UL listed.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 psig maximum, through middle third of flow range.
4. Body: Stainless steel.
5. End Connections: Flanged.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
   a. Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.
   c. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

H. Double-Check, Detector-Assembly Backflow Preventers:
1. Standard: ASSE 1048 and is FM Global approved or UL listed.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 5 psig maximum, through middle third of flow range.
4. Body: Stainless steel.
5. End Connections: Flanged.
6. Configuration: Designed for horizontal, straight-through flow.
7. Accessories:
   a. Valves: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
   b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.

I. Hose-Connection Backflow Preventers:
1. Standard: ASSE 1052.
2. Operation: Up to 10-foot head of water back pressure.
3. Inlet Size: NPS 1/2 or NPS 3/4.
4. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
5. Capacity: At least 3-gpm flow.

J. Backflow-Preventer Test Kits :
1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators :
   1. Standard: ASSE 1003.
   2. Pressure Rating: Initial working pressure of 150 psig.
   3. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
   4. Valves for Booster Heater Water Supply: Include integral bypass.
   5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water-Control Valves :
   1. Description: Pilot-operated, diaphragm-type, single-seated, main water-control valve.
   2. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
   3. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
      a. Pattern: Globe-valve design.
      b. Trim: Stainless steel.
   4. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
   1. Type: Y-pattern globe valve with two readout ports and memory-setting indicator.
   2. Body: Brass or bronze.
   3. Size: Same as connected piping, but not larger than NPS 2.
   4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves :
   1. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
   2. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves :
   1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
   2. Pressure Rating: 400-psig minimum CWP.
   3. Size: NPS 2 or smaller.
   4. Body: Copper alloy.
   5. Port: Standard or full port.
   6. Ball: Chrome-plated brass.
   7. Seats and Seals: Replaceable.
   8. End Connections: Solder joint or threaded.
   9. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices :
   1. Standard: ASSE 1017.
   2. Pressure Rating: 125 psig.
   3. Type: Thermostatically controlled, water mixing valve.
   4. Material: Bronze body with corrosion-resistant interior components.
   5. Connections: Threaded union inlets and outlet.
   6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   7. Tempered-Water Setting: 110 F

B. Primary, Thermostatic, Water Mixing Valves :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Armstrong International, Inc.
      b. Lawler Manufacturing Company, Inc.
      c. Leonard Valve Company.
      d. Powers.
      e. Symmons Industries, Inc.
      f. Zurn Industries, LLC.
   2. Standard: ASSE 1017.
   3. Pressure Rating: 125 psigminimum unless otherwise indicated.
   4. Type: Exposed-mounted, thermostatically controlled, water mixing valve.
   5. Material: Bronze body with corrosion-resistant interior components.
   6. Connections: Threaded union inlets and outlet.
   7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
   8. Tempered-Water Setting: 110 F
   9. Tempered-Water Design Flow Rate: 145 gpm

C. Manifold, Thermostatic, Water Mixing-Valve Assemblies:
   1. Description: Factory-fabricated, exposed-mounted, thermostatically controlled, water mixing-valve assembly in three-valve parallel arrangement.
   2. Large-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
   3. Intermediate-Flow Parallel: Thermostatic, water mixing valve and downstream-pressure regulator with pressure gages on inlet and outlet.
   4. Small-Flow Parallel: Thermostatic, water mixing valve.
   5. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
   6. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
   7. Pressure Rating: 125 psig minimum unless otherwise indicated.

D. Individual-Fixture, Water Tempering Valves:
   1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
   2. Pressure Rating: 125 psig minimum unless otherwise indicated.

3. Body: Bronze body with corrosion-resistant interior components.
4. Temperature Control: Adjustable.
5. Inlets and Outlet: Threaded.
6. Finish: Rough or chrome-plated bronze.
7. Tempered-Water Setting: 110 F

E. Primary Water Tempering Valves:
1. Standard: ASSE 1017, thermostatically controlled, water tempering valve, listed as tempering valve.
2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze.
4. Temperature Control: Manual.
5. Inlets and Outlet: Threaded.

2.8 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
   a. Strainers NPS 2 and Smaller: 0.033 inch.
   b. Strainers NPS 2-1/2 to NPS 4: 0.062 inch.
   c. Strainers NPS 5 and Larger: 0.125 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.9 OUTLET BOXES

A. Clothes Washer Outlet Boxes :
1. Mounting: Recessed.
2. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
5. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
6. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes <Insert drawing designation if any>:

1. Mounting: Recessed.
2. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.10 HOSE STATIONS

A. Single-Temperature-Water Hose Stations:
1. Standard: ASME A112.18.1.
2. Cabinet: Stainless-steel enclosure with exposed valve handle, hose connection, and hose rack. Include thermometer in front.
3. Hose-Rack Material: Stainless steel.
4. Body Material: Bronze.
5. Body Finish: Rough bronze.
6. Mounting: Wall, with reinforcement.
7. Supply Fittings: NPS 3/4 gate, globe, or ball valve and check valve and NPS 3/4 copper, water tubing. Omit check valve if check stop is included with fitting.
8. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
9. Nozzle: With hand-squeeze, on-off control.
10. Vacuum Breaker:
    a. Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

B. Hot- and Cold-Water Hose Stations:
1. Standard: ASME A112.18.1.
2. Faucet Type: Blending valve.
3. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and hose rack. Include thermometer in front.
4. Hose-Rack Material: Stainless steel.
5. Body Material: Bronze.
6. Body Finish: Rough bronze.
7. Mounting: Wall, with reinforcement.
8. Supply Fittings: Two NPS 3/4 gate, globe, or ball valves and check valves and NPS 3/4 copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 50 feet long.
10. Nozzle: With hand-squeeze, on-off control.
11. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

2.11 HOSE BIBBS

A. Hose Bibbs :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Woodford Manufacturing Company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.12 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Woodford Manufacturing Company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Chrome plated.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): Two with each wall hydrant.

B. Nonfreeze, Hot- and Cold-Water Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Woodford Manufacturing Company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Vacuum Breaker:
   a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Keys(s): Two with each wall hydrant.

C. Moderate-Climate Wall Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Woodford Manufacturing Company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Inlet: NPS 3/4 or NPS 1.
6. Outlet:

a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7.

7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet:
   a. Concealed, with integral vacuum breaker or nonremovable hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

D. Vacuum Breaker Wall Hydrants :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Watts; a Watts Water Technologies company.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 1/2 or NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

2.13 GROUND HYDRANTS

A. Nonfreeze Ground Hydrants <Insert drawing designation if any>:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Woodford Manufacturing Company.
   f. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, concealed-outlet ground hydrant with box.
4. Operation: Loose key.

5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Inlet: NPS 3/4.
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Box: Deep pattern with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Operating Key(s): Two with each ground hydrant.
12. Vacuum Breaker: ASSE 1011.

2.14 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. Watts; a Watts Water Technologies company.
   d. Woodford Manufacturing Company.
   e. Zurn Industries, LLC.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker:
   a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
   b. Garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each loose-key-operation wall hydrant.

B. Nonfreeze, Nondraining-Type Post Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Jay R. Smith Mfg. Co.
   b. MIFAB, Inc.
   c. Watts; a Watts Water Technologies company.
   d. Woodford Manufacturing Company.
   e. Zurn Industries, LLC.
2. Operation: Lever-piston operating mechanism and nondraining water-storage reservoir, designed without drain.
3. Length: As required for burial of valve below frost line.
4. Inlet: NPS 1 threaded.
5. Outlet:

a. NPS 1 (DN 25) outlet and coupling plug for 1-inch (25-mm) hose.
b. NPS 1 by NPS 3/4 (DN 25 by DN 20) adapter with nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
c. Garden-hose thread complying with ASME B1.20.7 on outlet.
d. NPS 1 by NPS 3/4 (DN 25 by DN 20) adapter with nonremovable, drainable, hose-connection backflow preventer complying with ASSE 1052.
e. Garden-hose thread complying with ASME B1.20.7 on outlet.

C. Freeze-Resistant Sanitary Yard Hydrants:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Jay R. Smith Mfg. Co.
b. MIFAB, Inc.
c. Watts; a Watts Water Technologies company.
d. Woodford Manufacturing Company.
e. Zurn Industries, LLC.
2. Standard: ASSE 1057, Type 5 for nondraining hydrants.
3. Operation: Wheel handle.
4. Head: Copper alloy, with pail hook.
5. Inlet: NPS 3/4-inch (DN 20) threaded inlet and inlet nozzle, galvanized-steel riser, and venturi.
6. Canister: Zinc-plated steel with atmospheric-vent device.
7. Vacuum Breaker:
a. Removable hose-connection backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7 on outlet for field installation.

2.15 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: ASTM B 62 bronze.
5. Inlet: NPS 3/4 (DN 20) threaded or solder joint.

6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

C. Stop-and-Waste Drain Valves <Insert drawing designation if any>:
1. Standard: MSS SP-110 for ball valves or MSS SP-80 for gate valves.
2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy or ASTM B 62 bronze.
5. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.16 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters :
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows or Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.17 AIR VENTS

A. Bolted-Construction Automatic Air Vents:
1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 (DN 15) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

B. Welded-Construction Automatic Air Vents:
1. Body: Stainless steel.
2. Pressure Rating: 150-psig (1035-kPa) minimum pressure rating.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.18 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig (860 kPa) minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Device:
   1. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.
   2. Size: NPS 1-1/4 (DN 32) minimum.
   3. Material: Chrome-plated, cast brass.

2.19 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems :
   1. Standard: ASSE 1044.
   2. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing.
   3. Cabinet: Recessed-mounted steel box with stainless-steel cover.
   4. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
      a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   5. Vacuum Breaker: ASSE 1001.
   6. Number Outlets: Eight.
   7. Size Outlets: NPS 1/2 (DN 15).

2.20 SPECIALTY VALVES

A. Comply with requirements for general-duty metal valves in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

2.21 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
   2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.
   3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged copper alloy.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
   1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
   2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.
   3. End Connections NPS 2-1/2 (DN 65) and Larger: Flanged steel nipple.

2.22 WATER METERS

A. Displacement-Type Water Meters:

1. Description:
    a. Standard: AWWA C700.
    b. Pressure Rating: 150-psig (1035-kPa) working pressure.
    c. Body Design: Nutating disc; totalization meter.
    d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
    e. Case: Bronze.
    f. End Connections: Threaded.

B. Turbine-Type Water Meters:
1. Description:
    a. Standard: AWWA C701.
    b. Pressure Rating: 150-psig (1035-kPa) working pressure.
    c. Body Design: Turbine; totalization meter.
    d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
    e. Case: Bronze.
    f. End Connections for Meters NPS 2 (DN 50) and Smaller: Threaded.
    g. End Connections for Meters NPS 2-1/2 (DN 65) and Larger: Flanged.

C. Compound-Type Water Meters:
1. Description:
    a. Standard: AWWA C702.
    b. Pressure Rating: 150-psig (1035-kPa) working pressure.
    c. Body Design: With integral mainline and bypass meters; totalization meter.
    d. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
    e. Case: Bronze.
    f. Pipe Connections: Flanged.

D. Remote Registration System: Direct-reading type complying with AWWA C706; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

E. Remote Registration System: Encoder type complying with AWWA C707; modified with signal-transmitting assembly, low-voltage connecting wiring, and remote register assembly as required by utility company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install Y-pattern strainers for water on supply side of each control valve and pump.

B. Install air vents at high points of water piping.

3.2 FIELD QUALITY CONTROL

A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

B. Prepare test and inspection reports.

END OF SECTION 221119

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.

B. Related Section:
   1. Section 221313 "Facility Sanitary Sewers" for sanitary sewerage piping and structures outside the building.

1.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 74, class.

B. Gaskets: ASTM C 564, rubber.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. CISPI, Hubless-Piping Couplings:
   1. Standards: ASTM C 1277 and CISPI 310.
   2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:
   1. Standards: ASTM C 1277 and ASTM C 1540.
   2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 STAINLESS-STEEL PIPE AND FITTINGS

A. Pipe and Fittings: ASME A112.3.1, drainage pattern with socket and spigot ends.

B. Internal Sealing Rings: Elastomeric gaskets shaped to fit socket groove.

2.5 ABS PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall ABS Pipe: ASTM D 2661, Schedule 40.

C. Cellular-Core ABS Pipe: ASTM F 628, Schedule 40.

D. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.

E. Solvent Cement: ASTM D 2235.

2.6 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.7 COPPER TUBE AND FITTINGS

A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

D. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.
1.

2.8 SPECIALTY PIPE FITTINGS

A. Transition Couplings:
1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:
   a. Standard: ASTM C 1173.
   b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. Sleeve Materials:
      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
      3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Non-pressure Transition Couplings:
   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

B. Provide a minimum of 6” sand bedding below all below grade piping. Provide backfill free of boulders larger than two (2") inches. Compact and test all backfill according to astm compaction standards or provide pea gravel backfill.

C. Provide a minimum trench width of not less than 1.5 times the pipe outside diameter plus 12 inches for all below grade piping.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Drain: 2 percent downward in direction of flow for all piping.
   2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."

N. Plumbing Specialties:
   1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
   2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
   3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
   1. Install transition couplings at joints of piping with small differences in OD's.
   2. In Drainage Piping: Unshielded, non-pressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.
   1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
   2. Floor Drains: Drain outlet backwater valves unless drain has integral backwater valve.
   3. Install backwater valves in accessible locations.
   4. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
   1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
   2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
   3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
   4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
   5. Vertical Piping: MSS Type 8 or Type 42, clamps.
   6. Install individual, straight, horizontal piping runs:
      a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
      b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
   7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
   8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
   2. NPS 3: 60 inches with 1/2-inch rod.
   3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
   4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
   5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

G. Install supports for vertical cast-iron soil piping every 15 feet.

H. Install hangers for stainless-steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 2 (DN 50): 84 inches (2100 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 96 inches (2400 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 (DN 100): 108 inches (2700 mm) with 1/2-inch (13-mm) rod.
   4. NPS 6 (DN 150): 10 feet (3 m) with 5/8-inch (16-mm) rod.

I. Install supports for vertical stainless-steel piping every 10 feet (3 m).

J. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
   2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
   3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
   4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
   5. NPS 10 and NPS 12 (DN 250 and DN 300): 48 inches (1200 mm) with 7/8-inch (22-mm) rod.

K. Install supports for vertical ABS and PVC piping every 48 inches (1200 mm).

L. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1-1/4: 72 inches with 3/8-inch rod.
   2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
   3. NPS 2-1/2: 108 inches with 1/2-inch rod.
   4. NPS 3 and NPS 5: 10 feet with 1/2-inch rod.
   5. NPS 6: 10 feet with 5/8-inch rod.
   6. NPS 8: 10 feet with 3/4-inch rod.

M. Install supports for vertical copper tubing every 10 feet.

N. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
   1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
   2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
   3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
   4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
   5. Install horizontal backwater valves with cleanout cover flush with floor.
   6. Comply with requirements for backwater valves cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."

7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

E. Do not expose ABS or PVC piping to direct sunlight for more than 30 days. If construction delays are encountered, provide cover to portions of piping exposed to direct sunlight.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Copper DWV tube, copper drainage fittings, and soldered joints.
4. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
    a. When used in plenum returns piping to be completely enclosed in insulation that meets the flame spread index of not more than 25 and a smoke-developed index of not more than 50.
5. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
    a. When used in plenum returns piping to be completely enclosed in insulation that meets the flame spread index of not more than 25 and a smoke-developed index of not more than 50.

C. Underground, soil, waste, and vent piping shall be any of the following:
   1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
   2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
   3. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
   4. Solid-wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
   5.
   6.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

SECTION 221319- SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Floor drains.
4. Trench drains.
5. Channel drainage systems.
6. Air-admittance valves.
7. Roof flashing assemblies.
8. Miscellaneous sanitary drainage piping specialties.
9. Flashing materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

A. Horizontal, Cast-Iron Backwater Valves:

1. Standard: ASME A112.14.1.
2. Size: Same as connected piping.
3. Body: Cast iron.
4. Cover: Cast iron with bolted or threaded access check valve.
5. End Connections: Hub and spigot or hubless.

6. Type Check Valve: Removable, bronze, swing check, factory assembled or field modified to hang open for airflow unless subject to backflow condition.
7. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

B. Drain-Outlet Backwater Valves:

1. Size: Same as floor drain outlet.
2. Body: Cast iron or bronze made for vertical installation in bottom outlet of floor drain.
3. Check Valve: Removable ball float.
4. Inlet: Threaded.
5. Outlet: Threaded or spigot.

2.2 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
2. Size: Same as connected drainage piping
3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Closure: Countersunk or raised-head, brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Floor Cleanouts:

1. Standard: ASME A112.36.2M for adjustable housing cleanout.
2. Size: Same as connected branch.
3. Type: Adjustable housing.
4. Body or Ferrule: Cast iron.
5. Clamping Device: Required.
6. Outlet Connection: Spigot.
7. Closure: Brass plug with straight threads and gasket.
8. Adjustable Housing Material: Cast iron with threads.
9. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
10. Frame and Cover Shape: Round.
11. Top Loading Classification: Heavy Duty.
12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Standard: ASME A112.36.2M. Include wall access.
2. Size: Same as connected drainage piping.

3. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
4. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains (FD)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Josam Company.

   b. MIFAB, Inc.

   c. Smith, Jay R. Mfg. Co.

   d. Watts; a Watts Water Technologies company.

   e. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Top of Body and Strainer Finish: Nickel bronze.
6. Top Shape: Square
7. Dimensions of Top or Strainer: 6”
8. Trap Features: Provide with trap guard.

2.4 TRENCH DRAINS

A. Trench Drains :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Jay R. Smith Mfg. Co.
   b. Josam Company.
   c. MIFAB, Inc.
   d. Watts; a Watts Water Technologies company.
   e. Zurn Industries, LLC.

2. Standard: ASME A112.6.3 for trench drains.

3. Material: Ductile or gray iron.
4. Flange: Anchor.
5. Clamping Device: Required.
6. Outlet: Bottom.
7. Grate Material: Ductile iron or gray iron.
8. Grate Finish: Painted.
9. Top Loading Classification: Heavy Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Standard P-trap.

2.5 CHANNEL DRAINAGE SYSTEMS

A. Stainless-Steel Channel Drainage Systems :

1. ASME A112.3.1, Stainless-Steel Channel Drainage Systems:

2. Non-ASME A112.3.1, Stainless-Steel Channel Drainage Systems:

3. Type: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

    a. Standard: ASME A112.3.1, for trench drains.
    b. Channel Sections: Interlocking-joint, stainless-steel with level invert.

    c. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.

        1) Material: Stainless steel.
        2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

    d. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
    e. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
    f. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

4. Type: Modular system of stainless-steel channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

    a. Channel Sections: Interlocking-joint, stainless steel with level invert.

b. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channels.

1) Material: Stainless steel.
2) Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

c. Covers: Solid stainless steel, of width and thickness that fit recesses in channels, and of lengths indicated.
d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

B. Polymer-Concrete Channel Drainage Systems:

1. Narrow, Sloped-Invert, Polymer-Concrete Channel Drainage Systems:

2. Narrow, Level-Invert, Polymer-Concrete Channel Drainage Systems:

3. Wide, Level-Invert, Polymer-Concrete Channel Drainage Systems:

4. Type: Modular system of channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling.

a. Channel Sections: Narrow, interlocking-joint, sloped-invert, polymer-concrete modular units with end caps. Include rounded bottom, with built-in invert slope of 0.6 percent and with outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

1) Dimensions: 4-inch inside width. Include number of units required to form total lengths indicated.
2) Frame: Gray-iron or galvanized steel for grates.

b. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

c. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.
d. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.
e. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

f. Channel Sections: Narrow, interlocking-joint, precast, polymer-concrete modular units with end caps. Include rounded bottom, with level invert and with NPS 4 outlets in number and locations indicated.
   1) Frame: Gray-iron or galvanized steel for grates.

g. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

h. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

i. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

j. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

k. Channel Sections: Wide, interlocking-joint, precast, polymer-concrete modular units with end caps. Include flat or rounded bottom, with level invert and with outlets in number, sizes, and locations indicated.

l. Grates: Manufacturer's designation "heavy duty," with slots or perforations, and of width and thickness that fit recesses in channel sections.

m. Covers: Solid ductile or gray iron, of width and thickness that fit recesses in channel sections, and of lengths indicated.

n. Supports, Anchors, and Setting Devices: Manufacturer's standard, unless otherwise indicated.

o. Channel-Section Joining and Fastening Materials: As recommended by system manufacturer.

2.6 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Description: Manufactured assembly made of 6.0-lb/sq. ft., 0.0938-inch-thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

   a. Low-Silhouette Vent Cap: With vandal-proof vent cap.

2.7 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

B. Vent Caps:

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.8 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

G. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

H. Install deep-seal traps on floor drains and other waste outlets.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install grease interceptors, including trapping, venting, and flow-control fitting, according to authorities having jurisdiction and with clear space for servicing.

1. Above-Floor Installation: Set unit with bottom resting on floor, unless otherwise indicated.
2. Flush with Floor Installation: Set unit and extension, if required, with cover flush with finished floor.
3. Recessed Floor Installation: Set unit in receiver housing having bottom or cradle supports, with receiver housing cover flush with finished floor.
4. Install cleanout immediately downstream from interceptors not having integral cleanout on outlet.

N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Interceptors: Connect inlet and outlet to unit, and connect flow-control fitting and vent to unit inlet piping. Install valve on outlet of automatic drawoff-type unit.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.

2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 07 62 00 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 233713- DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Round ceiling diffusers.
2. Rectangular and square ceiling diffusers.
3. Perforated diffusers.
4. Louver face diffusers.
5. Linear bar diffusers.
6. Linear slot diffusers.
7. Adjustable bar grilles.
8. Fixed face grilles.
9. Linear bar grilles.

B. Related Sections:
1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:
1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anemostat Products; a Mestek company.
b. Carnes Company.

c. Hart & Cooley Inc.
d. Krueger.
e. Nailor Industries Inc.
f. Price Industries.
g. Shoemaker Mfg. Co.
h. Titus.
i. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.
5. Face Size: See drawings
6. Face Style: See drawings
7. Mounting: See drawings
8. Pattern: See drawings
9. Dampers: Radial opposed blade.
10. Accessories:
    a. Equalizing grid.
    b. Plaster ring.
    c. Safety chain.
    d. Wire guard.
    e. Sectorizing baffles.
    f. Operating rod extension.

B. Perforated Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. Anemostat Products; a Mestek company.
    b. Carnes Company.
    c. Hart & Cooley Inc.
    d. Krueger.
    e. Nailor Industries Inc.
    f. Price Industries.
    g. Shoemaker Mfg. Co.
    h. Titus.
    i. Tuttle & Bailey.
2.
3. Devices shall be specifically designed for variable-air-volume flows.
4. Material: Steel backpan and pattern controllers, with aluminum face.
5. Finish: Baked enamel, color selected by Architect.
6. Face Size: See drawings
7. Duct Inlet: See drawings
8. Face Style: Flush.
9. Mounting: See drawings.
10. Pattern Controller: None.
11. Dampers: None
12. Accessories:
    a. Equalizing grid.

b. Plaster ring.
c. Safety chain.
d. Wire guard.
e. Sectorizing baffles.
f. Operating rod extension.

C. Louver Face Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anemostat Products; a Mestek company.
b. Carnes Company.
c. Hart & Cooley Inc.
d. Krueger.
e. Nailor Industries Inc.
f. Price Industries.
g. Shoemaker Mfg. Co.
h. Titus.
i. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.
5. Face Size: See drawings
6. Mounting: See Drawings
7. Pattern: See Drawings
8. Dampers: Radial opposed blade.
9. Accessories:
a. Square to round neck adaptor.
b. Adjustable pattern vanes.
c. Throw reducing vanes.
d. Equalizing grid.
e. Plaster ring.
f. Safety chain.
g. Wire guard.
h. Sectorizing baffles.
i. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Anemostat Products; a Mestek company.
b. Carnes Company.
c. Hart & Cooley Inc.
d. Krueger.
e. Nailor Industries Inc.

f. Price Industries.
g. Shoemaker Mfg. Co.
h. Titus.
i. Tuttle & Bailey.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.
5. Narrow Core Spacing Arrangement: 1/8-inch- (3-mm-) thick blades spaced 1/4 inch (6 mm) apart, 15-degree deflection.
6. Frame: 1 inch (25 mm) wide.

B. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anemostat Products; a Mestek company.
   b. Carnes Company.
   c. Hart & Cooley Inc.
   d. Krueger.
   e. Nailor Industries Inc.
   f. Price Industries.
   g. Shoemaker Mfg. Co.
   h. Titus.
   i. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Aluminum,.
4. Material - Pattern Controller and Tees: Aluminum.
5. Finish - Face and Shell: Baked enamel, black.
6. Finish - Pattern Controller: Baked enamel, black.
7. Finish - Tees: Baked enamel, color selected by Architect.
8. Slot Width: See drawings.
9. Number of Slots: See drawings.
10. Length: See Drawings.
11. Accessories: Engineered plenum.

2.3 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Anemostat Products; a Mestek company.
   b. Carnes Company.
   c. Hart & Cooley Inc.
   d. Krueger.
   e. Nailor Industries Inc.
   f. Price Industries.
   g. Shoemaker Mfg. Co.

h. Titus.
i. Tuttle & Bailey.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch (13 mm) apart.
5. Core Construction: Integral.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 224216.13- COMMERCIAL LAVATORIES & SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Sinks
2. Sink faucets.
3. Laminar-flow, faucet-spout outlets.
4. Supply fittings.
5. Waste fittings.

B. Related Requirements:

1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SINKS

A. Sinks S-1: Stainless steel, under counter mounted, ADA compliant. Elkay ELUHAD or equal by below manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Tabco.
b. Elkay Manufacturing Co.
c. Just Manufacturing.

2. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Number of Compartments: One
c. Overall Dimensions: 15 ½ x15 ½ x 6
d. Material: 304, 18-8 Stainless Steel, 18 Gauge
e. Holes: No holes
f. Mounting Type: Undermount

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets for S-1: Single Handle High Arc Pulldown Faucet, ADA compliant

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Acorn Safety; a division of Acorn Engineering Company.
b. Bradley Corporation.
c. Encon Safety Products.
d. Guardian Equipment Co.
e. Haws Corporation.
f. Sellstrom Manufacturing Company.
g. Speakman Company.
h. WaterSaver Faucet Co.
i. Moen

2. Faucet

a. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole-punching; coordinate outlet with spout and sink receptor.
b. Body Type: Single hole.
c. Body Material: General-duty brass
d. Finish: Chrome
e. Maximum Flow Rate: 1.5 gpm.
f. Handle(s): Single Handle
g. Mounting Type: Deck, exposed.
h. Spout Type: Swinging Gooseneck with pull down head.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2.

2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

2.6 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.
b. Variable-air-volume systems.

2. Balancing Hydronic Systems:

a. Constant-volume air systems.
b. Variable-volume systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.5 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Certified Test and Balance.
2. Bonneville Test and Balance.
3. BTC Test and Balance.
4. Diamond Test and Balance.
5. R and S Analysis
6. Intermountain Test and Balance
7. Test and Balancing, Inc.
8. Independent Test and Balance

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

F. Examine test reports specified in individual system and equipment Sections.

G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

H. Examine terminal units; such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Isolating and balancing valves are open and control valves are operational.
6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", or ASHRAE 111-1988, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."

3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. All instruments used by the Contractor shall have been calibrated within the previous 12 months. The final balance report shall contain copies of calibration documents showing calibration tolerances, date of calibration and calibrating firm.

E. Air and water quantities shall be balanced to within 5% of the quantities shown.

F. Balance air flow at duct branch damper with outlet dampers full open.

G. Test, adjust and record fan RPM to design requirements, record initial and final readings.

H. Test and record motor amps, initial and final readings.

I. Make pitot tube traverse readings of main ducts and obtain design CFM for supply, return and outside air systems by adjusting fans and dampers.

J. Test and record systems static pressures, suction and discharge; record initial and final readings.

K. Test and adjust each terminal unit.

L. Check and record inlet static pressures and modulation limit CFM values, initial and final readings after adjustments.

M. The Balancing Contractor shall have a Controls Mechanic available at all times to assist the balancing personnel in adjusting control devices.

N. Clearly mark the final position of all dampers, diffusers, reheat boxes, etc. with permanent identification material, neatly applied so as to be easily read and understood.

O. Confusing or illegible markings shall be removed and reapplied as directed by the Project Manager.

P. All mechanical HVAC systems, air and water, shown on the plans shall be tested and adjusted To design flow. If heating air flow values are different than cooling, provide certification that Heating CFM values are within design.

Q. Replace sheaves and drives where required to meet design conditions.

R. Copies of a formal balance report shall be prepared and submitted for inclusion in the Operation And Maintenance Manuals. The report shall contain a complete, legible

schedule of:

1. All equipment outlets/inlets and their respective flows
2. Pitot tube traverse readings and associated calculations
3. Reheat box settings, GPM and CFM
4. Box static pressures at inlets
5. Box CFM limits (maximum and minimum)
6. Status of each pump and fan, including RPM, AMPS, suction and discharge static pressures, and flow rates.
7. A set of master plans shall be bound with the schedules (11" x 17" maximum) identifying the location of each inlet/outlet and device tested.
8. Calibration documents

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient spaces in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

    a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.

B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:

1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
3. Measure total system airflow. Adjust to within indicated airflow.
4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.

6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

7. Measure static pressure at the most critical terminal unit and adjust the maximum static-pressure set point at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit. Notify engineer if pressure is above the allowable range before making the adjustment.
8. Record final fan-performance data.

3.8 PROCEDURES FOR HYDRONIC SYSTEMS.

A. Command all systems into full cooling or heating mode (Valves may not be 100% open). Pumps VFCs shall modulate in automatic control to meet the static pressure set point. When pump speed is stable take measurements.

1. Balance circuit setters for the end of line three-way valves to design flow.
2. Measure and record water flows at each air handler coil.
3. Measure flow of each pump.

3.9 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

A. Before performing testing and balancing of existing systems, inspect existing equipment that is to

remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

B. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.

1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet.

3.11 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING HYDRONIC SYSTEMS.

A. Balancing procedures shall ensure that balancing valves are open as much as possible to minimize system pressure drop

B. Constant speed primary boiler pumps.

1. Set flow rate to rated GPM.

C. Variable speed secondary hot water and chilled water systems.

1. All two way valves are pressure-independent self-flow regulating valves which are not manually balanced.
2. With controls contractor, set systems into automatic control with the VFCs regulating system pressure to maintain the static pressure set point. Close enough two-way control valves closer to the pumps so the system flow rate is approximately 50% of design. All other valves shall be 100% open.

    a. Balance flow rates through coils with 3-way valves. Adjust BAS DP set point lower if required so at least one of the balancing valves is 100% open.
    b. Verify that the system DP set point is adequate to provide rated flow through a small sample of the 2-way valves.

3. Chilled water system:

    a. With the two-way valve closed and the three-way chilled water valves 100%

open;

1) Balance the flows through the three coils served by three-way valves. (One balancing valve shall be 100% open).
2) Determine the minimum pump speed required to maintain the minimum chiller evaporator flow rate. Contractor shall program the minimum pump speed in the VFC at 10% above this flow rate.

b. With the chilled water pump at minimum speed, change the three-way valves to the closed position and verify that the system flow rate is the same or greater than when the control valves are in the open position.

3.12 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
2. Air Outlets and Inlets: Plus or minus 5 percent.
3. Heating-Water Flow Rate: Plus or minus 5 percent.
4. Cooling-Water Flow Rate: Plus or minus 5 percent.

3.13 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Engineer's name and address.
6. Contractor's name and address.

7. Report date.
8. Signature of TAB supervisor who certifies the report.
9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
10. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

11. Nomenclature sheets for each item of equipment.
12. Data for terminal units, including manufacturer's name, type, size, and fittings.
13. Notes to explain why certain final data in the body of reports vary from indicated values.
14. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.

g. Type and model number.
h. Size.
i. Effective area in sq. ft.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Air velocity in fpm (m/s).
c. Preliminary air flow rate as needed in cfm (L/s).
d. Preliminary velocity as needed in fpm (m/s).
e. Final air flow rate in cfm (L/s).
f. Final velocity in fpm (m/s).
g. Space temperature in deg F (deg C).

F. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

a. System and air-handling-unit identification.
b. Location and zone.
c. Room or riser served.
d. Coil make and size.
e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Air flow rate in cfm (L/s).
b. Entering-water temperature in deg F (deg C).
c. Leaving-water temperature in deg F (deg C).
d. Water pressure drop in feet of head or psig (kPa).
e. Entering-air temperature in deg F (deg C).
f. Leaving-air temperature in deg F (deg C).

G. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.14 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check

measurements to verify that the system is operating according to the final test and balance readings documented in the final report.

2. Check the following for each system:

    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure water flow of at least 10 percent of terminals.
    c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    d. Verify that balancing devices are marked with final balance position.
    e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.
3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.15 ADDITIONAL TESTS

A. The Test and Balance Contractor shall include an extended warranty of 90 days after the completion of the project, during which time the Owner may request a recheck or re-set of any outlet, inlet, control, or mechanical unit.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 233113- METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 GENERAL

A. HVAC Duct shall be fabricated from galvanized steel in accordance with SMACNA requirements. Abrasive, corrosive, or hazardous materials shall be conveyed by systems described in Industrial Ventilation, latest edition, in harmony with the Fume Hood Section of these Design Standards. Nonmetallic duct shall not be used.

B. All seams of ducts shall be sealed with mastic or mastic plus tape or gasketing as appropriate to limit the air leakage to SMACNA requirements.

C. Flexible ductwork shall only be used at terminal units and shall not exceed eight feet. Hard turns, offsets, or kinks will not be allowed. Provide duct supports every three feet.

D. High pressure ductwork shall be galvanized steel spiral lockseam construction.

E. The high pressure duct and fittings shall be manufactured by the same firm.

F. High pressure ductwork shall be tested and total allowable leakage of the system shall not exceed SMACNA requirements.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS – SEAL CLASS A

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.
d. Sheet Metal Connectors, Inc.
e. Spiral Manufacturing Co., Inc.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Linx Industries (formerly Lindab).
2. McGill AirFlow LLC.
3. MKT Metal Manufacturing.
4. SEMCO LLC.
5. Sheet Metal Connectors, Inc.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.

2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
    b. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 0.028-inch (0.7-mm) perforated galvanized sheet steel having 3/32-inch- (2.4-mm-) diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F (0.039 W/m x K) at 75 deg F (24 deg C) mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

F. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.

1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F (0.034 W/m x K) at75 deg F (24 deg C) mean temperature.

2.5 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G60 (Z180).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.

6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. VOC: Maximum 395 g/L.
12. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
13. Service: Indoor or outdoor.
14. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.8 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.; a division of Cooper Industries.
2. Ductmate Industries, Inc.
3. Hilti Corp.
4. Kinetics Noise Control.
5. Loos & Co.; Cableware Division.
6. Mason Industries.
7. TOLCO; a brand of NIBCO INC.
8. Unistrut Corporation; Tyco International, Ltd..

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

F. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class A.
3. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
4. Conditioned Space, Exhaust Ducts: Seal Class A
5. Conditioned Space, Return-Air Ducts: Seal Class A.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.

11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."

1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
2. Brace a change of direction longer than 12 feet (3.7 m).

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:
1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

b. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
c. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
d. Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new and existing duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner or any ductwork noted on mechanical plans that require painting. Apply one coat of flat, latex paint over a compatible galvanized-steel primer.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

3.12 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior or pre-insulated high-density polyethylene.

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Constant-Volume Air-Handling Units:

a. Pressure Class: Positive 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

a. Pressure Class: Positive 4-inch wg (1000 Pa).
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Type 304, welded black iron.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 2-inch wg (500 Pa).
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

3. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg (500 Pa).
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

4. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 316, stainless-steel sheet.

1) Exposed to View: No. 4 finish.
2) Concealed: No. 2B finish.

b. PVC-coated, galvanized sheet steel with thicker coating on duct interior.
c. Pressure Class: Positive or negative 4-inch wg (1000 Pa).
d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
e. SMACNA Leakage Class: 3.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: C.
c. SMACNA Leakage Class for Rectangular: 24.
d. SMACNA Leakage Class for Round and Flat Oval: 24.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch (25 mm) thick.

H. Double-Wall Duct Interstitial Insulation:

1. Supply Air Ducts: 1 inch (25 mm) thick.
2. Acoustical Performance:
   a. NRC: 1.09 according to ASTM C 423.
   b. STC: 40 according to ASTM E 90.

I. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

   a. Velocity 1000 fpm (5 m/s) or Lower:
      1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      2) Mitered Type RE 4 without vanes.
   b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:
1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c.

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.
b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter.

J. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233113 - METAL DUCTS

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SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Control dampers.
3. Fire dampers.
4. Ceiling radiation dampers.
5. Combination fire and smoke dampers.
6. Turning vanes.
7. Remote damper operators.
8. Duct-mounted access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.
12. Louvers

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 (Z180).
   2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2.

C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Air Balance Inc.; a division of Mestek, Inc.
      b. American Warming and Ventilating; a division of Mestek, Inc.
      c. Flexmaster U.S.A., Inc.
      d. McGill AirFlow LLC.
      e. Nailor Industries Inc.
      f. Pottorff.
      g. Ruskin Company.
      h. Trox USA Inc.
      i. Vent Products Company, Inc.
   2. Standard leakage rating
   3. Suitable for horizontal or vertical applications.
   4. Frames:
      a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
      b. Mitered and welded corners.
      c. Flanges for attaching to walls and flangeless frames for installing in ducts.
   5. Blades:
      a. Multiple or single blade.
      b. Parallel- or opposed-blade design.
      c. Stiffen damper blades for stability.
      d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
   6. Blade Axles: Galvanized steel.
   7. Bearings:

a. Oil-impregnated bronze.
b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

2.4 CONTROL DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Cesco Products; a division of Mestek, Inc.
4. Greenheck Fan Corporation.
5. Lloyd Industries, Inc.
6. McGill AirFlow LLC.
7. Metal Form Manufacturing, Inc.
8. Nailor Industries Inc.
9. NCA Manufacturing, Inc.
10. Pottorff.
11. Ruskin Company.
12. Vent Products Company, Inc.
13. Young Regulator Company.

B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

C. Frames:
1. Hat shaped.
2. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
3. Mitered and welded corners.

D. Blades:
1. Multiple blade with maximum blade width of 6 inches (152 mm).
2. Opposed-blade design.
3. Galvanized-steel.
4. 0.064 inch (1.62 mm) thick single skin.
5. Blade Edging: Closed-cell neoprene.
6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.

E. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

F. Bearings:
1. Oil-impregnated bronze.

2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.5 FIRE DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. Type: Static and dynamic; rated and labeled in accordance with UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000 fpm (1 m/s) velocity.

D. Fire Rating: 1-1/2 hours.

E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed galvanized sheet steel, interlocking full-length steel blade connectors. Material gauge is to be in accordance with UL listing.

I. Horizontal Dampers: Include blade lock and stainless steel closure spring.

J. Heat-Responsive Device:
1. Replaceable, 165 deg F (74 deg C) rated, fusible links.

2.6 CEILING RADIATION DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. General Requirements:
1. Labeled according to UL 555C by an NRTL.
2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction; gauge in accordance with UL listing.

D. Blades: Galvanized sheet steel with refractory insulation; gauge in accordance with UL listing.

E. Heat-Responsive Device: Replaceable, 165 deg F (74 deg C) rated, fusible links.

F. Fire Rating: 1 hour(s).

2.7 COMBINATION FIRE AND SMOKE DAMPERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. General Requirements:
1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
3. Unless otherwise indicated, use parallel-blade configuration.

C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000 fpm (10 m/s) velocity.

D. Fire Rating: 1-1/2

E. Performance:
1. AMCA Certification: Test and rate in accordance with AMCE Publication 511.
2. Leakage:
   a. Class I: Leakage shall not exceed 4 cfm/sq. ft. (20 L/s/ per sq. m) against 1-inch wg (250-Pa) differential static pressure.
3. Pressure Drop: 0.05 in. wg (12.5 Pa) at 1500 fpm (7.6 m/s) across a 24-by-24-inch (600-by-600-mm) damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm (15 m/s).
5. Temperature: Minus 25 to plus 180 deg F (Minus 32 to plus 83 deg C).
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

F. Construction:
1. Suitable or horizontal or vertical airflow applications.

2. Linkage out of airstream.
3. Frame:
   a. Hat shaped.
   b. Galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
   c. Gauge is to be in accordance with UL listing.
4. Blades:
   a. Roll-formed, horizontal, airfoil or extruded aluminum.
   b. Maximum width and gauge in accordance with UL listing.
5. Blade Edging Seals:
   a. Silicone rubber.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of airstream.
8. Bearings:
   a. Molded synthetic.

G. Mounting Sleeve:
1. Factory installed, galvanized sheet steel.
2. Length to suit wall or floor application.
3. Gauge in accordance with UL listing.

H. Heat-Responsive Device:
1. Electric resettable device and switch package, factory installed, rated.

I. Master control panel for use in dynamic smoke-management systems.

J. Damper Actuator - Electric:
1. Electric - 24 V ac.
2. UL 873, plenum rated.
3. Designed to operate in smoke-control systems complying with UL 555S requirements.
4. Two position with fail-safe spring return.
   a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
   b. Maximum 15-second full-stroke closure.
   c. Minimum 90-degree drive rotation.
5. Clockwise or counterclockwise drive rotation as required for application.
6. Environmental Operating Range:
   a. Temperature: Minus 40 to plus 130 deg F ((Minus 40 to plus 55 deg C)).
   b. Humidity: 5 to 95 percent relative humidity noncondensing.
7. Environmental Enclosure: NEMA 2.
8. Actuator to be factory mounted and provided with single-point wiring connection.

K. Controllers, Electrical Devices, and Wiring:
1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2. Electrical Connection: 24 V, 60 Hz.

L. Accessories:
1. Auxiliary switches for signaling fan control or position indication.
2. Momentary test switch Test and reset switches, damper remote mounted.
3. Smoke Detector: Integral, factory wired for single-point connection.

2.8 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

2.9 REMOTE DAMPER OPERATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Pottorff.
2. Ventfabrics, Inc.
3. Young Regulator Company..

B. Description: Cable system designed for remote manual damper adjustment.

C. Tubing: Brass.

D. Cable: Stainless steel.

E. Wall-Box Mounting: Recessed.

F. Wall-Box Cover-Plate Material: Steel.

2.10 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Elgen Manufacturing.
5. Flexmaster U.S.A., Inc.
6. Greenheck Fan Corporation.
7. McGill AirFlow LLC.
8. Nailor Industries Inc.
9. Pottorff.
10. Ventfabrics, Inc.
11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
1. Door:
   a. Double wall, rectangular.
   b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
   c. Vision panel.
   d. Hinges and Latches: 1-by-1-inch (25-by-25-mm)butt or piano hinge and cam latches.
   e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
   a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
   b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.
   c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.
   d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. Ventfabrics, Inc.

5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

2.12 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
2. Maximum Air Velocity: 4000 fpm (20 m/s).
3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:
1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.13 LOUVERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ruskin Company

2. Greenheck Fan Corporation
3. Pottorff

B. Fabrication: Hidden support style.
   1. Frame:
      a. Frame Depth: 6 inches .
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.125 inch, nominal.
   2. Blades:
      a. Style: Drainable.
      b. Material: Formed aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.081 inch, nominal.
      d. Angle: 37-1/2 degrees.
      e. Centers: 4 inches, nominal.
   3. Gutters: Drain gutter in head frame and each blade.
   4. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   5. Fabrication:
      a. Mullion/Hidden Intermediate Support Style – Design incorporates visible mullions or frames at the perimeter of the louver and at section joints only. Rear-mounted hidden blade supports are utilized where required and do not interrupt the louver blade sightlines. The rear-mounted blade support depth varies depending on louver height and the design windload.
   6. Assembly:
      a. Factory assembled louver components. Mechanically fastened construction.

C. Performance Data:
   1. Performance Ratings: AMCA licensed.
      a. Based on testing 48 inch by 48 inch size unit in accordance with AMCA 500.
   2. Free Area: 58 percent, nominal.
   3. Maximum Recommended Air Flow through Free Area: 1250 feet per minute.
   4. Air Flow: 11,600 cubic feet per minute.
   5. Maximum Pressure Drop (Intake): 0.20 inches w.g. .
   6. Water Penetration: Maximum of 0.01 ounces per square foot of free area at an air flow of 1250 feet per minute free area velocity when tested for 15 minutes.

D. Bird Screen:
   1. Aluminum: Aluminum, 1/4 inch x 1/4 inch.
   2. Frame: Removable, re-wireable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
   1. Install steel volume dampers in steel ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

F. Install access doors with swing against duct static pressure.

G. Access Door Sizes:
   1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
   2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
   3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
   4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
   5. Body Access: 25 by 14 inches (635 by 355 mm).
   6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).

H. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

I. Install flexible connectors to connect ducts to equipment.

J. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

K. Connect terminal units to supply ducts with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

L. Connect diffusers or light troffer boots to ducts in-directly with maximum 36-inch (900-mm) lengths of flexible duct clamped or strapped in place. Do not use flexible ducts to change directions.

M. Connect flexible ducts to metal ducts with liquid adhesive plus clamp-type draw bands.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate dampers to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed.
   3. Inspect turning vanes for proper and secure installation.
   4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate electrical connections to equipment:
1. Refer to equipment manufacturer's shop drawings and written instructions. Provide all power and control wiring with associated raceways for complete operation.
2. Verify electrical requirements of equipment on nameplate and installation manual. Ensure that the electrical connections meet the requirements and notify Engineer of any discrepancies.
3. Meet with equipment manufacturers representatives to coordinate equipment installation and electrical connections.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping".

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
   1. Minimum Metal Thickness:
      a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
      b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular, water tight sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. O-Z Gedney
      e. Pipeline Seal and Insulator, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Carbon steel. Include two for each sealing element.
   4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL DEMOLITION

A. Contractor to protect and maintain existing devices out of scope area and to extend conduit and cabling as required.

B. Contractor to protect and maintain fire alarm system and maintain building occupancy during demolition and construction.

C. Contractor to protect and maintain existing architectural elements to remain.

3.2 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.3 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
   1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals. Install water-tight assembly.
   1. Slope underground conduits away from building to prevent accumulated water from traveling down conduit into building.

3.4 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.5 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. RoHS: Restriction of Hazardous Substances.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Insulated Wire Corp.; a Leviton Company.
2. Cerro Wire LLC.
3. General Cable Technologies Corporation.
4. Southwire Incorporated.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 or ASTM B 496 (as applicable) for stranded conductors.

E. Conductor Insulation:
1. Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. AFC Cable Systems, Inc.
2. General Cable Technologies Corporation.
3. Southwire Incorporated.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type THHN/THWN-2: Comply with UL 83.

H. Armor: Steel, interlocked.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; a brand of the EGS Electrical Group.
4. 3M; Electrical Markets Division.
5. Tyco Electronics.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 14 AWG and smaller; stranded for No. 12 AWG and larger.

B. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

C. MC cabling is allowed for branch circuits only where they are concealed above ceilings or in walls. MC is not allowed where it is visible in public areas and not allowed for homeruns. All homeruns shall be in rigid conduit.

3.2 CONDUCTOR INSULATION APPLICATIONS AND WIRING METHODS

A. Feeders: Type THHN/THWN-2, single conductors in raceway.

B. Branch Circuits: Type THHN/THWN-2, single conductors in raceway. Metal-clad cable, Type MC, may be used where concealed in ceilings and walls except for home runs to the panelboard. All home-runs shall be Type THHN/THWN-2, single conductors in raceway.

C. Multi-Wire Branch Circuits: Install no more than three circuits in a raceway, unless indicated otherwise.

D. Neutral Conductors: Provide one neutral conductor for each phase conductor. Shared neutral conductors are not allowed including for MC cabling.

E. Minimum Branch Circuit Conductor Size: Provide the following minimum sizes for distances listed on 20A branch circuits to prevent excessive voltage drop. The circuit length shall be measured along the length of the conductor from the circuit breaker in the panelboard to the last device on the circuit. Increase raceway size to comply with conductor fill requirements of NFPA 70.

1. Branch Circuit Voltage of 120V:
    a. Circuit lengths less than 70 feet: Provide minimum #12 AWG conductor size.
    b. Circuit lengths between 70 feet and 110 feet: Provide minimum #10 AWG conductor size.
    c. Circuit lengths between 110 feet and 170 feet: Provide minimum #8 AWG conductor size.
    d. Circuit lengths greater than 170 feet: Perform voltage drop calculations and provide conductor size to keep branch circuit voltage drop less than 3% with a 15 amp load.

2. Branch Circuit Voltage of 277V:
    a. Circuit lengths less than 150 feet: Provide minimum #12 AWG conductor size.
    b. Circuit lengths between 150 feet and 240 feet: Provide minimum #10 AWG conductor size.
    c. Circuit lengths between 240 feet and 380 feet: Provide minimum #8 AWG conductor size.
    d. Circuit lengths greater than 380 feet: Perform voltage drop calculations and provide conductor size to keep branch circuit voltage drop less than 3% with a 15 amp load.

F. Fire Alarm Circuits:
1. Type THWN-2 in raceway for fire alarm power circuits, for horn circuits, and for strobe circuits.
2. Power-limited, fire-protective, signaling circuit cable in raceway for initiating loop circuits.
3. Twisted shielded pair in raceway for evacuation speakers.
4. MC cabling is not allowed for fire alarm circuits.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Install all conductors and cables in raceways per Section 260533, "Raceway and Boxes for Electrical Systems."

C. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

D. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

E. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

F. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

G. Support cables not in raceway according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

1. [Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.]

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.

2. Perform each of the following visual and electrical tests:

    a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
    b. Test bolted connections for high resistance using one of the following:

        1) A low-resistance ohmmeter.
        2) Calibrated torque wrench.
        3) Thermographic survey.

    c. Inspect compression-applied connectors for correct cable match and indentation.
    d. Inspect for correct identification.
    e. Inspect cable jacket and condition.
    f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
    g. Continuity test on each conductor and cable.
    h. Uniform resistance of parallel conductors.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

B. Related Requirements:

1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Hangers.
b. Steel slotted support systems.
c. Nonmetallic support systems.
d. Trapeze hangers.
e. Clamps.
f. Turnbuckles.
g. Sockets.
h. Eye nuts.
i. Saddles.
j. Brackets.

2. Include rated capacities and furnished specialties and accessories.

B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Trapeze hangers. Include product data for components.

2. Steel slotted-channel systems.
3. Nonmetallic slotted-channel systems.
4. Equipment supports.
5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which hangers and supports will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Items penetrating finished ceiling, including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.

B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
2. Component Importance Factor: 1.5 raceways and equipment connected to an emergency/standby system; 1.0 for other raceways and equipment.

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. B-line, an Eaton business.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation; A Member of the ABB Group.
f. Unistrut; Part of Atkore International.

2. Material: Galvanized steel.
3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
5. Channel Dimensions: Selected for applicable load criteria.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
   1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
   4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
   5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
   6. Toggle Bolts: All-steel springhead type.
   7. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.

B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."

C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slottedsupport system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps.

E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts Beam, clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69 [Spring-tension clamps].
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Metal conduits, tubing, and fittings.
   2. Nonmetal conduits, tubing, and fittings.
   3. Metal wireways and auxiliary gutters.
   4. Surface raceways.
   5. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

C. EMT: Electrical metal tubing.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
   1. Structural members in paths of conduit groups with common supports.
   2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

B. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
   4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1.
   2. AFC Cable Systems, Inc.
   3. Alflex Inc.
   4. Allied Tube & Conduit; a Tyco International Ltd. Co.
   5. Anamet Electrical, Inc.; Anaconda Metal Hose.
   6. Electri-Flex Co.
   7. Manhattan/CDT/Cole-Flex.
   8. Maverick Tube Corporation.
   9. O-Z Gedney; a unit of General Signal.
   10. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. EMT: Comply with ANSI C80.3 and UL 797.

F. FMC: Comply with UL 1; zinc-coated steel.

G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
   1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
   2. Fittings for EMT:
      a. Material: Steel.
      b. Type: Setscrew or compression.

3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

I. Joint Compound for IMC, GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 or Type 3R as required, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

C. Wireway Covers: Screw-cover type unless otherwise indicated.

D. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

A. Listing and Labeling: Surface raceways and tele-power poles shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hubbell Incorporated; Wiring Device-Kellems.
b. MonoSystems, Inc.
c. Wiremold / Legrand.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

D. Metal Floor Boxes:
1. Material: Cast metal or sheet metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

H. Minimum Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

I. Gangable boxes are allowed.

J. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R as required by location, with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass.
3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

K. Cabinets:
1. NEMA 250, Type 1 or Type 3R as required by location galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Concealed in Ceilings and Interior Walls and Partitions: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

B. Minimum Raceway Size: 3/4-inch (21-mm) trade size for power and 1" for all low voltage.

C. Minimum junction box size for data device: 4 11/16" box with 5/8" mud ring.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install nonferrous conduit or tubing for circuits operating above 60 Hz.

F. Install surface raceways only where indicated on Drawings.

G. Fire alarm conduits size: Minimum ¾" and painted red.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300

mm) of changes in direction. For low voltage raceways no more than equivalent of two 90-degree bends will be allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Support conduit within 12 inches ((300 mm))of enclosures to which attached.

I. Do not install conduits embedded in elevated slabs.

J. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

N. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

P. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

S. Surface Raceways:
   1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Expansion-Joint Fittings:
1.
2. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.

Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, comply with ADA requirements and refer to Architectural elevations.

Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260548 - SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Restraint channel bracings.
2. Restraint cables.
3. Seismic-restraint accessories.
4. Mechanical anchor bolts.
5. Adhesive anchor bolts.

B. Related Requirements:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

B. Delegated-Design Submittal: For each seismic-restraint device.

1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic and wind forces required to select seismic and wind restraints and for designing vibration isolation bases.

    a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

3. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
    d. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Deferred Submittals for the Authority Having Jurisdiction (AHJ) shall be as required by IBC 106.3.4.2.
1. Deferred submittals of seismic restraint of nonstructural components must be submitted to the AHJ a minimum of two weeks prior to the planned installation in order to allow for plan review and forwarding to inspectors. In the event that the submittal is deficient additional time may become necessary.
2. No deferred submittal element shall be installed until AHJ approval has been received.
3. If seismic restraints of nonstructural components are installed prior to receiving AHJ approval they shall not be covered or concealed until plan review and inspection approval. Further, installers are proceeding at their own risk until plan review and inspection approval occurs.
4. Deferred Submittals are required for:
    a. Electrical distribution equipment (switchboards, panelboards, transformers, MCC's etc.).
    b. Conduit racks.
    c. Cable trays.
    d. Lighting fixtures.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC and ASCE 7 unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: Obtain from building structural engineer.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: Obtain from building structural engineer.

    a. Component Importance Factor: 1.5.
    b. Component Response Modification Factor: Obtain from building structural engineer.
    c. Component Amplification Factor: Obtain from building structural engineer.

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): Obtain from building structural engineer.
4. Design Spectral Response Acceleration at 1.0-Second Period: Obtain from building structural engineer.

2.2 RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.

B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.

C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.

D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.

E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Equipment and Hanger Restraints:

1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
2. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

F. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.

C. Seismic controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 SPECIAL INSPECTION

A. Per the requirements of ASCE 7, the building owner will employ a special inspector(s) to observe the construction of all Designated Seismic Systems in accordance with the Quality Assurance Plan.

B. Special inspection for electrical components shall be as follows:

1. Periodic special inspection during the anchorage of electrical equipment for emergency and standby power systems, including but not limited to:
   a. Generator systems.
   b. Emergency and standby power distribution equipment, wiring and raceways.
   c. Emergency lighting, with associated conduit, wiring and distribution system.
   d. Fire alarm system and devices, with associated conduit, wiring and distribution system.
   e. Uninterruptible Power Systems with associated distribution equipment, conduit and wiring.
   f. Pendant light fixtures, where pendant length exceeds 24”.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
2. Colors for 208/120-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.
    c. Phase C: Blue.

3. Colors for 240-V Circuits:

    a. Phase A: Black.
    b. Phase B: Red.

4. Colors for 480/277-V Circuits:

    a. Phase A: Brown.
    b. Phase B: Orange.
    c. Phase C: Yellow.

5. Color for Neutral: White or gray.
6. Color for Equipment Grounds: Green.
7. Colors for Isolated Grounds: Green with white stripe.

B. Raceways and Cables Carrying Circuits at More Than 600 V:

1. Black letters on a red field.
2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.3 LABELS

A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

D. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Minimum Nominal Size:

a. 1-1/2 by 6 inches (37 by 150 mm)for raceway and conductors.
b. 3-1/2 by 5 inches (76 by 127 mm)for equipment.
c. As required by authorities having jurisdiction.

2.4 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameters and that stay in place by gripping action.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

2.5 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.

C. Tape and Stencil: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers placed diagonally over orange background and is 12 inches (300 mm) wide. Stop stripes at legends.

D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.6 TAGS

A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

B. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch (0.58 mm) thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.

C. Write-on Tags:

1. Polyester Tags: 0.015 inch (0.38 mm) thick, with corrosion-resistant grommet and cable tie for attachment.
2. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
3. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.7 SIGNS

A. Baked-Enamel Signs:

1. Preprinted aluminum signs,punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 7 by 10 inches (180 by 250 mm).

B. Metal-Backed Butyrate Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:

   a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick).
   b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
   c. Engraved legend with white letters on a dark gray background.
   d. Punched or drilled for mechanical fasteners with 1/4-inch (6.4-mm) grommets in corners for mounting.
   e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

L. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

M. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

N. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

O. Self-Adhesive Labels:

1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

P. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

Q. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

R. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

S. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

T. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

U. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

V. Metal Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

W. Nonmetallic Preprinted Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

X. Write-on Tags:

1. Place in a location with high visibility and accessibility.
2. Secure using UV-stabilized cable ties.

Y. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

Z. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

AA. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use labels 2 inches (50 mm) high.

BB. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Vinyl wraparound labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

D. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

E. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."
4. “FIRE ALARM”

F. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive wraparound labels to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.

H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

I. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.

J. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

K. Auxiliary Electrical Systems Conductor Identification: Marker tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

M. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:

1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to raceways concealed within wall.
3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.

N. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

O. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.
b. Controls with external control power connections.

Q. Arc Flash Warning Labeling: Self-adhesive labels.

R. Operating Instruction Signs: Self-adhesive labels.

S. Emergency Operating Instruction Signs: Laminated acrylic or melamine plastic signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

T. Equipment Identification Labels:

1. Indoor and Outdoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine sign.
3. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
4. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
5. Color Coding of Labels: Identify branch of electrical system by coloring coding the labels
   a. Equipment Connected to Normal Power: White lettering on black background.
   b. Equipment Connected to Emergency (life-safety) Power: White lettering on red background.
   c. Equipment Connected to Stand-by(optional) Power: Red lettering on white background.
   d. Equipment Connected to UPS Power, "A" system: White lettering on orange background.
   e. Equipment Connected to UPS Power, "B" system: White lettering on blue background.
   f. Equipment Connected to UPS Power, non-redundant office system: Orange lettering on white background
6. Identify source bus, voltage and location feeding the equipment, for example:

   PANEL 3LBA
   120/208V 3-PHASE 4-WIRE
   FED FROM 3LDPB
   ROOM #1003

7. Equipment to Be Labeled:

   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchgear.
   e. Switchboards.
   f. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
   g. Substations.
   h. Emergency system boxes and enclosures.
   i. Motor-control centers.
   j. Enclosed switches.
   k. Enclosed circuit breakers.
   l. Enclosed controllers.
   m. Variable-speed controllers.
   n. Push-button stations.
   o. Power-transfer equipment.
   p. Contactors.
   q. Remote-controlled switches, dimmer modules, and control devices.

r. Battery-inverter units.
s. Battery racks.
t. Power-generating units.
u. Monitoring and control equipment.
v. UPS equipment.

3.4 IDENTIFICATION REQUIREMENTS FOR UNIVERSITY OF UTAH MEDIUM-VOLTAGE INSTALLATIONS

1) Switchboards, Distribution Boards, and Panel boards

a) Permanently engraved lamicoid labels are required for each switchboard, distribution board, and panel board, as described below.

b) For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.

c) Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

d) Conductors shall be color coded by phase with colored tape. See 3.2.E-F for the color code for conductors and Medium voltage cable.

e) Switchboard Label

The switchboard label shall include the switchboard name, electrical source feeding the switchboard, voltage, size (amps), number of phases, number of wires, and AIC rating (i.e., MDP1, Transformer-1, 480V, 3P, 4W, 65kAIC). If the switchboard contains a main building disconnect, this shall be included on the label, (i.e., Main Building Disconnect 1 of 2).

f) Switchboard Breaker and Spare Space Labels

Switchboard breaker and spare space labels shall be installed to clearly identify each switchboard breaker and spare/space. Each label shall include the breaker number and the load served (i.e., MDP1-1, Panel PH1). For spare/space, the label shall indicate “spare” as well as the size in amps and phase (i.e., Spare, 200A, 3P or Space, 400A max, 3P).

g) Panel board Labels

Panel board labels shall be mounted inside the door for flush panels, and on the outside face of the door for surface panels. The label shall include the panel name, source feeding panel, voltage, size (Amps), number of phases, number of wires, AIC rating, and the arc flash hazard class based upon NFPA 70E (i.e., PH1, MDP11, 277/480V, 225A, 3P, 5W, 42kAIC, Arc Flash Class __).

h) Use the labeling scheme for panel boards provided on the following page:

Level	UPS / Emergency Power	Voltage Level	Panel Sequence
0 (Level 0 / Basement	U (UPS)	L (277 / 480 V)	1
1 (Level 1)	E1 (Emergency Life Safety – Connected to ATS-1)	P (120 / 208 V)	2
2 (Level 2)	E2 (Critical Emergency – Connected to ATS-2)		3
3 (Level 3)	E2 (Optional Emergency – Connected to ATS-3)		4
etc.	etc.	etc.	etc.

Examples: *(a)* 2E1L1 – Level 2, Emergency Life Safety Power, 277/480V, 1st panel on level 2
(b) 0UP6 – Level 0, UPS Power, 120/208V, 6th panel on level 0
(c) 1L2 – Level 1, 277/480V, 2nd panel on level 1
(d) 3P11 – Level 3, 120/280V, 11th panel on level 3

2) Motor Control Centers (MCC), Motor Controllers
   a) Permanently engraved 3" x 5" lamicoid labels are required to identify the MCC and each controller.
   b) For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.
   c) Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.
   d) MCC labels shall identify the MCC, source feeding the MCC, voltage, size (amps), number of phases, number of wires, and AIC rating (i.e., MCC#1, MDP1-2, 600A, 3P, 4W, 42kAIC). Where applicable, the label shall also include the load served and the breaker size (i.e., EF-1, 125A). For spare / space, the label shall indicate the size in amps and phase (i.e., Spare, 200A, 3P or Space, 400A max, 3P).
3) Additionally provide permanently engraved lamicoid nameplate labels / tags for the following, as well as all other similar electrical devices and equipment.
   a) UPS and Surge Protection Devices.
   b) Safety Disconnects.
   c) Generators.
   d) Automatic Transfer Switches.
   e) Paralleling Switchgears.
   f) Electrical Contactors and Relays.
   g) Lighting Control Panels, Lighting Contactor.
   h) Panels, Dimming Panels.
   i) Timeclocks.
   j) Security Panels.

k) Power Supplies.

2. Self-Adhesive Labels
   a. Specify self-adhesive labels for the devices and equipment identified in 4) below, as well as all other similar devices and equipment.
   b. Self-adhesive labels shall have black lettering with a clear (see through) background, and a self-adhesive sticky back.
   c. Each label shall identify the applicable circuit number feeding the device. The label shall also display “EMERGENCY” or “UPS” as applicable next to the circuit number for devices fed from Emergency or UPS power. For example, a receptacle fed from circuit 2 in panel 1P1 would read “1P1-2” on the label.
   d. Self-adhesive labels shall be applied to the following devices and equipment, and all similar equipment:
      1) Thermal Switches and Manual Starters.
      2) Power Outlet Receptacles.
      3) Light Switches.
      4) Wall Mounted Occupancy Sensors e) Wall Mounted Time Switches.
3. Handwritten Labeling
   a. Legible handwritten labeling shall be written on all junction boxes containing power and fire alarm wiring.
   b. A permanent chisel tip black marker shall be used to write the required information in a neat and clearly legible manner clearly visible from the floor.
   c. Label each junction box with the applicable circuit number(s) for the cables contained within.
4. Word Processor Generated Branch Panel Schedules
   a. Specify typewritten branch panel schedules incased in clear, transparent covers for each branch panel.
   b. Every breaker or available space shall be labeled.
   c. Note: Actual room designations (room name and room number) assigned by the University must be used. Instruct the Contractor to verify room designations. Room identifiers on project drawings may be different than final room assignments.
   d. When the project requires changes in, or additions to existing panels, distribution boards, etc., provide new schedules and labeling to accurately reflect the changes.

END OF SECTION 260553

SECTION 260923 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEMS

GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Digital Lighting Load Controls
   2. Relay Panels
   3. Emergency Lighting Control (if applicable)

B. Related Sections:
   1. Section 262726 - Wiring Devices Receptacles
   2. Section 265113 – Interior Lighting.

C. Control Intent – Control Intent includes, but is not limited to:
   1. Defaults and initial calibration settings for such items as time delay, sensitivity, fade rates, etc.
   2. Initial sensor and switching zones
   3. Initial time switch settings
   4. Emergency Lighting control (if applicable)

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE) (www.ansi.org and www.ieee.org)

B. International Electrotechnical Commission (IEC) (www.iec.ch)

C. International Organization for Standardization (ISO) (www.iso.ch):

D. National Electrical Manufacturers Association (NEMA) (www.nema.org)

E. WD1 (R2005) - General Color Requirements for Wiring Devices.

F. Underwriters Laboratories, Inc. (UL) (www.ul.com):
   1. 508 – Industrial Controls
   2. 916 – Energy Management Equipment
   3. 924 – Emergency Lighting

G. Underwriter Laboratories of Canada (ULC) (www.ulc.ca)

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Lighting Control and Automation system as defined under this section covers the following equipment:
   1. Digital Lighting Management (DLM) local network – Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.

2. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
3. Digital Fixture Controllers – Self-configuring, digitally addressable one relay fixture-integrated controllers for on/off/0-10V dimming control.
4. Digital Occupancy Sensors – Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
5. Digital Switches – Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
6. Handheld remotes for personal control – On/Off, dimming and scene remotes for control using infrared (IR) communications. Remote may be configured in the field to control selected loads or scenes without special tools.
7. Digital Daylighting Sensors – Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
8. Configuration Tools – Handheld remote for room configuration and relay panel programming provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
9. Digital Lighting Management (DLM) segment network – Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
10. Network Bridge – Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
11. Segment Manager – BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
12. Programming and Configuration Software – Optional PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.
13. Digital Lighting Management Relay Panel and Zone Controller – Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
14. Emergency Lighting Control Unit (ELCU) – Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building

1.4 LIGHTING CONTROL APPLICATIONS

A. Unless relevant provisions of the applicable local energy codes are more stringent, provide a minimum application of lighting controls as follows:
   1. Space Control Requirements – Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
   2. Daylit Areas – Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
      a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
      b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
      c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
      d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
   3. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.

1.5 SUBMITTALS

A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.

B. Shop Drawings:
   1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
   2. Show exact location of all digital devices, including at minimum sensors, load controllers, and switches for each area on reflected ceiling plans. (Contractor must provide AutoCAD format reflected ceiling plans.)

3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
4. Network riser diagram including floor and building level details. Include network cable specification and end-of-line termination details, if required. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:
1. Indicates where sensor is proposed to be installed.
2. Prove that the sensor is suitable for the proposed application.

1.6 QUALITY ASSURANCE

1.7 Manufacturer: Minimum 10 years experience in manufacture of lighting controls.

1.8 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
1. Ambient temperature: 0° to 40° C (32° to 104° F).
2. Relative humidity: Maximum 90 percent, non-condensing.

1.9 WARRANTY

A. Provide a five year limited manufacturer’s warranty on all room control devices and panels.

1.10 MAINTENANCE

A. Spare Parts:
1. Provide the minimum of 5% or [5] of each of the following spares of each product that are used on this project to be used for maintenance as listed below:
a. Single-zone room controller
b. Two-zone room controller
c. Three-zone room controller
d. Single-zone dimming controller
e. Two-zone dimming controller
f. Three-zone dimming controller
g. Fixture controller
h. Network bridge
i. Isolated auxiliary relay
j. Ceiling occupancy sensor (each type used)
k. Wall mount occupancy sensor (each type used)

l. Wall switch (each type used)
m. Interior photocell

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:
1. Basis of design product: WattStopper Digital Lighting Management (DLM) or subject to compliance and prior approval with specified requirements of this section, one of the following:
a. nLight
b. Hubbell Building Automation
c. Greengate

2.2 DIGITAL LIGHTING CONTROLS

A. Furnish the Company's system which accommodates the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories which suit the lighting and electrical system parameters.

2.3 DLM LOCAL NETWORK (Room Network)

A. The DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

B. Features of the DLM local network include:
1. Plug n' Go™ automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
2. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
3. Push n' Learn™ configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

C. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.

D. If manufacturer's pre-terminated Cat5e cables are not used for the installation, the contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

E. WattStopper Product Number: LMRJ-Series

2.4 DIGITAL LOAD CONTROLLERS (ROOM AND FIXTURE CONTROLLERS)

A. Digital controllers for lighting loads automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room load controllers shall be provided to match the room lighting load control requirements. The controllers will be simple to install, and will not have dip switches or potentiometers, or require special configuration for standard Plug n' Go applications. The control units will include the following features:
   1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
   2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
   3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are sequentially assigned using each controller's device ID's from highest to lowest.
   4. Device Status LEDs to indicate:
      a. Data transmission
      b. Device has power
      c. Status for each load
      d. Configuration status
   5. Quick installation features including:
      a. Standard junction box mounting
      b. Quick low voltage connections using standard RJ-45 patch cable
   6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
      a. Turn on to 100%
      b. Turn off
      c. Turn on to last level
   7. Each load shall at a minimum be configurable to operate in the following sequences based on occupancy:
      a. Auto-on/Auto-off (Follow on and off)
      b. Manual-on/Auto-off (Follow off only)
   8. The polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
   9. BACnet object information shall be available for the following objects:
      a. Load status
      b. Electrical current (when available)
      c. Total watts per controller
      d. Schedule state – normal or after-hours
      e. Demand response enable and disable

f. Room occupancy status
g. Total room lighting loads watts
h. Total room watts/sq ft
i. Force on/off all loads

10. UL 2043 plenum rated
11. Manual override and LED indication for each load
12. Dual voltage (120/277 VAC, 60 Hz), or 347 VAC, 60 Hz (selected models only). 120/277 volt models rated for 20A total load, derating to 16A required for some dimmed loads (forward phase dimming); 347 volt models rated for 15A total load.
13. Zero cross circuitry for each load
14. All digital parameter data programmed into an individual room controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.

B. On/Off Room Controllers shall include:
1. One or two relay configuration
2. Efficient 150 mA switching power supply
3. Three RJ-45 DLM local network ports with integral strain relief and dust cover
4. WattStopper product numbers: LMRC-101, LMRC-102

C. On/Off/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
2. Multiple relay configurations
   a. One, two or three relays (LMRC-21x series)
   b. One or two relays (LMRC-22x series)
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports with integral strain relief and dust cover
5. One dimming output per relay
   a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting. (LMRC-21x series)
   b. Line Voltage, Forward Phase Dimming - Where indicated, one forward phase control line voltage dimming output per relay for control of compatible two-wire or three-wire ballasts, LED drivers, MLV, forward phase compatible ELV, neon/cold cathode and incandescent loads. (LMRC-22x series)
   c. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
   d. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
   e. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
   f. Calibration and trim levels must be set per output channel.

g. Devices that set calibration or trim levels per controller are not acceptable.
h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.

6. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
7. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
8. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%
   b. Set high and low trim for each load
   c. Set lamp burn in time for each load up to 100 hours
9. Override button for each load provides the following functions:
   a. Press and release for on/off control
   b. Press and hold for dimming control

10. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213, LMRC-221, LMRC-222
    .

D. Fixture Controllers shall include:
1. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
2. One 3A 120/277V rated mechanically held relay.
3. Programmable behavior on power up following the loss of normal power:
   a. Turn on to 100%
   b. Turn off
   c. Turn on to last level
4. Requirement for 7 mA of 24VDC operating power from the DLM local network.
   a. The Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
   b. Power to drive the LMFC Fixture Controller electronics can come from any Room Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
5. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
6. Terminals to connect an RJ-45 adaptor with 24” leads, mountable in a ½” KO, for connection to the DLM local network.

a. The adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.

7. A complete set of dimming features described above in the section detailing On/Off/Dimming Enhanced Room Controllers (subsection C.5 onward).
8. WattStopper product numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24, Power Booster: LMPB-100

2.5 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

A. Wall or ceiling mounted (to suit installation) passive infrared (PIR), ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor.

B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
a. Sensitivity – 0-100% in 10% increments
b. Time delay – 1-30 minutes in 1 minute increments
c. Test mode – Five second time delay
d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
e. Walk-through mode
2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
3. Programmable control functionality including:
a. Each sensor may be programmed to control specific loads within a local network.
b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
e. Ultrasonic and Passive Infrared
f. Ultrasonic or Passive Infrared
g. Ultrasonic only
h. Passive Infrared only
i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. One or two RJ-45 port(s) for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.

6. Device Status LEDs, which may be disabled for selected applications, including:
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
8. Manual override of controlled loads.
9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.

C. BACnet object information shall be available for the following objects:
   1. Detection state
   2. Occupancy sensor time delay
   3. Occupancy sensor sensitivity, PIR and Ultrasonic

D. Units shall not have any dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

F. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.6 DIGITAL WALL SWITCH OCCUPANCY SENSORS

A. Wallbox mounted passive infrared PIR or dual technology (passive infrared and ultrasonic) digital occupancy sensor with 1 or 2 switch buttons.

B. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton configuration for the following variables:
      a. Sensitivity – 0-100% in 10% increments
      b. Time delay – 1-30 minutes in 1 minute increments
      c. Test mode – Five second time delay
      d. Detection technology – PIR, Dual Technology activation and/or re-activation.
      e. Walk-through mode
      f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
   2. Programmable control functionality including:
      a. Each sensor may be programmed to control specific loads within a local network.
      b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
      c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.

d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
   i Ultrasonic and Passive Infrared
   ii Ultrasonic or Passive Infrared
   iii Ultrasonic only
   iv Passive Infrared only

3. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. Two RJ-45 ports for connection to DLM local network.
5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
6. Device Status LEDs including
   a. PIR detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
8. Assignment of local buttons to specific loads within the room without wiring or special tools
9. Manual override of controlled loads
10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.

C. BACnet object information shall be available for the following objects:
1. Detection state
2. Occupancy sensor time delay
3. Occupancy sensor sensitivity, PIR and Ultrasonic
4. Button state
5. Switch lock control
6. Switch lock status

D. Units shall not have any dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.

F. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button
   a. Press and release - Turn load on
   b. Press and hold - Raise dimming load
2. Right button
   a. Press and release - Turn load off
   b. Press and hold - Lower dimming load

G. Low voltage momentary pushbuttons shall include the following features:
   1. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
   2. The following button attributes may be changed or selected using a wireless configuration tool:
      a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
      b. Individual button function may be configured to Toggle, On only or Off only.
      c. Individual scenes may be locked to prevent unauthorized change.
      d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
      e. Ramp rate may be adjusted for each dimmer switch.
      f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
      g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.7 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
   1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
   2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
   3. Configuration LED on each switch that blinks to indicate data transmission.
   4. Load/Scene Status LED on each switch button with the following characteristics:
      a. Bi-level LED
      b. Dim locator level indicates power to switch
      c. Bright status level indicates that load or scene is active
      d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
   5. Programmable control functionality including:
      a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
      b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.

6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.

B. BACnet object information shall be available for the following objects:
   1. Button state
   2. Switch lock control
   3. Switch lock status

C. Two RJ-45 ports for connection to DLM local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.

E. The following switch attributes may be changed or selected using a wireless configuration tool:

F. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
   1. Individual button function may be configured to Toggle, On only or Off only.
   2. Individual scenes may be locked to prevent unauthorized change.
   3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
   4. Ramp rate may be adjusted for each dimmer switch.
   5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependant; each button may be bound to multiple loads.
   6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.8 DIGITAL DAYLIGHTING SENSORS

A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
   1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
   2. Open loop sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones.
   3. Dual loop sensors measure both ambient and incoming daylight in the space to insure that proper light levels are maintained as changes to reflective materials are made in a single zone.

B. Digital daylighting sensors shall include the following features:

1. The sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-6,553 footcandles (fc).
3. The capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Configuration LED status light on device that blinks to indicate data transmission.
11. Status LED indicates test mode, override mode and load binding.
12. Recessed switch on device to turn controlled load(s) ON and OFF.
13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
    a. Light level
    b. Day and night setpoints
    c. Off time delay
    d. On and off setpoints
    e. Up to three zone setpoints
    f. Operating mode – on/off, bi-level, tri-level or dimming
14. One RJ-45 port for connection to DLM local network.
15. A choice of accessories to accommodate multiple mounting methods and building materials. The photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62" thickness (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62"-1.25" thickness (LMLS-400-L, LMLS-500-L). Mounting brackets are

compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.

16. Any load or group of loads in the room can be assigned to a daylighting zone
17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.

C. Closed loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
   2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
   3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
   4. WattStopper Product Number: LMLS-400, LMLS-400-L.

D. Open loop digital photosensors shall include the following additional features:
   1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
   2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
   3. Each of the three discrete daylight zones can include any non overlapping group of loads in the room.
   4. WattStopper Product Number: LMLS-500, LMLS-500-L.

E. Dual loop digital photosensors shall include the following additional features:
   1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
   2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
   3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.

4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.
5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.9 DIGITAL PARTITION CONTROLS

A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by reconfiguring the connected digital switches and occupancy sensors.

B. Four-button low voltage pushbutton switch for manual control.
1. Two-way infrared (IR) transceiver for use with configuration remote control.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Configuration LED on each switch that blinks to indicate data transmission.
4. Each button represents one wall; Green button LED indicates status.
5. Two RJ-45 ports for connection to DLM local network.
6. WattStopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.

C. Contact closure interface for automatic control via input from limit switches on movable walls (by others).
1. Operates on Class 2 power supplied by DLM local network.
2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
3. Input max. sink/source current: 1-5mA
   a. Logic input signal voltage High: >18VDC
   b. Logic input signal voltage Low: <2VDC
4. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
5. Two RJ-45 ports for connection to DLM local network.
6. WattStopper part number: LMIO-102

2.10 HANDHELD AND COMPUTER CONFIGURATION TOOLS

A. A wireless configuration tool facilitates optional customization of DLM local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include but not be limited to:
   1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
   2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
   3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
   4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
   5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
   6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
   7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
   8. Verify status of building level network devices.

C. WattStopper Product Numbers: LMCT-100, LMCI-100/LMCS-100

2.11 DLM SEGMENT NETWORK (Room to Room Network)

A. The segment network shall be a linear topology, BACnet-based MS/TP subnet to connect DLM local networks (rooms) and LMCP relay panels for centralized control.
   1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
   2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate “in” and “out” terminations, for segment network connections.
   3. The segment network shall utilize 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. The maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
   4. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
   5. Substitution of manufacturer-supplied cable must be pre-approved: Manufacturer will not certify network reliability, and reserves the right to void warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer’s specific requirements.
   6. Segment networks shall be capable of connecting to BACnet-compliant BAS (provided by others) either directly, via MS/TP, or through NB-ROUTERs, via BACnet/IP or BACnet/Ethernet. Systems whose room-connected network

infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.

B. WattStopper Product Number: LM-MSTP, LM-MSTP-DB

2.12 NETWORK BRIDGE

A. The network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
   1. The network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
   2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
   3. The network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
      a. Read/write the normal or after hours schedule state for the room
      b. Read the detection state of each occupancy sensor
      c. Read the aggregate occupancy state of the room
      d. Read/write the On/Off state of loads
      e. Read/write the dimmed light level of loads
      f. Read the button states of switches
      g. Read total current in amps, and total power in watts through the load controller
      h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
      i. Activate a preset scene for the room
      j. Read/write daylight sensor fade time and day and night setpoints
      k. Read the current light level, in footcandles, from interior and exterior photosensors and photocells
      l. Set daylight sensor operating mode
      m. Read/write wall switch lock status
      n. Read watts per square foot for the entire controlled room
      o. Write maximum light level per load for demand response mode

p. Read/write activation of demand response mode for the room
q. Activate/restore demand response mode for the room

B. WattStopper product numbers: LMBC-300

2.13 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. HARDWARE:

Provide LMCP lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
   a. Removable, plug-in terminal blocks with connections for all low voltage terminations.
   b. Individual terminal block, override pushbutton, and LED status light for each relay.
   c. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
   d. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
   e. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
   f. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
   g. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.

h. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.

4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
   a. Electrical:
      i 30 amp ballast at 277V
      ii 20 amp ballast at 347V
      iii 20amp tungsten at 120V
      iv 30 amp resistive at 347V
      v 1.5 HP motor at 120V
      vi 14,000 amp short circuit current rating (SCCR) at 347V
      vii Relays shall be specifically UL 20 listed for control of plug-loads
   b. Mechanical:
      i Replaceable, ½" KO mounting with removable Class 2 wire harness.
      ii Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
      iii Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
      iv Tested to 300,000 mechanical on/off cycles.
5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.
8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
   a. Each panel shall include digital clock capability able to issue system wide automation commands to up to (11) eleven other panels for a total of (12) twelve networked lighting control panels. The clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
   b. The clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
   c. The clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery back up for the clock function and program retention in non-

volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.

d. The clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
   i Scheduled ON / OFF
   ii Manual ON / Scheduled OFF
   iii Astro ON / OFF (or Photo ON / OFF)
   iv Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

e. The user interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)

f. The clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.

g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.

9. The lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.

10. The lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet® protocol.

a. The panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 – 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.

b. The panel shall support MS/TP MAC addresses in the range of 0 – 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.

c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 – 64. The state of each relay shall be readable and writable by the BAS via the object present value property.

d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 – 64.

e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 – 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.

f. Setup and commissioning of the panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the

handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:

i. Binary output objects in the instance range of 1 – 64 (one per relay) for on/off control of relays.

ii. Binary value objects in the instance range of 1 – 99 (one per channel) for normal hours/after hours schedule control.

iii. Binary input objects in the instance range of 1 – 64 (one per relay) for reading true on/off state of the relays.

iv. Analog value objects in the instance range of 101 – 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warn feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.

g. The description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.

h. The BO and BV 1 – 99 objects shall support BACnet priority array with a relinquish default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf)

i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.

j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.

11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:

a. The LMZC shall use the same intelligence board as the LMCP relay panel.

b. The LMZC shall not include relay driver boards or relays.

c. The LMZC shall have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.

d. The LMZC tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.

e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.

12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50% output when any digital occupancy sensor detects motion..
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.

B. USER INTERFACE

Each lighting control panel system shall be supplied with at least (1) handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. The user interface shall have the following panel-specific functions as a minimum:

1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive, and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
7. WattStopper Product Number: LMCT-100

2.14 SEGMENT MANAGER

A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256 bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).

B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manger via external BACnet-to-IP interface routers and switches, using standard Ethernet

structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the plans.

C. Operational features of the Segment Manager shall include the following:
   1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
   2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
   3. Log in security capable of restricting some users to view-only or other limited operations.
   4. Segment Manager shall provide two main sets of interface screens – those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system, and provide a centralized scheduling interface.

      Capabilities using the Config Screens shall include:
      a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
      b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager
      c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
      d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.
      e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an “Export Table” that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator’s request for info and the overall system performance.

5. Capabilities using the Segment Manager's Dashboard Screens shall include:
   a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x).Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles shall be color coded based on three energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. The tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.
   b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.
   c. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).
6. If shown in the contract drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.
7. The Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

D. Segment Manager shall support multiple DLM rooms as follows:
   1. Support up to 120 network bridges and 900 digital in-room devices (LMSM-3E).
   2. Support up to 300 network bridges and 2,200 digital in room devices, connected via network routers and switches (LMSM-6E).

E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.15 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.

B. Additional parameters exposed through this method include but are not limited to:
1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
6. Load control polarity reversal so that on events turn loads off and vice versa.
7. Per-load DR (demand response) shed level in units of percent.
8. Load output pulse mode in increments of 1second.
9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.

C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
1. Device list report: All devices in a project listed by type.
2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
5. Device parameter report: Per-room lists of all configured parameters accessible via hand held IR programmer for use with O&M documentation.
6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100%, 2 = all loads 75%, 3 = all loads 50%, 4 = all loads 25%, 5-16 = same as scene 1).

7. Occupancy sensor report: Basic settings including time delay and sensitivity(ies) for all occupancy sensors.

D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
1. Set, copy/paste an entire project site of sensor time delays.
2. Set, copy/paste an entire project site of sensor sensitivity settings.
3. Search based on room name and text labels.
4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
5. Filter by parameter value to search for product with specific configurations.

E. Network-wide firmware upgrading remotely via the BACnet/IP network.
1. Mass firmware update of entire rooms.
2. Mass firmware update of specifically selected rooms or areas.
3. Mass firmware upgrade of specific products.

F. WattStopper Product Number: LMCS-100, LMCI-100

2.16 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface

B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 – EXECUTION

3.1 PRE-INSTALLATION MEETING

A. A factory authorized manufacturer's representative shall provide the electrical contractor a functional overview of the lighting control system prior to installation. The contractor shall schedule the pre-installation site visit after receipt of approved submittals to review the following:
1. Confirm the location and mounting of all digital devices, with special attention to placement of occupancy and daylighting sensors.
2. Review the specifications for low voltage control wiring and termination.
3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
4. Discuss requirements for integration with other trades.

3.2 CONTRACTOR INSTALLATION AND SERVICES

A. Contractor to install all devices and wiring in a professional manner. All line voltage connections to be tagged to indicate circuit and switched legs.

B. Contractor to install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors. If pre-terminated cable is not used for room/area wiring, the contractor is responsible for testing each field-terminated cable following installation, and shall supply the lighting controls manufactuerer with test results. Contractor to install any room to room network devices using manufacturer-supplied LM-MSTP network wire. Network wire substitution is not permitted and may result in loss of product warranty per DLM SEGMENT NETWORK section of specification. Low voltage wiring topology must comply with manufacturer's specifications. Contractor shall route network wiring as shown in submittal drawings as closely as possible, and shall document final wiring location, routing and topology on as built drawings.

C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated. Before start up, contractor shall test all devices to ensure proper communication.

D. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings.
   1. Adjust time delay so that controlled area remains lighted while occupied.

E. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
   1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
   2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
   3. Load Parameters (e.g. blink warning, etc.)

F. Post start-up tuning – After 30 days from occupancy contractor shall adjust sensor time delays and sensitivities to meet the Owner's requirements. Provide a detailed report to the Architect / Owner of post start-up activity.

3.3 FACTORY SERVICES

A. Upon completion of the installation, the manufacturer's factory authorized representative shall start up and verify a complete fully functional system.

B. The electrical contractor shall provide both the manufacturer and the electrical engineer with three weeks written notice of the system start up and adjustment date.

C. Upon completion of the system start up, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system

D. Include a certified lighting control acceptance verified in writing by the factory authorized representative.

3.4 COMMISSIONING SUPPORT SERVICES

A. On this project, a commissioning agent will be hired to verify the installation and programming of all building systems, which includes the lighting control system. Manufacturer should include an extra day of technician's time to review the functionality and settings of the lighting control hardware with the commissioning agent, including reviewing submittal drawings and ensuring that instructions on how to configure each device are readily available. Manufacturer is NOT responsible for helping the commissioning agent inspect the individual devices. It will be the commissioning agent's responsibility to create and complete any forms required for the commissioning process, although the manufacturer or contractor may offer spreadsheets and/or printouts to assist the agent with this task.

B. The commissioning agent shall work with the electrical contractor during installation of the lighting control hardware to become familiar with the specific products. The agent may also accompany the manufacturer's technicians during their start-up work to better understand the process of testing, calibration and configuration of the products. However, the contractor and manufacturer shall ensure that interfacing with the agent does not prevent them from completing the requirements outlined in the contract documents.

3.5 FINE TUNING AFTER SUBSTANTIAL COMPLETION

A. Provide a factory authorized representative for fine tuning and adjustments to the system within 6 months after substantial completion as coordinated and requested by the Owner. Modify and adjust controls, settings, and programming as directed by Owner.

END OF SECTION 260923

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Straight-blade convenience, receptacles.
2. USB charger devices.
3. GFCI receptacles.
4. Hazardous (classified) location receptacles.
5. Twist-locking receptacles.
6. Pendant cord-connector devices.
7. Cord and plug sets.
8. Toggle switches.
9. Decorator-style convenience.
10. Digital timer light switches.
11. Wall-box dimmers.
12. Wall plates.
13. Floor service outlets.
14. Poke-through assemblies.
15. Prefabricated multioutlet assemblies.

1.3 DEFINITIONS

A. Abbreviations of Manufacturers' Names:

1. Cooper: Cooper Wiring Devices; Division of Cooper Industries, Inc.
2. Hubbell: Hubbell Incorporated: Wiring Devices-Kellems.
3. Leviton: Leviton Mfg. Company, Inc.
4. Pass & Seymour: Pass& Seymour/Legrand.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include color selections for all areas of the project.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Poke-Through, Fire-Rated Closure Plugs: One for every ten floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton (Arrow Hart).
2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.
4. Pass & Seymour/Legrand (Pass & Seymour).

B. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

D. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with the requirements in this Section.
3. Connectors are approved by the university or institution of the project.

E. Devices for Owner-Furnished Equipment:

1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

F. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STRAIGHT-BLADE RECEPTACLES

A. Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Hospital-Grade, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.

C. Isolated-Ground, Duplex Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

D. Tamper-Resistant Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Description: Labeled and complying with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.3 USB CHARGER DEVICES

A. Tamper-Resistant, USB Charger Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 1310, and FS W-C-596.
1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
2. USB Receptacles: Dual, Type A.
3. Line Voltage Receptacles: Dual, two pole, three wire, and self-grounding.

2.4 GFCI RECEPTACLES

A. General Description:

1. 125 V, 20 A, straight blade, non-feed-through type.
2. Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, UL 943 Class A, and FS W-C-596.
3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.

B. Duplex GFCI Convenience Receptacles.

C. Tamper-Resistant, Duplex GFCI Convenience Receptacles.

2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

A. Hazardous (Classified) Locations Receptacles: Comply with NEMA FB 11 and UL 1010.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton (Arrow Hart).
b. EGS/Appleton Electric.
c. Killark.

2.6 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

B. Twist-Lock, Isolated-Ground, Single Convenience Receptacles: 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.

1. Grounding: Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

1. Single Pole
2. Two Pole
3. Three Way
4. Four Way

C. Pilot-Light Switches: 120/277 V, 20 A.
1. Description: Single pole, with LED-lighted handle, illuminated when switch is off.

D. Key-Operated Switches: 120/277 V, 20 A.
1. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

2.10 DIGITAL TIMER LIGHT SWITCH

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton (Arrow Hart).

2. Hubbell Incorporated; Wiring Device-Kellems.
3. Leviton Manufacturing Co., Inc.

B. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.

1. Rated 960 W at 120-V ac for tungsten lighting, 10 A at 120-V ac or 10 A at 277-V ac for fluorescent or LED lighting, and 1/4 hp at 120-V ac.
2. Integral relay for connection to BAS.

2.11 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.12 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Provide full range of finished metal wall plates as selected by the Architect. Colors will vary depending on specific areas of the project.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, [die-cast aluminum] [solid brass] with satin finish.

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements of the voice/data cabling installer.

2.14 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Incorporated; Wiring Device-Kellems.
2. Thomas & Betts Corporation; A Member of the ABB Group.
3. Wiremold / Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks complying with requirements of the voice/data cabling installer.
4. Size: Selected to fit nominal 3-inch (75-mm) or 4-inch (100-mm) cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 271500 "Communications Horizontal Cabling."

2.15 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing. Colors will vary depending on specific areas of the project, for instance black areas like the Sound/Light locks shall be dark/black to match wall color.
2. Wiring Devices Connected to Emergency Power System: Red.
3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.

7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Convenience Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Shunt trip fusible switches (elevator disconnects).
4. Molded-case circuit breakers (MCCBs).
5. Molded-case switches.
6. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

2. Fuse Pullers: Two for each size and type.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:
1. 600-V ac.
2. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
3. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

A. Type HD, Heavy Dut, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

B. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.

7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

2.5 SHUNT TRIP FUSIBLE SWITCHES (ELEVATOR DISCONNECTS)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussman
2. Eaton.
3. General Electric Company; GE Energy Management - Electrical Distribution.
4. Siemens Energy.
5. Square D; by Schneider Electric.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate indicated fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, pilot, indicating and control devices.

E. Accessories:

1. Oiltight key switch for key-to-test function.
2. Oiltight red ON pilot light.
3. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
4. Form C alarm contacts that change state when switch is tripped.
5. Three-pole, double-throw, fire-safety and alarm relay; [120-V ac] [24-V dc] coil voltage.
6. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
7. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper neutral conductors.
8. Isolated Ground Kit: Internally mounted; insulated, labeled for copper neutral conductors.
9. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
10. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac.
11. Hookstick Handle: Allows use of a hookstick to operate the handle.
12. Lugs: Mechanical type, suitable for number, size, and conductor material.
13. Service-Rated Switches: Labeled for use as service equipment.

2.6 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Energy.
4. Square D; by Schneider Electric.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated or series rated as indicated on the Drawings. Circuit breaker/circuit breaker combinations for series connected interrupting ratings shall be listed by UL as recognized component combinations. Any series rated combination used shall be marked on the end-use equipment along with the statement "Caution - Series Rated System. _____ Amps Available. Identical Replacement Component Required."

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 167 deg F (75 deg C) rated wire.

G. Standards: Comply with UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Instantaneous trip.

2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I-squared t response.

K. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

L. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
7. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.7 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
1. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
6. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and clearances.
d. Verify that the unit is clean.
e. Operate the circuit breaker to ensure smooth operation.
f. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

g. Inspect operating mechanism, contacts, and chutes in unsealed units.
h. Perform adjustments for final protective device settings in accordance with the coordination study.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

END OF SECTION 262816

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior lighting fixtures, lamps, and ballasts.
2. Emergency lighting units.
3. Exit signs.
4. Lighting fixture supports.

B. Related Sections:

1. Section 260923 "Distributed digital lighting controls" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. LER: Luminaire efficacy rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. Ballast, including BF.
4. Energy-efficiency data.
5. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."
6. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
7. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.

a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples – When requested by Architect/Engineer (include in bid): For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:

1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

D. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Lighting fixtures.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extends to within 12 inches (305 mm) of the plane of the luminaires.
4. Ceiling-mounted projectors.
5. Structural members to which suspension systems for lighting fixtures will be attached.
6. Other items in finished ceiling including the following:

    a. Air outlets and inlets.
    b. Speakers.
    c. Sprinklers.
    d. Smoke and fire detectors.
    e. Occupancy sensors.
    f. Access panels.

7. Perimeter moldings.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910, complying with the IESNA Lighting Measurements Testing & Calculation Guides.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NFPA 70.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

1. Warranty Period for LED Lamps and Power Supplies: 5 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
2. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
3. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Products: Subject to compliance with requirements, provide one of the products indicated on Drawings.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Metal Parts: Free of burrs and sharp corners and edges.

C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

E. Diffusers and Globes:

1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
b. UV stabilized.

2. Glass: Annealed crystal glass unless otherwise indicated.

F. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp and ballast characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
f. CCT and CRI for all luminaires.

2.3 LED LAMPS AND DRIVERS:

A. Minimum CRI Ra- 82 or as specified.

B. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used, per IES LM-79 and LM-80.

C. Color Consistency 3 MacAdams Ellipse or better.

D. LED Rated life L70 of 50,000 hours per (IES TM-21). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.

E. Flicker: No visible or detectable flicker, operating on all dimmed intensities.

F. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level shall be 1% or as scheduled.

G. Inrush current shall be negligible. Maximum allowed is 30mAs.

H. THD shall not exceed 20% at full load.

I. Minimum driver efficiency shall be 86% at 65% rated load.

J. Maximum off-state power consumption 0.5w.

K. Compliant with FCC 47 CFR Part 15 A for Residential applications and B for Commercial applications.

L. LED module shall be replaceable in the field using modules with digitally traceable matching modules.

M. Luminaire shall be NRTL Listed at intended operating temperature.

N. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.

O. Approved Manufacturers- Drivers

1. General Electric.
2. Philips.
3. Osram / Sylvania.
4. Lutron
5. EldoLED
6. Thomas Research

P. Approved Manufacturers- LEDs
1. General Electric
2. Philips
3. Osram
4. Cree
5. Xicato
6. Nichia

Q. Approved Manufacturers for Luminaires shall be as scheduled.

2.4 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.

    a. Battery: Sealed, maintenance-free, nickel-cadmium type.
    b. Charger: Fully automatic, solid-state type with sealed transfer relay.
    c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
    d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
    f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
    g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage (2.68 mm).

F. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

G. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers and Globes:
1. Glass: Annealed crystal glass unless otherwise indicated.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.

D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI for all luminaires.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Lighting fixtures:

1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

C. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary.

When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

D. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

E. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from lighting fixture corners.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

F. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

G. Wall-Mounted Luminaire Support:

1. Attached to a minimum 20 gauge backing plate attached to wall structural members.
2. Do not attach luminaires directly to gypsum board

H. Suspended Lighting Fixture Support:

1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

I. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 Mock Ups

A. A mock up of all theater lights and theater lobby lights shall be performed. All mock ups shall be reviewed and walkdown with the Owner and Architect prior to releasing additional installation of any fixture.

3.3 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Verify that self-luminous exit signs are installed according to their listing and the requirements in NFPA 101.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.5 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

END OF SECTION 265100

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Fire-alarm control unit.
   2. Manual fire-alarm boxes.
   3. System smoke detectors.
   4. Notification appliances.
   5. Digital alarm communicator transmitter.

B. Related Requirements:
   1. Retain subparagraph below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

C. Section 260519 "Lowe-Voltage Electrical Power Conductors and Cables" for cables and conductors for fire-alarm systems

1.3 DEFINITIONS

A. LED: Light-emitting diode.

B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

A. Noncoded, UL-certified addressable system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.6 SUBMITTALS

A. General Submittal Requirements:

1. In addition to the submittal to the Architect/Engineer, provide a complete submittal to the office of the Utah State Fire Marshal for review and approval. Incorporate Fire Marshal's corrections prior to submitting to the Architect/Engineer.
2. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
3. Shop Drawings shall be prepared by persons with the following qualifications:
    a. Trained and certified by manufacturer in fire-alarm system design.
    b. NICET-certified fire-alarm technician, Level IV minimum.
    c. Licensed or certified by authorities having jurisdiction.

B. Product Data: For each type of product indicated.

C. Shop Drawings: For Campus and Building fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery-size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. Qualification Data: For qualified Installer.

E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

F. Field quality-control reports.

G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
3. Record copy of site-specific software.
4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
    a. Frequency of testing of installed components.
    b. Frequency of inspection of installed components.
    c. Requirements and recommendations related to results of maintenance.
    d. Manufacturer's user training manuals.
5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire-alarm control unit.
7. Copy of NFPA 25.

H. Software and Firmware Operational Documentation:
1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
1. Installation shall be by personnel certified by NICET as fire-alarm Level III technician.

B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system if applicable.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

E. GUARANTEES:
1. Furnish a three-year guarantee for all equipment, materials and installation, including all labor and transportation
2. Emergency Response: The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

1.8 SOFTWARE SERVICE AGREEMENT

A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for two years.

C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
   1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
   2. Keys and Tools: One extra set for access to locked and tamperproofed components.
   3. Audible and Visual Notification Appliances: Quantity equal to 5 percent of amount of each type installed, but no fewer than 1 unit of each type.
   4. Fuses: Two of each type installed in the system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Tying to an existing system, subject to compliance with requirements, provide products by:
   1. FCI (Honeywell Gamewell Fire Control Instruments) furnished and installed by Siemens.
   2. Alternate installers may be provided if prior approved before bidding by University.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
   1. Manual stations.
   2. Heat detectors.
   3. Smoke detectors.
   4. Verified automatic alarm operation of smoke detectors.
   5. Automatic sprinkler system water flow.
   6. Fire-extinguishing system operation.

B. Fire-alarm signal shall initiate the following actions:
   1. Continuously operate alarm notification appliances.
   2. Identify alarm at fire-alarm control unit and remote annunciators.
   3. Transmit an alarm signal to the remote alarm receiving station.
   4. Unlock electric door locks in designated egress paths.
   5. Activate voice/alarm communication system.
   6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.

7. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
8. Activate emergency lighting control.
9. Activate emergency shutoffs for gas and fuel supplies.
10. Record events in the system memory.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
2. Low-air-pressure switch of a dry-pipe sprinkler system.
3. Elevator shunt-trip supervision.

D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 REQUIREMENTS FOR UNIVERSITY OF UTAH BUILDINGS

A. The following is required for fire alarms in University of Utah buildings from the Rules and Regulations providing for Life Safety in buildings regulated by the Utah State Fire Prevention Board:
1. The main panel on the fire alarm system shall be addressable analog and have the following features:
a. Unit shall be red, baked enamel, lockable, 16 gauge steel, with hinged door cabinets.
b. It shall be capable of supervising the fire alarm circuits, and of detecting shorts in circuits on either side of the power supply to ground.
c. It shall have a battery standby power supply which is capable of operating the system for twenty-four hours at full normal load, with five minutes of alarm sounding at the end of the period.
d. It shall have the capability of re-sounding the alarm once silenced, if a subsequent alarm is received from another initiating device.
e. It shall have the capability of shutting down individual initiating devices for maintenance purposes without affecting the continued operation of other initiating devices.
f. All necessary provisions shall be made in the design of the fire alarm system to allow for automatic reporting of all alarms from the project

fire alarm system to the remote station receiving console in Building #0301 via telephone lines.

2. Newly installed or updated systems:
    a. Pre-signal (alarm delay) systems of any type are prohibited. *Exception*: Approved smoke detection alarm verification systems in accordance with UL 864.
    b. All fire protection systems within a building, to include special extinguishing systems and elevator lobby detectors, shall be interconnected with the fire alarm system to sound the evacuation alarm when activated. *Note*: The fire alarm system shall not activate elevator recall.
    c. The fire alarm system shall be extended to all out-buildings subject to human occupancy which are used in connection with the primary building where the alarm system is installed.
3. Main board requirements:
    a. An approved key plan drawing shall be posted at the main fire alarm panel which graphically displays the location of all indicating appliances, initiation devices, their addresses, area occupancy and smoke separation walls. Provide a high plastic sign holder with two layers. The front layer shall be clear for viewing the CAD file alarm drawings.
    b. The main panel shall be located in a normally attended area such as the main office or lobby. Where this is not possible (and only if approved in writing by the University Fire Marshal), an electrically supervised remote annunciator from the panel shall be located in a supervised area of the building. The remote annunciator shall visually indicate system power status, alarms for each zone, and give both a visual and audible indication of trouble conditions in the system. All indicators of both the main and remote annunciator shall be adequately labeled. The main panel shall not be mounted in a custodial closet.
    c. Power to the panel, battery charger, or any other device which affects the operation of the system, shall be controlled through a single circuit breaker labeled ‘Fire Alarm System – Do Not Turn Off.’ Connect to engine generator supported emergency circuit where available.
4. System Wiring:
    a. The alarm initiating circuits (IDC) shall be Style D as defined in NFPA Pamphlet 72.
    b. The notification appliance circuits (NAC) shall be Z as defined in NFPA Pamphlet 72.
    c. Signal Line Circuits (SLC) shall be style 6 or 7 as defined in NFPA 72.
    d. Strobes shall be wired separately from audible devices, including combination horn/strobe units.
    e. Unless otherwise specified, minimum wire size shall be 16 gauge for audible alarm circuits, and 18 gauge for signal initiating circuits.
5. System Devices:
    a. Indication devices in newly installed systems shall be of the strobe/horn type. Electronic indication horn/strobes are not acceptable.
        1) Exception: Voice alarm systems and systems in health care facilities.

b. External indicating appliance horn/strobes shall be provided to allow the alarm to be heard in the direction of parking lot and playground areas.
c. Any auxiliary equipment to be connected into the system and not supplied by the fire alarm contractor, shall be complete, to be controlled by standard auxiliary contacts in the fire alarm system.
d. Manual alarm initiating stations shall be provided at all required building exits, boiler rooms, kitchens, and main administrative offices, and elsewhere to provide a maximum 200' travel distance to a pull station from any point in the building.
e. Visually indicating call stations.
f. Where elevator recall is required, recall initiating detectors shall have auxiliary contacts. Appropriate wiring in conduit shall be run from the initiating devices to the elevator control panel. These devices shall also initiate an evacuation alarm.
g. Duct detectors required by the mechanical code shall be manufactured by Fire Control Instruments (Nelson Fire Systems) and shall be interconnected and compatible with the fire alarm system and shall be addressable.

6. System Features:
   a. Trouble lamp and buzzer.
   b. Self-restoring silencing switch.
   c. Automatic locking of alarm signals until the device is returned to its normal condition and the panel manually reset.
   d. Supervision of circuits such that a fault condition in any circuit, or group of circuits, will not affect the proper operation of any other circuit.
   e. Circuit fuses for each signal initiating and alarm circuit which, if blown, shall cause audible and visual trouble signals to operate.
   f. Digital transmitter with terminals and other necessary hardware/software to permit the transmission of trouble and alarm circuits over telephone lines to a remote station receiving panel.
   g. A key operated "Drill Switch" to simulate the operation of an initiating device. The switch shall not trip the device which transmits a signal to the fire department, operates elevator return systems or operates fire doors.
   h. The battery system shall be capable of operating the fire alarm system at full load for 24 hours and still provide five minutes of alarm sounding at the end of the 24 hour period.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:
   1. Comply with UL 268; operating at 24-V dc, nominal.
   2. Detectors shall be four -wire type.
   3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
   7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
      a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
      b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
      c. Provide multiple levels of detection sensitivity for each sensor.
   8. Color: White or as selected by the architect.

B. Photoelectric Smoke Detectors:
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
   2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      a. Primary status.
      b. Device type.
      c. Present average value.
      d. Present sensitivity selected.
      e. Sensor range (normal, dirty, etc.).

C. Ionization Smoke Detector:
   1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
   2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
      a. Primary status.
      b. Device type.
      c. Present average value.
      d. Present sensitivity selected.
      e. Sensor range (normal, dirty, etc.).

2.6 FIRE EXTINGUISHER MONITORING SYSTEM

A. During design, coordinate with the University Fire Marshal through the University Project Manager to determine the type of monitoring system (wireless or hard-wired), and type of fire extinguishers (A, B, C, D, CO2, Halon, etc,) to be used in the project.

B. For new buildings, design a hard wired fire extinguisher monitoring system, supervised through the building's fire alarm system.

C. For existing buildings provide fire extinguishers with wireless monitoring systems.
   1. At or before the design development phase review, coordinate with the University Fire Marshall through the University Project Manager to determine the locations of wireless receivers and high power repeaters, and fix their locations on project drawings.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections. Factory white unless otherwise directed by architect.
   1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

C. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
   1. Rated Light Output:
      a. 15/30/75/110 cd, selectable in the field.
   2. Mounting: Wall mounted unless otherwise indicated.
   3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
   4. Flashing shall be in a temporal pattern, synchronized with other units.
   5. Strobe Leads: Factory connected to screw terminals.
   6. Mounting Faceplate: Factory finished white or another color as selected by the Architect.

D. Voice/Tone Notification Appliances:
   1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
   2. High-Range Units: Rated 2 to 15 W.
   3. Low-Range Units: Rated 1 to 2 W.
   4. Mounting: Semi-recessed.
   5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.8 ADDRESSABLE INTERFACE DEVICE

A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

B. Integral Relay: Capable of providing a direct signal to external system or equipment.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install wall-mounted fire-alarm control units with tops of cabinets not more than 72 inches (1830 mm) above the finished floor. Retain first subparagraph below if Project requires seismic bracing. Coordinate with Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
   1. Install seismic bracing. Comply with requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
   2. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   3. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Smoke- or Heat-Detector Spacing:
   1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
   2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
   3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
   4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
   5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
   6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

D. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.

E. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling and at least 84" above the floor.

F. Pull Station height shall be not more than 48 inches (1200 mm) above the floor level to the bottom of the device.

G. Device Location-Indicating Lights: Locate in public space near the device they monitor.

3.2 WIRING INSTALLATION

A. Wiring Method: Install all cables and wiring in metal raceways according to Division 26 Section "Raceway and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated.

B. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by the manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

D. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and a different color-code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
   1. Comply with campus color-code standard for fire alarm system wiring.

E. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.

F. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

G. All necessary provisions shall be made for automatic reporting of all alarms from the project fire alarm system to the remote station receiving console in Building 301 via leased telephone lines. The contractor will provide a conductor pair run in conduit from the fire alarm panel to the telephone panel and will make the final connection to the desired leased telephone line. The contractor will inform the proper authorities (Facilities Management) when the phone line is ready to be connected. U of U Project

H. Concerning NAC the Horn and strobe circuits shall be separate. The horns shall have a temporal pattern signal. IDC, NAC and SLC wiring shall have independent feeds and returns from the panel to form a loop.

3.3 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.

B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems.
4. Door hold open devices on designated doors.
5. Alarm-initiating connection to elevator recall system and components.
6. Alarm-initiating connection to activate emergency lighting control.
7. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
8. Supervisory connections at valve supervisory switches.
9. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
10. Supervisory connections at elevator shunt trip breaker.
11. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
12. Supervisory connections at fire-pump engine control panel.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

A. Field tests shall be witnessed by authorities having jurisdiction.

B. Perform tests and inspections.
1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:
1. Visual Inspection: Conduct visual inspection prior to testing.
    a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.

b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

G. All information pertaining to the Facility's fire alarm system shall be supplied to the facilities managers. This information shall include everything necessary to change the fire alarm program themselves. The minimum amount of information required is:

a. CAD drawing files of building fire alarm map.
b. CAD drawing files of "as built" fire alarm components and point to point connections.
c. CAD drawing files of "as built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of equipment.
d. General configuration programming
e. Job specific configuration programming.
f. Tutorial file on complete programming of fire alarm system.

H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111

DESIGN REQUIREMENTS

UNIVERSITY OF UTAH SUPPLEMENT

November 1, 2017

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TABLE OF CONTENTS

REVISION SUMMARY

The following major revisions have been approved by the University's Design Standards Committee. Throughout this document there are vertical lines to the left of the text that identify locations where revisions were made to the May 1, 2017 edition.

DATE	PAGE NO.	SECTION	SUMMARY OF APPROVED CHANGE
11/1/17	17	3.2 C	Minor changes to Water Distribution System requirements
11/1/17	20	3.2 E	Minor changes to Sanitary Sewer system requirements
11/1/17	22	3.2 G (6) d.	Removed requirement for specific product/vendor
11/1/17	98	3.6 B (11)	Removed requirement for specific product/vendor for pipe/duct identification
11/1/17	105	3.8 A (2)	Removed requirement for specific product/vendor
11/1/17	111	3.8 N (1)	Added requirement regarding conflicting standards. Clarified that the Alternate Design may be allowed upon approval of an engineered system.
11/1/17	188	5.1 A	Revision to when LEED certification is required.
11/1/17	188	5.1 B, C	Removed reference to LEED v4; required to follow current LEED standard
11/1/17	188	Table 5.1	Numerous additions and revisions to reference table for LEED and HPBS requirements
11/1/17	192	5.2 A, B	Revised Measurement and Verification Plan, added Enhanced Commissioning requirement
11/1/17	195	6.2	Removed requirements for specific products/vendors

1.0 GENERAL

1.1 General

A. The latest edition of the *DFCM Design Requirements* and the *University Design Requirements* supplement shall be followed on all University of Utah projects. This document accepts the *DFCM Design Requirements* as the University's own, and supplements it with additional requirements. These documents together form the core standard for architectural and engineering services provided on University projects.

B. The Architect and/or Engineer (herein after referred to as "A/E") is to adhere to both the *DFCM* and *University Design Requirements* on all projects for the University whether the contract originates from DFCM or from the University of Utah.

(1) To remain consistent with the *DFCM Design Requirements*, this supplement has been organized in a similar manner. The outline of the University supplement has been formatted to follow the same outline as the DFCM sections, headings and subheadings, with a few minor exceptions.

a. The University's supplement has additional sections, headings and subheadings to accommodate additional requirements that are unique to the University.

(2) The A/E should refer first to the *DFCM Design Requirements*, then to the *University Design Requirements* supplement to understand the specific standards, functional requirements, and systems limitations needed to satisfy University infrastructure, organization, and mission objectives. An understanding of this information is essential for the successful completion of the A/E's responsibilities.

(3) For University managed projects, the A/E is to replace references to DFCM and the DFCM Project Manager with the University and University Project Manager, respectively, within the *DFCM Design Requirements*.

1.2 Procedure

A. Complete the 'University of Utah Design Standards Change Request Form' to make recommendations for additions, deletions and changes to the *University Design Requirements*. All modifications shall require approval by the University's Design Standards Committee.

B. Complete the 'University of Utah Design Standards Project Variance Request Form' for approval to vary from these *Design Requirements* based upon specific project needs. The A/E shall document why the current design requirement cannot be met, including valid justifications and recommended solutions. All variance requests require approval by the University's Design Standards Committee.

1.3 Hierarchy of Requirements

A. For DFCM managed projects, the State Building Official with the approval of the Director of DFCM and/or the State Fire Marshal shall have authority to grant modifications. DFCM modifications granted by the State Building Official shall be documented in as required by DFCM.

B. For University managed projects, the University Building Official and/or the University Fire Marshal shall have the authority to grant modifications. Any modifications granted by the University shall be documented as required by 1.4 below.

1.4 Changes and Additions to Design Requirements

A. The A/E shall submit the Change Request Form or the Project Variance Request (as appropriate) to the University Project Manager. These forms can be found in the *University*

Design Process Supplement, and on the University's Facilities Management website. All requests require approval by the University's Design Standards Committee.

1.5 University Approved Equal

A. The materials, products, and equipment described in the *University Design Requirements* establish the standard of required function, dimension, appearance, durability, warrantee, maintainability and quality to be met by any proposed alternative. The A/E may submit an approved equal product for consideration through the University Project Manager if they believe that a product meets or exceeds the current *University Design Requirements*. Refer to 6.0 for University Approved Products.

B. The definition of "Approved Equal" throughout the *University Design Requirements* shall be as follows: Material, equipment, or method of construction that has been approved by the University as an acceptable alternative to that specified in the *University Design Requirements*.

C. The Design Professional shall submit proposed approved equal products to the University Project Manager for review and approval by the Design Standards Committee as a Project Variance Request prior to final inclusion in contract documents. The approved equal submittal shall include an analysis and recommendation by the design professional.

D. The Project Variance Request form shall be submitted in a timeframe that allows for a 30-day review period by the University prior to the time that a decision shall be made in the design process. An exception to the 30-day review period may be made for substitution requests submitted by Contractors during bidding.

(1) Potential actions in response to substitution requests during bidding include (but are not limited to): approval, denial, extension of bidding to allow for review, and denial for that specific bid due to time constraints while initiating a separate review for consideration of modifying the *University Design Requirements*.

E. Prior to making a decision regarding "approved equal" requests, the Design Standards Committee shall seek input from appropriate parties within Facilities Management or elsewhere within the University.

2.0 CODES / LAWS / RULES AND REGULATORY REQUIREMENTS

The DFCM Design Requirements shall be followed on all University projects, along with the additional University requirements detailed below.

2.1 General
- A. Comply with adopted State Codes and all other applicable Standards and Codes at the time submitted to the State Building Official for DFCM managed projects or the University Building Official for University managed projects.

2.2 DFCM Requirements
- A. The A/E shall coordinate with the University Project Manager for additional Administrative Services and University Services requirements.

2.3 Building Code Commission
- A. Enforcement is the responsibility of the University's Building Official for University managed projects.

2.4 Fire Prevention Board
- A. The A/E is to coordinate with the University Fire Marshal.

2.5 Accessibility Code
- A. No additional University requirements.

2.6 Labor Commission
- A. No additional University requirements.

2.7 Department of Health
- A. No additional University requirements.

2.8 Department of Environmental Quality
- A. In addition to the DFCM requirements, the A/E shall coordinate with the University's Occupational and Environmental Health & Safety Office for specific University requirements.

2.9 County Health Department
- A. No additional University requirements.

2.10 Department of Commerce
- A. No additional University requirements.

3.0 UNIVERSITY REQUIREMENTS

The DFCM Design Requirements shall be followed on all University projects, along with the additional University requirements detailed below.

3.1 General

A. Enhanced Accessibility

(1) University of Utah projects managed either by DFCM or the University of Utah shall include in the project's scope of work the construction of primary or secondary accessible paths of travel, or improvements to existing primary/secondary accessible paths of travel. The intent of this requirement is to enhance and provide consistency with the network of accessible pathways throughout the University campus or University owned properties. This requirement shall apply to new buildings, additions to existing buildings, site landscaping, civil or utility infrastructure improvements which interface with or impact the primary and secondary accessible routes as shown in the Accessible Paths of Travel Study. The University Project Manager or Project Planner shall determine the extent of this requirement during the planning or programming phase. The A/E shall provide design solutions as guided by the Accessible Paths of Travel Study a copy of this Study will be provided by the University Project Manager or Planner.

B. Energy Efficient Products

(1) Many buildings on campus have been retrofitted with energy efficient equipment as part of an energy management plan. When remodeling any building, the energy efficiency and operating characteristics of existing and new equipment shall not be diminished by the building revisions.

C. Energy Design Standards

(1) The DFCM and University High Performance Building Systems (HPBS) apply to all design and construction projects. The University also has additional LEED requirements detailed in 5.1.

D. Hazardous Materials

(1) A/E shall coordinate with University Project Manager regarding hazardous materials on site.

E. Vibration

(1) No additional University design requirements.

F. Utah Space Standards

(1) No additional University design requirements.

G. Infrastructure Flexibility

(1) No additional University design requirements.

H. Standard Building Plaque

(1) A/E shall coordinate with University Project Manager for specific University design.

I. Construction Coordination

(1) Work Restrictions

a. The A/E is to work with Facilities Management through the University Project Manager to establish the limits of construction during the design development stage to include the area which is affected by the work. If possible, this is to include areas affected by the shutdown of the landscape irrigation.

(2) Traffic Management Plan

a. Traffic control is a major concern on campus. Consult with Facilities Management through the University Project Manager to identify procedures to be used in a traffic management plan for the project. Describe access routes to the job site through the campus for concrete trucks, delivery trucks and other vehicles concerned with the project. The approved plan should be detailed for the Contractor and included as part of the project documents.

(3) Parking Requirements for Construction

a. Project Parking Plan shall be developed to establish the parking impact during and after a construction Project. This Plan is to be done during the design process to provide direction in the contract documents that will inform the bidding and successful contractor what parking will be available to the project during construction. This plan is to be developed jointly by the Design Team, University Project Manager, University Project Planner, and University Commuter Services. Once prepared, the Parking Plan form is to be included with the design documents when they are submitted for plan review, preferably at DD review, but no later than CD. The Plan shall be approved during the plan review process and the information then included in the bid contract documents.

(4) Contractor's Use of Building Equipment

a. Include provisions for the Contractor to use equipment such as electric motors, blowers, heat exchangers, filters, lighting fixtures, etc., with the written permission of the University. As each piece of equipment is used (such as electric motors and blowers), require the Contractor to follow maintenance procedures approved by the manufacturer. Require the Contractor to maintain a careful record of the time used, maintenance procedures followed, and any difficulties experienced with the equipment. These contractors' records on the equipment are to be submitted to the University upon acceptance.

b. For extended projects, require the Contractor to replace used expendables of the equipment with new replacements which meet equipment and project specifications (i.e., belts, filter media, fluorescent lamps, bearings, etc.). Require these items to be inspected just prior to acceptance. Any excessive wear noted during the inspection shall require replacement. Require the guarantee period for equipment to begin with Substantial Completion acceptance by the University. Coordinate these items with Facilities Management (especially Facility Operations) through the University Project Manager.

(5) Temporary Facilities for Construction

a. Include provisions for a construction area fence and gate at least 6-ft high. Refer to 4.3 F for chain link fence requirements.

b. Require the Contractor to provide dust and noise barriers in all remodeling areas.

c. Temporary Project Sign requirements should be coordinated with the University Project Manager.

d. Where construction sites interrupt existing pedestrian pathways (determined by consultation with Facilities Management, and the Occupational and Environmental Health & Safety officials through the University Project Manager), such pathways shall be replaced with temporary walks to circumvent the interrupted areas. Damage to existing walkways shall be restored at the completion of construction at Contractor's expense whether inside or outside (adjacent to) the construction site.

e. The A/E is to specify and delineate requirements for the Contractor to provide adequate outdoor lighting along walkways and around the perimeter of construction site. Such lighting shall be operational for all hours of darkness during extent of construction.

J. Emergency Phones

(1) The decision to install emergency phones as part of a construction project will be by the University. The University Project Manager will obtain University approval to include E-phones in the project design; and, obtain approved equipment specifications through the Managing Director of Occupational and Environmental Health & Safety and Emergency Management, and the University Chief of Police.

(2) Facilities management, through the University Project Manager, will provide to the A/E:

a. Guide specifications for approved emergency phone devices.

b. Specific E-phone functionality and operational characteristics required by University Public Safety.

c. Contractor instructions for equipment connections.

K. Demolition – Expectations of the A/E's Design

(1) Prior to Design Development Submittal

a. During the design of the project (before submission of the design development documents for review), the A/E, together with its sub consultants, shall identify furnishings, accessories, equipment, material, systems, etc. which will be affected or removed by demolition.

b. The A/E and sub consultants as appropriate shall meet with the University Project Manager, representatives from Facility Operations, and a representative of University Surplus and Salvage. This focus of this meeting will be to determine final ownership of all of removed items; and, for those items returned to the University, any required preparation, delivery and transfer instructions.

i. Items which will remain the property of the University shall be clearly identified and listed for inclusion in the Contract Documents.

(a) Generally, all fire alarm components will remain the property of the University. The disposition of removed fire alarm wiring and conduit will be considered on a project by project basis.

ii. Include instructions to the Contractor for preparations and delivery of each of the removed items to the University (safety preparations, coiling, packaging, palletizing, cleaning, prior notification, delivery location, etc.).

c. The A/E may be asked to tag or otherwise identify specific items at the site before demolition to aid the Contractor's awareness and protection of University property.

d. Remaining items which will become the property of the Contractor shall be included in the Contract Documents, allowing the Contractor to include salvage value in the bid. This may be a general summarization of all remaining demolition, or specific items or systems.

i. Include both declarations in the design development review documents as they are intended to appear in the bidding documents.

ii. Include salvage value in the detailed cost estimate.

(2) Site Visit Reports

a. Include the disposition of items which are identified to be returned to the University in site visit reports.

L. Parking and Service Access

(1) Provide service area for a minimum of two trucks adjacent to each building and provide space for trash containers which will be picked up by a truck lift.

(2) The University uses the dumpster system of trash removal. This consists of metal containers placed outside each building (one per building is usually required) in which the trash is deposited.

(3) All dumpsters are to be enclosed in an appropriate enclosure and screening device appropriately located on the site. The design for the approach to the enclosure shall be reviewed with Facilities Management prior to going to bid.

M. University Hospitals, Clinics and the School of Medicine – Special Design Requirements

(1) University of Utah Health Care (UUHC) operates University hospitals, clinics, and other facilities throughout the State.

(2) UUHC Department of Facilities & Engineering (Hospital F&E) manages some projects under delegation from U of U Facilities Management.

(3) All requirements described in the DFCM Design Manual and University of Utah Supplement (Programming Standards, Design Process, and Design Requirements) apply to all UUHC projects. The UUHC Hospital Design Standards and the UUHC Contractor Handbook supplement, but do not replace A/E requirements for design described in the DFCM Design Manual and University of Utah Supplement.

(4) UUHC Hospital Design Standards

a. Special design requirements for UUHC projects are described herein below and in the UUHC Hospital Design Standards. The UUHC document is available from Hospital F&E through the University Project Manager. UUHC standards may be applicable to the Project for hospital grade materials and finishes, and/or non-patient care construction requirements. Where UUHC Hospital Design Standards are silent on any design issue, the instructions provided in the DFCM Design Manual and this Supplement shall apply.

(5) UUHC Contractor Handbook

a. Special construction requirements for UUHC projects are described in the Contractor Handbook for UUHC Construction Projects (or “Handbook”) available on the University’s Facilities Management web site. The Handbook shall be included in the A/E’s project specifications, either in print or by reference. The A/E’s specifications shall require the Contractor to print the Handbook for use during construction.

b. Parking and staging areas

i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine appropriate staging and parking areas for the Project, and include this information in the Project design drawings or specifications.

ii. Include a warning that emergency access to UUHC facilities, and patient, staff, fire lane, and handicapped parking is critically important to UUHC operations, and must not be impeded, even temporarily.

c. Stair / Elevator Access

i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify appropriate routes for Contractor access to the work site,

including selected stairwells and elevators for the transport of materials. This information shall be included in the Project design drawings or specifications and describe or show any areas to be avoided by construction workers.

d. Special Working Hours
   i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine the need for special working hours, and certain hours when noise transmission must be limited. Any special requirements must be included in the Project design drawings or specifications.

e. Restroom Limitations
   i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine the limitations to be imposed on the use of restrooms in the facility. Unless approved otherwise, the A/E shall specify that the Contractor shall provide hand washing and restroom facilities for its personnel, separate from UUHC restrooms.

f. Dumpster Locations
   i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine approved locations for the Contractor's dumpsters/trash receptacles, and show these on the Project drawings.

g. Requirements for Interim Life Safety Measures (ILSM)
   i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor for a site review meeting held with the Hospital Fire Marshal, the infection control team, and any other applicable safety team to conduct an assessment of the proposed construction to identify any possible compromise to the building's life safety system.
   ii. The A/E shall keep accurate minutes of the meeting. Documents provided by UUHC life safety staff for use on the Project shall be combined with applicable items in the A/E minutes to form an "ILSM Project Plan." A specific form or format will be required by UUHC.
   iii. The ILSM Project Plan must include the Statement of Conditions fire drawings, including requirements for patching walls, available from the Hospital Fire Marshal or the Hospital F&E Project Supervisor.
   iv. Insert the ILSM Project Plan, the required ILSM Form, and all terms of the ILSM plan in the Project specifications, including but not limited to assessment summaries, expected UUHC monitoring, the maximum number of expected debrief meetings, any required documentation to be posted and/or kept in a Contractor's project file on site, any required Contractor reports with expected frequency, any other special procedures, etc.

h. Requirements for Infection Control Construction Risk Assessment
   i. An Infection Control Construction Risk Assessment (ICRA) is generally required on all projects affecting or near patient areas. UUHC will initiate the ICRA for each applicable project, and the A/E shall apply the project's completed ICRA to the drawings and specifications, and require the Contractor to comply with ICRA safety measures and requirements.

ii. Include any other project specific requirements directed by the UUHC's safety team or infection control team (*e.g.*, assessment, documentation, monitoring, reports, special procedures, pressure / flow indicators, tacky mats, etc.).

i. Dust, Vapor, Etc., Containment

i. The A/E shall coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify project requirements for the containment of dust, aerosol, fumes, vapors, etc. (e.g., any required approved plans, Contractor documentation, reports, etc.). Include any requirements in the Project specifications.

j. Materials & Equipment Specified for UUHC Projects

i. All materials/equipment specified must be U/L approved. Require independent testing lab sheets with the Contractor's submittal.

ii. For all hospital and clinic designs, material and equipment components are required to be Hospital Grade. Coordinate with the FM Project Manager / Hospital F&E Project Supervisor to determine if Hospital certification will be required.

iii. Coordinate with the FM Project Manager / Hospital F&E Project Supervisor to identify approved finish materials for the Project specifications.

iv. The design and resulting construction must meet federal/state/local and UUHC requirements.

v. Only non-asbestos containing materials may be specified.

3.2 Civil

A. Paving

(1) Sidewalk Requirements

a. Campus sidewalks require extended width and added structural strength to handle heavy vehicular loads without damage. Due to the perimeter road system surrounding the University of Utah campus, campus sidewalks may be the only vehicular access to interior campus buildings and construction sites. All sidewalks on campus shall be designed in accordance with the requirements below.

b. Sidewalks on campus shall be 8-ft wide (minimum). Central slab thickness shall be 6-in thick, and grow to 8-in thick at both edges. The width of the thicker edge on each side of the sidewalk shall not be less than 6-in. Six inches from the sidewalk edge, the 8-in thick concrete shall taper approximately 45° from 8-in to the 6-in central slab thickness.

c. All concrete sidewalk slabs shall be doweled to adjacent slabs with rebar dowels at expansion joints or any break in the pour. Dowels are to be evenly spaced with maximum distance between dowels not to exceed 24-in. Rebar dowels must be #4 or larger at least 24-in long. Dowels must be embedded at least 3-in deep and no closer than 6-in from the edge of the slab.

d. Concrete materials are to comply with 3.4 A.

e. Require the Contractor to provide 6-in compacted road base (untreated) under the central slab, tapering down to match the thickening concrete, to maintain a continuous 6-in compacted road base under the full width of the sidewalk.

f. Backfill for campus sidewalks shall be specified to be laid and compacted in lifts to meet the requirements described in 3.2 I (4).

g. Compaction testing shall be specified to meet the test schedule for sidewalks described in 3.2 I (4).
h. All sidewalks shall include polypropylene multifilament fiber reinforcement.
i. Sidewalk control joints shall be specified or drawn at 5-ft on center, and shall be a 1/4-in score, 1/4th the depth of the slab.
j. For walking surfaces along accessible paths of travel, control joints shall be in accordance with the requirements found in 3.4 A.
k. Sidewalk expansion joints shall be specified or drawn at 20-ft on center maximum, and shall be dimensioned and tooled in accordance with 3.4A. The expansion joint shall include asphalt impregnated fiber expansion material. Direct the Contractor to use bond breaker tape with polyurethane joint sealant to a depth of 3/8-in.
l. Require the Contractor to finish the concrete sidewalk with a tooled 1-in edge above grade, and broom surface finish.

(2) ADA Curb Ramps
a. Where detectable warning surfaces are installed, the surfaces and locations shall comply with the requirements of the latest edition of the ICC-A117.1, ADA standards and Federal Highway Administration (FHWA) for public right-of-way elements.
b. The detectable warning surface system shall be an approved replaceable polymer concrete or plastic homogenous color product which color is a reddish hue.
c. The detectable warning surface system shall be recessed and wet-set in new concrete. No surface mounted applications on existing concrete surfaces shall be approved.
d. Approved manufacturers: Armorcast Products Company; or approved equal.

(3) Concrete Paving
a. In general, 1% minimum grade is desired, 0.5% grade is the absolute minimum.
b. For parking lots, do not exceed 6% maximum grade.
c. For roadways, do not exceed 10% maximum grade
d. As an alternate for University consideration, the A/E's design shall include at least one concrete pavement section that incorporates pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include concrete pavers, etc.

(4) Asphalt Paving
a. In general, 2% minimum grade is desired, 1% grade is the absolute minimum.
b. For parking lots, do not exceed 6% maximum grade.
c. For roadways, do not exceed 10% maximum grade except as approved by Facilities Management through the University Project Manager.
d. Asphalt surfaces are not to be used as gutters, or used as channel paths for water.
e. As an alternate for University consideration, the A/E's design shall include at least one asphalt pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt, or pervious concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents.

B. Site Utilities

(1) Campus Utility Systems

a. Facilities Management owns and operates multiple utility systems on Campus. The following requirements herein apply to all utilities on Campus. Specific design requirements can be found in the individual sections.

i. Water Distribution System, see 3.2 C.

ii. Storm Drain, see 3.2 D.

iii. Sanitary Sewer, see 3.2 E.

iv. Natural Gas, see 3.2 F.

v. Electrical Distribution, see 3.5.

vi. High Temperature Water, see 3.8 D.

vii. Chilled Water, see 3.8 G.

viii. Irrigation Water, see 4.4.

ix. Communication Systems, 3.11

b. The most recently published version of the American Public Works Association ("APWA") Standard Specifications and APWA Standard Plans, as currently adopted by the APWA Utah Chapter, may be used for the design and construction of campus utilities. While the APWA standards are to be closely followed, this University supplement contains additional or alternative requirements which shall be included in the A/E's design. In the event of conflict, the DFCM and University Design Manual will govern.

(2) Utility Layout, Capacity, Connection Points

a. Facilities Management through the University Project Manager will provide all utility information available concerning the project work and surroundings. The A/E shall evaluate the utility information available against the project needs.

b. If exact elevations and locations are deemed necessary or desirable, the University will uncover the utilities and make the necessary surveys required (upon request from the A/E). Requests for this special information should be made to Facilities Management through the University Project Manager.

c. Coordinate with Facilities Management through the University Project Manager concerning utility connection points, capacities, crossings, etc.

i. Computer models of campus utility systems shall be used to evaluate the impact of new systems on existing pipe sizes and capacities.

ii. The proposed system layout shall be optimized by model analysis. Consult with Facilities Management regarding the model software used for each utility.

iii. Submit the proposed system layout with a complete report, including calculations, to the University Project Manager for Facilities Management review. The A/E is responsible for the accuracy of the submittal and subsequent design. University approval of the submittal shall not be considered a verification of the data, nor verification of the workability of the proposed design.

(3) Utility Metering

a. Construction Utilities

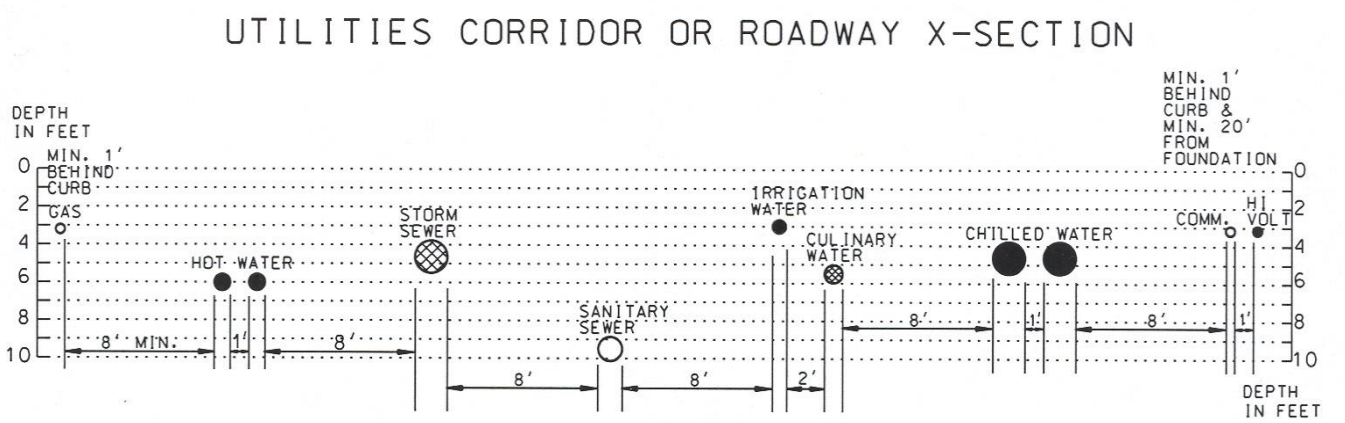
i. For non-State funded projects, specify construction utility metering per University meter specifications for water, electrical and natural gas (this does not include high temperature water which shall not be activated nor used until directed by the University). The Contractor will purchase the meters and either install them at locations directed by the University, or pay the University to install the meters. During construction, the Contractor will be invoiced for utilities used. This is only applicable to non-State funded projects where all the monies for construction come from University or donated sources.

b. University Auxiliaries, Dining Facilities, State Supported O&M Facilities, etc.

i. Design the utilities such that water, natural gas, and electricity can be separately metered for auxiliary functions within a University building. Include overall building meters, as well as sub-meters for utilities used by the auxiliary function. Coordinate with the University Project Manager to determine which end user activities will require metering. Refer to DFCM 5.11 for metering requirements.

(4) Underground Utility Depth & Separation Standard

a. The extension of buried utility systems on campus must conform to the University's Utility Master Plan to maintain minimum depth of bury and service clearances from underground structures and other utilities. Deviation from the master plan, as summarized in the following graphic, may only occur after review and approval from Facilities Management.



b. Easement Matrix for Existing Utilities

	HTW	CHILLED WATER	SAN. SEWER	STORM SEWER	WATER	GAS	POWER	COMM.
Minimum Depth	6'	4'	4'	4'	5'	3'	3'	3'
HTW								
Horizontal		10'	8'	8'	8'	6'	10'	10'
Vertical		10'	8'	8'	4'	6'	10'	10'
Chilled Water								

	HTW	CHILLED WATER	SAN. SEWER	STORM SEWER	WATER	GAS	POWER	COMM.
Horizontal	10’		8’	8’	8’	4’	8’	8’
Vertical	10’		3’	3’	3’	3’	3’	3’
Sanitary Sewer								
Horizontal	8’	8’		8’	10’	8’	8’	8’
Vertical	8’	3’		3’	3’	3’	3’	3’
Storm Sewer								
Horizontal	8’	8’	8’		8’	8’	8’	8’
Vertical	8’	3’	3’		3’	3’	3’	3’
Water								
Horizontal	8’	8’	8’	8’		8’	8’	8’
Vertical	4’	3’	3’	3’		3’	3’	3’
Gas								
Horizontal	6’	4’	8’	8’	8’		4’	4’
Vertical	6’	3’	3’	3’	3’		3’	3’
Power								
Horizontal	10’	8’	8’	8’	8’	4’		1’
Vertical	10’	3’	3’	3’	3’	3’		1’
Communications								
Horizontal	10’	8’	8’	8’	8’	4’	1’	
Vertical	10’	3’	3’	3’	3’	3’	1’	

(5) Utility Conflicts

a. Where piping systems (i.e., sewer, water, irrigation, drainage, chilled water, etc.) will unavoidably cross structures (i.e., footings, walls, concrete ducts, tunnels, etc.) that are more than 4 feet wide and 5 or more feet deep; and, where direct access to the piping is limited and will not comply with OSHA trench standards, design the crossing with either a casing pipe that extends a minimum of 5 feet beyond the structure, or require a 20 foot (minimum) section of ductile iron pipe.

b. See 3.8 D (10) for special requirements at buried high temperature water (HTW) pipeline crossings. All utilities that cross or come within 5-ft horizontally of existing HTW must adhere to these special requirements.

c. Any new above grade structure which will be located over any existing utility will require one of the following design options:

i. Relocate all utilities.

ii. Design a tunnel, chase way, pipe sleeve, or other suitable access for any utility being crossed by, or in the “near vicinity” of footings, retaining walls, staircases,

or other concrete structures 8" thick or greater. "Near vicinity" means a lateral distance 1 ½ times the depth of the utility, from each side of the pipe or conduit. This will allow for excavations to comply with OSHA trench standards and eliminate the need for costly concrete demolition and replacement during utility failures. The chosen access must extend a minimum of 2' past each side of the concrete structure.

(6) Utility Trenches

a. All buried piping on Campus shall be inspected and surveyed by the University Surveyor prior to backfill.

b. All underground pipelines shall be installed with magnetic plastic tape intended for direct bury, indicating the type of utility installed.

c. Direct the Contractor to test and verify continuity of trace wire at the terminal end points prior to backfill. Also direct the Contractor to verify continuity again after backfill using the installed termination end points.

d. The A/E shall show the location for each trace wire termination end point on the drawings.

i. Each trace wire is to be terminated in the interior of an irrigation valve box or manhole. If no suitable box or manhole exists at the termination point, instruct the Contractor to install an irrigation valve box for the trace wire.

ii. Where underground pipe penetrates the building, the trace wire shall be terminated and secured in a box or manhole at the building exterior over the pipe penetration.

iii. Instruct the Contractor to complete each termination with a screwed connection to the side of the box or manhole, conveniently located for easy access. Excess wire may be coiled in place beyond the screwed attachment.

iv. As-built drawings shall show the actual location of each trace wire termination box or manhole, and note the pipe or conduit it serves.

(7) Salt Lake City Public Utilities

a. Any construction project (either new or remodel) which may affect Salt Lake City public utilities (sanitary sewer, storm drainage, or domestic water) by either feeding or using these utilities, must include coordination with Salt Lake City.

b. The A/E shall include in the specifications that the Contractor must provide all required information needed by Salt Lake City for review, and pay for and secure subsequent permits. The Contractor will then be required to conform to the jurisdiction's requirements for subsequent inspections and certificates of occupancy for the utility portion of the project.

C. Water Distribution System

(1) The source of the University's domestic water distribution system is Salt Lake City's water supply system.

(2) Water conservation measures are to be designed into, and implemented on all new construction or substantial remodeling projects. No project is to increase the quantity of water consumed; indeed; water consumption should decrease with the completion of each project.

(3) The building water supply for each project shall be taken from the University water distribution system. Fire flow tests are required for all new connections to water system.

(4) Hydraulically calculated fire suppression systems shall include a water system computer analysis to provide water pressure information.

(5) Water lines that are part of the campus water distribution system shall not be smaller than 8” in diameter. All lines supplying fire hydrants shall not be smaller than 6” in diameter.

(6) All tees, crosses and connections to water mains will have valves installed on all branches of piping.

(7) Minimum allowable cover over the top of pipe shall be 5'-0" to grade.

(8) All components of the water system shall be designed for a 200-psi working pressure.

(9) Specify blue PVC pipe per AWWA C900, DR-18 (235-psi) for sizes up to 12”. Specify Class 52 ductile iron pipe with cement-mortar lining per AWWA C151, C104, and M41, with mechanical-joint fittings, per AWWA C110, for pipe sizes 14" and larger. Thrust blocks are required for all tees, valves, and bends in pipelines. See APWA Plan 561 and 562.

(10) PVC Pipe shall not be installed any closer than 10 feet from the outside building line.

(11) Distribution Valves shall be designed following guidelines in AWWA M44. Valves approved for use are gate, butterfly, pressure reducing, and check type.

(12) Any valve located more than 5 feet below grade shall be installed with a valve operator extension to allow operation from the surface with a 5-foot key.

(13) Isolation valves 12" and smaller shall be resilient-seated gate valves with nonrising stems in accordance with AWWA C509. Include valve box and 2" nuts for buried locations.

(14) Valves 14” and larger shall be butterfly valves per AWWA C504, Class 250B. Valves shall be installed in a vault to allow access for maintenance and operations. Valve bodies shall be cast iron with mechanical-joint end connections. Valve shaft shall be AWWA C504, 18-8 type 304 Stainless Steel.

(15) Air-Release, Air/Vacuum, and Combination Air Valves shall be per AWWA M51, and AWWA C512. Drawings should show: (1) Weld-O-Let (for steel pipe only); (2) threaded pipe outlet; (3) corporation cock; (4) gate valve; (5) nipple; and, (6) air release valve.

(16) Pressure valves and check valves should be hydraulically operated globe valves, single seat construction, with replaceable stainless steel seat ring and a reversible inner valve disc. The valves shall have fully supported diaphragm operators.

(17) All water mains require testing at 1.5 times the working pressure, or minimum 225 psi, for two hours in accordance with AWWA C600. Each test shall be witnessed by the A/E’s professional engineer and the University’s Water Master.

(18) All new water lines shall be chlorinated to 50 ppm or higher and remain in the piping system for a 24-hour period. The heavily chlorinated water shall be flushed into a sanitary sewer (do not empty into a storm drain). The Salt Lake City Sewer Department shall be contacted prior to discharge. Salt Lake City shall be notified that highly chlorinated water is coming to them. Upon refilling the new domestic water system with clean potable water, two bacteriological samples, 24 hours apart, shall be analyzed. After the second sample comes back satisfactory, the system can be connected to the University’s water system. All work shall be inspected by the University Water Master before being concealed or buried, and prior to start-up.

D. Storm Drain

(1) Storm drainage calculations and drawings are to be submitted to the University Project Manager for review and approval. The submittal shall include the engineer's stamp and dated signature.

(2) Storm Water Design Criteria
   a. The storm water hydrology associated with new construction projects must mirror predevelopment hydrology of the previously undeveloped site; or, the design must improve the hydrology of a redeveloped site and reduce the discharge of storm water.
   b. Projects which add impervious surfaces and storm water run-off must include storm-water control systems that will not increase flow into the University's (and consequently Salt Lake City's) storm-water system.
   c. Provide on-site detention of storm water runoff to detain the 100 year, 24-hour storm, with 0.20 CFS/Acre run-off rate. Show calculations for detention volume requirement.
   d. Provide on-site retainage for a 10 year 2-hour storm. If a 10 year 2-hour storm cannot be retained on the project site, design a modification to the University's storm water system which will accommodate an equivalent retention of the 10 year 2-hour storm. The modification could include bio retention (bioswale), pervious pavement, etc.
   e. Runoff First to Pervious Surfaces or Landscape. The A/E's design shall direct the runoff onto pervious surfaces or landscaped areas prior to capture in a formal drainage system/structure to slow the time of concentration and increase water quality, and provide supplemental irrigation for landscaped areas.
   f. Limit Impervious Surfaces. Every effort shall be made to minimize and disconnect impervious surfaces, slow the time of concentration, and improve water quality through the use of micro detention, bio retention (bioswale), etc. Convey runoff in surface conveyances to the greatest extent possible.
   g. The design shall incorporate both water quality and water quantity best management practices (BMP) and pollutant concentration calculations.

(3) Sub-Drainage Systems
   a. Approved sub-drainage systems are traditional building perimeter foundation and under floor drainage networks with gravity outfall systems.
   b. Containment sub-drainage systems shall not be used (i.e., sumps, pits, detention, or other containment systems) without prior approval of Facilities Management through the University Project Manager.

(4) Concrete Pipe. Gravity flow storm drainage systems shall be reinforced concrete or non-reinforced concrete pipe. Non-reinforced concrete pipe shall only be used where load requirements permit.

(5) Minimum pipe size for storm drainage lines shall be 12" diameter.

(6) Minimum slope for storm drainage lines shall be 0.5%.

(7) Maximum distance between manholes or cleanouts shall not be greater than 300 feet.

(8) Manholes, catch basins or cleanouts shall be provided at every change in direction and every lateral tie-in point.

(9) Minimum allowable cover over the top of pipe shall be 3'-0" to grade.

(10) Camera Inspection. If the new storm drainage piping system fails during testing, require a camera inspection to identify the location and extent of failure. Failed or damaged portions of the new piping system shall be excavated and repaired. Require repeat test(s) until the system is proved.

E. Sanitary Sewer

(1) The University sanitary sewer system drains into Salt Lake City's sanitary sewer system; therefore, codes applicable to that system shall be followed. Refer to the 'Salt Lake City Building Design and Processes Manual'.

(2) The minimum lateral size outside a building shall be 6" diameter. The minimum main size shall be 8" diameter.

(3) All building laterals shall be tied in with a manhole, not a wye.

(4) The minimum design slope for a 6" lateral is 1.0%. The minimum design slope for an 8" main is 0.5%. The design for larger piping shall include 2.0 feet per second minimum velocity.

(5) The maximum distance between manholes shall not exceed 300 feet. Manholes shall be provided at every change of direction.

(6) New piping penetrations up to 12" diameter into existing manholes on campus are to be specified with an inside drop connection, similar to APWA Plan 433, Alternate 2. No excavated outside drop connections.

(7) The minimum allowable cover over the top of pipe shall be 4'-0" to grade.

(8) Buried sewer mains shall be bedded in sand and supported throughout its entire length. See APWA Plan 382.

(9) In addition to standard testing requirements, direct the Contractor to verify continuity of the piping with an air test between manholes. If the air test fails, require the Contractor to provide a camera inspection to identify the leak. Failed or damaged portions of the new sewer line shall be excavated and repaired. Require the Contractor to provide air testing until the piping is proved airtight.

F. Natural Gas

(1) Exterior buried gas lines shall follow Questar approved specifications for plastic pipe and shall be bedded in sand the entire length of the line.

(2) No gas lines shall be run under-ground down-stream of the building regulator/meter set.

(3) Exterior above ground gas lines 2-1/2" and larger shall be Schedule 40 forged black steel butt welded fittings; or, for 2" and smaller shall be 150 lb malleable iron with screwed fittings. Steel pipe shall have an approved protective coating. All outside above ground gas piping shall be painted with a protective gray paint.

(4) When a gas pipe is run through a wall, the pipe shall be run though protective sleeve and sealed to prevent water from entering the building.

(5) All gas piping shall be tested at 3 PSI for 10 minutes with no drop. A half-pound increment gauge shall be used. Where the supply is over 2 pounds, the test shall be at 1 ½ times the maximum working pressure. All tests shall be witnessed by the University of Utah Plumbing Shop or its' designee.

(6) Natural gas systems on Campus are owned and operated by the University. Extensions or connections shall be coordinated with Questar when applicable and Facilities Management through the University Project Manager.

(7) During design, notify Questar of any intended construction activity on their main lines, and continue coordination with Questar as the design progresses toward construction.

(8) For buried natural gas piping, in addition to the trace wire, lines shall be installed with 2 feet of sand covering the pipe, and yellow warning tape 8" over the sand layer routed along the entire length of the pipe.

(9) When work is required on any gas line, require the Contractor to submit for prior approval worker qualification sheets for each worker in accordance with Pipeline Safety Regulations Part 191 and Part 192, published by The Department of Transportation Research and Special Programs Administration, Office of Pipeline Safety, current edition.

(10) Require the Contractor to submit qualification sheets to the A/E, then the A/E shall submit two sets to the University Project Manager, who will submit one set to the supervisor of the Plumbing Shop for review and approval.

(11) Existing buried steel natural gas piping which will be replaced, modified, or removed as part of the project shall have a cathodic design with specifications for the application or removal and/or general upgrade of cathodic protection. Any modification or disturbance of steel piping is to include an upgrade of the local cathodic system and provisions for adequate protection to the remaining extended system. Once completed, the system is to be inspected and cathodic readings are to be written in a report to the University Project Manager who will relay the information to the University's Plumbing Shop. Likewise, the location of new anode bags and test stations shall be plotted and presented to the Plumbing Shop Supervisor.

(12) If new plastic piping is to be routed under any road, the pipe must have a PVC pipe sleeve two pipe sizes larger than the gas line it will protect.

G. Storm Water Management Plan

(1) General Requirements

a. An approved Storm Water Pollution Prevention Plan (SWPPP) for projects 1-acre or larger will be required prior to obtaining a digging permit.

b. Direct the Contractor to submit the SWPPP to the University Project Manager and the Occupational and Environmental Health & Safety Department for review.

(2) Maintenance and Escalation of Best Management Practices

a. The density of developed area and close proximity of impervious surfaces requires proactive storm water protection at the University of Utah. Impermeable surfaces adjacent to construction sites are to be kept free of sediment and construction site debris. The University requires all contractors to ensure that these potential pollutants be controlled to the "Maximum Extent Practicable" (MEP) as defined by the Federal Clean Water Act (CWA) part 402(p)(3)(B)(iii). In situations where the installation of a Best Management Practice (BMP) has proven ineffective (two or more corrective actions issued) the University of Utah will require alternate BMPs.

(3) Long Term Storm Water Controls

a. The design team shall complete the University's Utah Pollution Discharge Elimination System (UPDES) submittal form for Long Term Storm Water control compliance. Describe why the specific long-term storm water controls were selected, the pollutant removal expected from the selected controls and the technical basis that supports the performance claims for the selected controls. For a copy of this form, please see the forms section on the University's Documents and Standards web page.

(4) Job-Site Cleanup Responsibilities

a. Specifications shall identify daily, weekly, and job completion cleanup responsibilities for the removal of garbage, rubbish and unused materials.

b. Require the Contractor to coordinate daily cleanup operations in areas of the jobsite which may be affected by surrounding University activity. Construction activities shall be coordinated with the University Project Manager to reduce congestion and limit interruption of University traffic, operations, graduation ceremonies, etc.

c. Facilities Management approval shall be included in the final project cleanup process.

(5) Construction Dewatering

a. The A/E shall consider possible needs for dewatering during construction. When needed, include mitigation measures in the design to prevent erosion (i.e., seeding, landscaping, etc.).

b. Any dewatering system design shall be submitted for review and approval by Facilities Management. Dispose site water to an existing underground gravity flow system that is approved by Facilities Management.

c. Dewatering systems should be of the gravity underground type, but may be pumped or flow overland if prior approved by Facilities Management through the University Project Manager.

d. Require that all dewatering systems be maintained and operated by the Contractor during the entire construction of the project. The system is not to be shut down or interrupted without Facilities Management approval.

(6) Erosion Control

a. Avoid disturbing areas of high erosion susceptibility, sensitive vegetation areas, and areas with steep slopes.

b. Provide special erosion control measures on slopes greater than the angle of repose necessary for natural erosion control. Coordinate erosion control measures with the soils engineer.

c. Create an erosion control and sedimentation plan for all construction activities associated with the entire project site. The plan shall incorporate practices for stock piling of top soil for reuse, seeding, grading, mulching, filter socks, stabilized site entrances, protection of drain inlets, preservation of existing vegetation, and any other 'best management practices' ("BMP") needed to control site erosion and sedimentation from storm water runoff.

i. The plan shall include a drawing and a complete description of the BMPs that will be implemented to prevent erosion at the site and control sedimentation in storm water runoff. A menu of sample erosion and sediment control BMPs can be found at the EPA's National Pollutant Discharge Elimination System / National Menu of Storm Water Best Management Practices web site.

d. Sediment Control at Open Utilities: For projects where open utilities will be necessary during construction, require the Contractor to protect the University's utility systems by installing sediment control devices at each open utility. Require the Contractor to install the devices in accordance with the manufacturer's recommendations.

H. Site Grading

(1) Finish Floor Elevations: Establish finish floor elevations 6" above the finish grade adjacent to the building. Provide 2% minimum positive grade away from the building for at least 12'.

(2) Landscaping: In general, 2% minimum grade is desired, 1.0% grade is the absolute minimum. Do not exceed 3' horizontal to 1' vertical maximum slope.

a. When slopes steeper than 3:1 are unavoidable, require seeded slopes or blanket type slope protection.

(3) Demolition

a. Require the removal of existing objects, not designated to remain, down to the subgrade. Direct the Contractor to remove designated objects and material from the construction site and University property in a neat, orderly and legal manner.

b. Materials, objects, excavation export, garbage, residue, etc., which contain hazardous or regulated waste shall be properly transported and disposed in accordance with the laws of the State of Utah.

c. On-site burning is not permitted.

d. Unforeseen Conditions: Upon discovery of unknown utilities or concealed conditions, instruct the Contractor to discontinue work which would affect the utility or concealed condition, and immediately notify both the A/E and the University Project Manager.

e. Explosives are not to be used without approval from Facilities Management. Any perceived need to use explosives will require extensive review in advance, and shall not be organized without written approval from the University Project Manager. If approved, allow ample time for University notices and preparation.

f. Rock/cobbles up to 30-inches in diameter are considered ordinary earthwork. When unexpected rock removal is required, direct the Contractor to notify both the A/E and the University Project Manager.

I. Earthwork

(1) Soils Reports for University Projects

a. All new building, parking or roadway projects shall include soils investigations performed by a professional soils engineering firm qualified and licensed for such work.

b. The A/E shall provide the soils engineering firm with the following items:

i. A preliminary site plan showing new improvement locations with finish floor and finish grade elevations.

ii. A general description of the type of structure or facility to be constructed.

iii. Pavement locations and instructions for any needed pavement sections.

iv. Specific areas where potential infiltration would suggest permeability testing, with specific testing locations and associated depths.

c. The soils engineering firm shall provide a report of its investigative findings, and shall include all information required by State adopted codes.

i. The report shall contain an evaluation of on-site soils and their suitability for use in construction of the building or other improvements. All on-site material shall be recycled to the greatest extent possible to limit import/export and meet the University’s sustainability goals.

ii. The report shall prioritize the use of onsite soils and any soil amendments to reduce import/export.

iii. The report shall include recommendations for the modification of non-acceptable soils for reuse on site.

iv. The report shall indicate appropriate locations where on-site soils can be used (*i.e.*, trench backfill, etc.).

v. The report shall indicate soil suitability for storm water infiltration and include infiltration rates and recommended methods, if requested, based on permeability testing.

vi. The report should contain recommendations for at least one foundation system and describe precautions to be taken for special problems such as expansive soils, collapsible soils, etc.

vii. Special attention is to be given to the possibility of expansive soil conditions.

viii. In roadway or parking lot areas, the report shall contain recommendations for roadway and parking lot cross sections including asphalt or concrete thickness and thickness of accompanying road base.

(a) Pay particular attention to areas where the asphalt or concrete paved surface will be subject to heavy loads. The pavement section may require special design to ensure long use with minimal maintenance. Consult with Facilities Management through the University Project Manager to determine where heavy use design will apply.

(b) As an alternate for University consideration, the report shall include at least one pavement section that incorporates rubberized asphalt (at a minimum as a top layer), or pervious (gap graded) asphalt or concrete. The A/E will consult with Facilities Management through the University Project Manager about the possibility of including at least one section as an alternate bid item in the bidding documents. Options might include pervious concrete, 4" asphalt over 8" road base, pervious concrete over 18" gravel, etc.

ix. The report shall have a specific section addressing site specific sustainability recommendations to support the University's sustainability goals and climate change concerns.

d. The A/E shall modify project plans and specifications appropriately to incorporate the soils engineering firm's recommendations.

(2) Backfill

a. To the greatest degree possible, on-site materials are to be evaluated for suitability as structural backfill. The University desires to use on-site materials to the greatest degree possible as long as there is no loss of quality or stability.

b. The A/E should carefully define minimum acceptable standards for structural backfill, and quantify on-site sources of acceptable material.

c. Minimize the potential for change order cost issues by including material unit prices on the bid form. These unit-cost items should be clearly described in the measurement and payment section of the specifications. Coordinate unit pricing and alternate pricing schemes with Facilities Management through the University Project Manager during design.

(3) Excavation

a. Alternate Storage Site: Specify that any excavated soil identified for use as backfill is to be stored at the project site. Where this is not feasible, an alternate temporary storage site should be arranged with Facilities Management through the University Project Manager. Such storage shall be discussed and arranged with Facilities Management early in the design process.

b. Soil Not Usable as Backfill: Direct the Contractor to remove and legally disposed of any excavated soil not identified for use as backfill. There will be no permanent dumping on University property

(4) Compaction

a. Specify that backfill shall be properly laid and compacted in lifts to the following standards. Where specific compaction recommendations are included in the soils report for the project, the soils report recommendations shall be followed in lieu of the following standards.

i. In lawn and landscaped areas: 85% of maximum dry density, 12-inch layers.

ii. In sidewalks, roads, parking areas or under buildings: 96% maximum dry density, 8-inch layers.

b. Compaction testing shall be required. Coordinate the need for anticipated testing with the University Project Manager who will arrange a contract for the services of an independent testing firm. Note: The first test will be provided by the University, but any retesting due to test failure will be at the Contractor's expense.

i. The A/E shall include testing requirements for the Contractor and the testing firm in the project specifications. Duties of the University's testing firm should also be made a part of the specifications.

ii. Specifications shall indicate the testing frequency and type.

iii. Include in the specifications, "Failure of Facilities Management or the A/E to detect defective work or material does not prevent later rejection of the work, nor obligate the A/E for final acceptance when such defective work or material is discovered."

iv. Include in the specifications a list of informational items required for submittal.

v. A test schedule shall be included in the specifications.

(a) Curb and gutter with grade less than 0.5%: One random test per lift per 200 lineal feet.

(b) Curb and gutter with grade greater than 0.5%: One random test per lift per 400 lineal feet.

(c) Sidewalk: One random test per lift per 400 lineal feet.

(d) Trenches: One random test per lift per 200 lineal feet.

(e) Roadways: One random test per lift per 1000 square yards.

(f) Landscape Areas: No specific requirements.

3.3 Architectural

A. Daylight and Outside Views

(1) No additional University design requirements.

B. New Roofing Requirements

(1) Contractor Roofing Warranty/Guarantee

a. On University roofs, specify the minimum guarantee period for any type of roofing shall be 20-year from the manufacturer and 5-year weather tightness and workmanship.
b. On roofs covered by overburden, specify that warranty coverage shall include removal and replacement of overburden, and such removal and replacement shall coincide with the guarantee period.

(2) Approved Manufacturers
a. Any work on University roofs described herein shall be performed by a licensed roofing contractor.
b. Specify that new roof installations or modifications to roofs under warranty shall be performed by a contractor authorized by the roof manufacturer to perform such work.
c. Modifications shall not negatively impact existing warranties and shall themselves carry a 5-year workmanship warranty.

(3) Roofing Systems
a. 60-mil thickness (minimum). Single ply roof membranes shall be used on roofs with a slope of 2:12 and less.
i. 80-mil or thicker shall be used for areas with mechanical equipment or other areas requiring heavier traffic. Ballasted roofs are not allowed.
ii. Georgia-Pacific “DensDeck” roof boards or prior approved equal shall be specified as underlayment between the insulation and the membrane where more than light or occasional foot traffic is anticipated.
b. Roof areas underneath any overburden such as soil, plantings or concrete shall be a built-up modified asphalt system such as Hydrotech Garden Roof (American Hydrotech, Inc.) or prior approved equal.
i. The built-up modified asphalt system under overburden shall include appropriate protection boards, drainage layers and drain protection methods.
ii. Overburden materials shall not obstruct any roof drain and shall be kept clear of drain sump areas by use of appropriate stops or barriers, compatible with the roofing system.
iii. Overburden areas shall be clearly separated from any single ply roofed area by a capped curb wall system.
c. Roof slopes greater than 2:12 shall be an architectural laminated shingle or a standing seam metal roofing system.

(4) On University roofs, the termination (top edge) of the roofing membrane shall be at least 8-in above the roof surface in the immediate vicinity. Single ply membrane shall wrap over the top of parapet walls (beneath the parapet cap).
a. Where it cannot wrap over the top of a curb or wall, the termination must be mechanically fastened, with water cut off mastic behind the termination and silicone caulk sealant (equal to Dow 795, 790) at the top of the termination bar or counter flashing.
b. The top bend on counter flashing shall return to the wall rather than projecting outwards.
c. Parapet cap metal shall have positive slope (1/4-in per foot) back to the interior (roof) side of the parapet wall.

d. Cap metal shall be standing seam, with corners caulked using silicone as specified above.

(5) Roof Access

a. All roof areas must be accessible via secured walk out door (strongly preferred) or secured fixed ladder access.

i. All means of roof access shall be keyed to the University roof master key.

ii. Such access may be from a custodial closet, mechanical room, stairwell, or other readily accessible area. Do not design a roof access location in any area that might pose a restriction, such as an office space, lab, restroom, conference room, class room, etc.

iii. Roof hatches must have a metal safety rail secured to the hatch on the sides not used for egress or otherwise shielded by the open hatch cover. The maximum roof access hatch size is 36-in x 36-in.

b. Walk pads must be installed at all roof entry points including the tops and bottoms of ladders between levels, at roof access doors, at the front edge of roof hatches, around all equipment on the roof, and along the route connecting the roof access point to equipment or other traffic required routes.

(6) Roof Drainage

a. Roof drain domes shall be metal. Acceptable brands are Zurn, Wade, Smith, and Josam.

b. Primary drains must be sumped below the main roof drainage plane.

c. Primary drainage via scuppers, downspouts, and gutters is not allowed.

i. If these non-standard methods of primary drainage are approved by variance, the design shall include heat trace equipment.

d. Areas of standing water are not permitted.

e. Drain sumps shall not be obstructed by equipment, overburden, or pavers.

f. Refer to 3.7 D for additional rainwater/roof drainage details.

(7) Roof Penetrations

a. Individual penetrations such as conduits and pipes should be separated by at least 12-in (24-in if penetrations are greater than 6-in diameter).

b. Where tighter clusters of penetrations are necessary (such as condensing unit line sets), pitch pans may be utilized. Pitch pans must be filled with two component sealant or self-leveling silicone sealant (Dow 890 or prior approved equal) made for this purpose (do not allow pitch or other asphaltic material). Insulation on line sets must not be continuous through pitch pans or other flashing (i.e., the seal must affix to the pipe, not to insulation).

c. Electrical lines through the roof or adjacent walls must be via rigid conduit, not flex.

(8) Conduit and Pipe Supports

a. Exposed wood is not allowed on roof areas. Roof mounted pipe and conduit runs must be supported on blocking manufactured for this purpose (U.V. resistant with integrated clamping and protective padding equal to “PipePier” by PipePier Support Systems).

b. Conduit and pipe runs should be limited to 10-feet or less, with longer runs made on the interior of the building whenever possible.

(9) Equipment on Existing Roofs
   a. Require contractor to notify University Project Manager and Carpentry Shop to coordinate placement or installation of items on existing roofs
   b. Do not allow sleepers, ballasted curbs, or any equipment to sit on the roof surface, other than for a temporary purpose.

(10) Mechanical Units, Curbs and Other Roof Top Equipment
   a. Mechanical units and other roof top equipment shall be designed to be installed in a location and manner that readily allows repair or replacement of the roof system without removal or disconnection of the equipment.
   b. All equipment and installations must be mechanically attached to the structural roof deck, parapet, or other structural element of the building using round flashable pipe supports.
   c. Equipment curbs are to be fully wrapped where feasible and capped with a metal cap. Joints in the cap must be standing seam and be accessible for maintenance. The cap design shall allow free drainage of water from the cap surface.
      i. Equipment shall mount to roof curbs via structural elements equal to Unistrut which bear on top of the metal curb cap but attach through the side of the curb cap (the top of the curb cap shall not be penetrated by fasteners). Where possible, do not allow conduit or line set penetrations to be routed through a curb cap – specify or detail separately flashed routing through membrane.
      ii. If conduits or line sets must be routed through the curb cap, they must do so through an appropriate flashing or pitch pan, and must not be obstructed by the equipment itself.
   d. Where equipment is supported on two or more posts or post mounted curbs, specify or detail a minimum of 24-in clearance beneath the equipment.
   e. Equipment installation shall not be located in a valley or drainage plain, or where an installation will block access to essential roof system components such as parapets, drains, or other equipment.
   f. Curbs, equipment, and roof penetrations shall be far enough from each other, and from other obstructions, so as to be readily accessible for inspection and maintenance.
   g. Guy lines must anchor to building structural elements which extend above the roof plane. Structural elements may be rigid posts installed for this purpose or existing elements. Guy lines shall not be connected to the building structure through pitch pans or directly through the roof membrane.
   h. Roof mounted solar racking and arrays shall comply with above and other requirements in this standard, including the establishment and maintenance of access to other roof top equipment, clearance under equipment to roof surface, and compliance with roofing manufacturer's warranty requirements.

(11) Labeling of all Roof Mounted Equipment
   a. Direct the contractor to label roof mounted equipment to clearly indicate ownership, contact information, purpose, and expected duration of installation.
   b. Require the contractor to notify the University Project Manager and Carpentry Shop when existing roof mounted equipment lacking labeling is encountered so that labeling or removal/disposal as appropriate can be pursued.

C. Roofing Requirements
   (1) For replacement and/or modification of University roofs, comply with 3.3 B above.
   (2) Partial Replacement or Extension of an Existing Built-up Roof (BUR)
      a. The termination (top edge) of the roofing plies must be at least 8-in above the roof surface in the immediate vicinity.
      b. All transitions from horizontal to vertical in the roofing plies or cap sheets of a BUR system require the use of cant strips to eliminate 90-degree bends. To further avoid such bends, BUR plies and cap sheets shall not be wrapped over the top of curbs or parapets unless specifically designed for this purpose by the manufacturer.
      c. All materials used in the creation of a BUR system, detail, or tie in must be protected from UV exposure by the use of aluminized roofing paint (silver coat), or properly imbedded granules, or the use of a compatible and purpose-made foil flashing.
      d. Any exposed mastic must be finished to a smooth surface and feathered edges.
      e. Projects which modify or extend existing roof areas which have existing standing water issues or other problems on areas of the roof that are not initially included in the project scope may be asked to address these existing areas as a scope addition.

D. Waterproofing and Sealants
   (1) Fluid-Applied Waterproofing
      a. For all foundation /retaining walls (including walls which do not carry a building load and for slab-on-grade foundation walls) and for all underground horizontal structures (new and remodeled), provide the following:
         i. Specify a complete hot or cold applied waterproofing assembly, a fluid applied product over membrane system obtained from a single source manufacturer, and which will meet or exceed a 20 year guarantee/warranty and to comply with ASTM D412-06a, ASTM C836 / C836M-12.
            (a) The assembly shall have a proven record of superior performance commensurate with the 20 year guarantee/warranty and shall include surface conditioner (primer); adhesives and sealants; a monolithic (no seams) fluid applied waterproof membrane, drainage and protection board; Flashings, reinforcing fabric; drainage course, filter fabric, flexible waterproof boots; and perforated pipe adjacent to the base of the footing.
            (b) A fully compatible electronic field vector mapping testing system shall be specified on any plaza type project requirement waterproofing on horizontal applications.
            (c) All products used in the waterproofing system intended for a project are required to be the products of one manufacturer or part of the warranted system of the manufacturer (with one exception, the vector mapping system; however, the vector mapping system shall be certified to work with the intended system.
         ii. Before the Contractor orders waterproofing materials, require submittals describing the system and installer. Submittals are to be submitted through the A/E and University Project Manager to Facilities Management for approval. Include the following as a minimum:
            (a) A complete description of the fluid applied system assembly.

(b) Verification that all products are from one manufacturer except the vector mapping system.

(c) Verification that each product in the manufacturer's wall protection assembly must be manufactured for the intended use; and must be fully compatible with all other materials which will be used in the manufacturer's waterproofing assembly.

(d) Certification that the vector mapping system is compatible and fully functional with the intended fluid applied waterproofing system.

(e) Manufacturer's certification that the installer is fully qualified to apply the manufacturer's products to meet a 20-year warranty.

(f) A written commitment that a manufacturer's rep will be present on site monitoring and inspecting the installation as it proceeds, and will submit regular reports to the A/E and University Project manager certifying compliance to manufacturer's installation requirements.

b. Damp-proofing will generally not be allowed, but where seemingly appropriate, will be considered only through a Variance Request.

c. Specify the following minimum installation requirements:
   i. Top of the waterproofing assembly will be 6-in below finish grade.
   ii. The drainage and protection board is to be applied over the fluid applied waterproofing membrane.
   iii. Gravel fill shall be a minimum of 12-in thick and protected with a filter fabric between the gravel and surrounding soil.
   iv. The filter fabric must completely envelope the gravel and perforated pipe from the wall surface near the top, along the outer gravel boundary, around the gravel base containing the perforated pipe, and terminating over the flashing at the footing base.
   v. The upper fabric connection at the top of the gravel fill must be affixed to the drainage/protection board.
   vi. The lower fabric connection near the bottom of the gravel fill must be affixed to the drainage/protection board above the footing.
   vii. Specify either a 4-in or 6-in diameter perforated pipe at the base of the footing in the gravel. Engineer the pipe to meet the anticipated soil moisture conditions.
   viii. Direct the contractor to set the top of the perf-pipe below the top of the footing.
   ix. Fluid applied waterproofing is to be applied in two directions. The horizontal application shall be installed with reinforcing fabric to a thickness of 215-mil. The vertical application shall be installed to a thickness of 180-mil applied in two 90-mil applications.

d. Require the Contractor to adhere to specific restrictions imposed or recommended by the manufacturer for environmental conditions, product delivery, inspection, storage handling, product protection, surface inspection, surface preparation, product application, etc.

e. Guarantee/Warranty

i. At the conclusion of the installation, require the manufacturer's rep to certify verification that the installed system is leak free; that the membrane application is tight without voids; and that the system assembly including the applied mil thickness meets the manufacturer's requirements for the 20 year guarantee/warranty period.

ii. Before accepting the installation for plaza (horizontal) applications, require the installer or manufacturer's representative to demonstrate to the A/E and University complete functionality and continuity of the vector mapping system within the completed waterproofing system.

iii. The guarantee shall include the cost of materials and labor (no dollar limit and not pro-rated), and include the removal and reinstallation of landscaping, soil, paving, etc., to access the area to be repaired/replaced.

iv. If during the 20-year period, either the manufacturer or contractor goes out of business, the other is required to assume full responsibility for the guarantee/warranty.

(2) Joint Sealants

a. Precast Concrete, metal window walls (curtain wall), and metal windows: Silicone Rubber equal to Dow Corning #780, or a Polysulfide equal to Thiokol Base, Federal Specification TT-S-00227, or "Hornflex."

E. Acoustical Quality

(1) Classroom walls shall be designed to STC (Sound Transmission Class) 50 minimum. Spaces with even higher sensitivity shall be designed to STC 55 minimum.

(2) Ceiling materials in halls and lobbies with carpeted floors shall have a NRC (Noise Reduction Coefficient) of at least 0.5. Ceiling materials in halls and lobbies with hard floors shall have a NRC of at least 0.65.

(3) An acoustical engineering consultant for special use halls, classrooms, and lecture spaces is recommended. Obtain services before shape of space is fixed.

F. Exterior Insulation & Finish Systems (EIFS)

(1) The application of EIFS systems is not allowed on campus. Portland cement stucco may be considered if a recommendation for its use is submitted to the University early in the design of a building. The use of stucco on campus buildings is generally discouraged.

G. Building Graphics

(1) Exterior Building Graphics

a. The A/E shall coordinate with the University Project Manager regarding the latest changes to this standard.

(2) Interior Building Graphics

a. This item includes room numbers, room names and a standard building dedication plaque.

b. Academic Branding. If the building interior is designed using a coordinated functional branding theme, room identification graphics, way finding graphics, International Building Code, ADA, directional graphics, etc., will require review and approval by Facilities Management early in the design. Consideration will be given to materials, aesthetic coordination, size and serviceability of the proposed graphics by the University Sign Shop.

c. Standard University Interior Graphics.

i. Interior graphics on campus have been standardized for buildings which will not have a coordinated functional theme.

ii. Specify sign panels to be ADA compliant, raised character, acrylic multipolymer sign panels with square edges and Braille (acrylic beads), tactile text shall include painted acrylic backers and square edges.

iii. Require copy / typographic letterforms and symbols to be router cut using multipolymer engraving stock, appliquéd with permanent, proven adhesive specified by the product manufacturer and rated for exterior environments. Text shall be 1/32-in thick or as noted in current ADA standards. Braille text shall utilize individual clear acrylic beads. Note: Router cut Braille text is not acceptable.

iv. Panel and sign backer thickness, sizes and finishes are to be noted on the project drawings. All panels are to be specified to be precision cut and finished. Low gloss finish shall be ADA compliant (20% reflectance is desired).

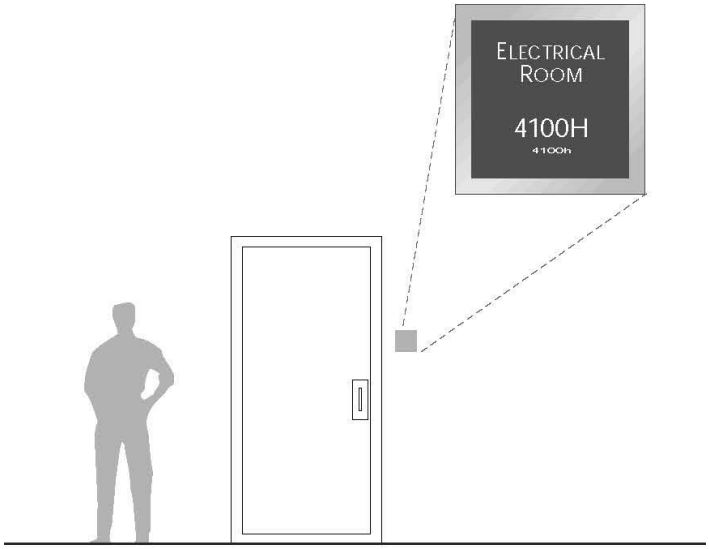
v. Coordinate the intended method of sign mounting with the University Project Manager and Sign Shop.

vi. Sign panels with changeable paper inserts shall be specified with square edge sign face and clear acrylic window panel to accommodate changeable, laser / color printed paper sign inserts. Note: The initial paper inserts are to be provided and installed by the installing supplier/contractor. The acrylic top layer shall have a precision cut window to expose the bottom layer. The sign face sizes and thicknesses shall be scheduled on the drawings.

vii. Require the supplier/contractor to submit final layouts and text as well as symbol locations to the designer and University Project Manager for approval prior to fabrication or installation of any signs. Signs shall conform to applicable code requirements. Life safety maps and related signage are subject to Fire Marshal review and approval, and shall conform to Fire Marshal's requirements. When signs are initially installed – and when changeable insert messages are not ready or finalized – the supplier/contractor shall insert heavy blank paper (black in color) into the paper message signs to provide a complete and finished appearance (unless the background area behind the sign window is already black).

d. The following are examples of the University standard for interior sign graphics:

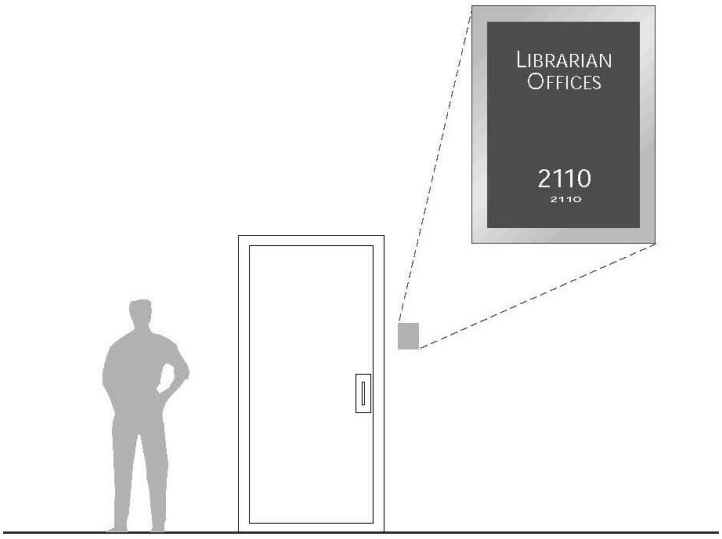
i. Sign Type A1/00 – Small Door ID Sign. Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics:



SIGN TYPE A1/00 - Small Door ID Sign

Painted acrylic backer with square edges and modified acrylic sign face with square edges. Braille beads and applied machine engraved tactile graphics.

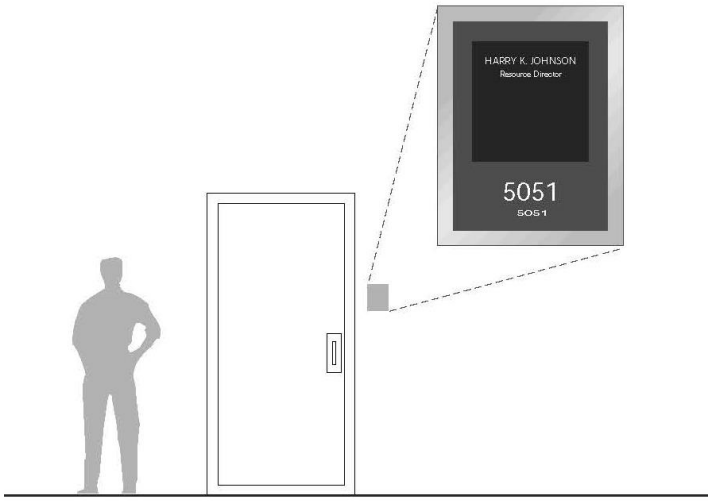
ii. Sign Type A3/00 - Large Door ID Sign. Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.



SIGN TYPE A3/00 - Large Door ID Sign

Painted acrylic backer with square edges and modified acrylic sign face with square edges. Braille beads and applied machine engraved tactile graphics.

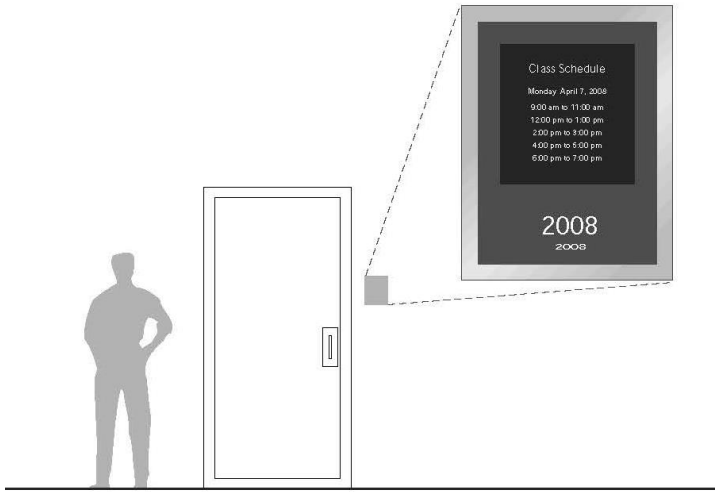
iii. Sign Type A4/00 – Small Door ID / Changeable Painted acrylic backer with square edges and multi-layered modified acrylic sign face with square edges, routed window and Braille beads and applied machine engraved tactile graphics. Window for printed paper insert.



SIGN TYPE A4/00 - Small Door ID / Changeable

Painted acrylic backer with square edges and multi-layered modified acrylic sign face with routed window and square edges. Braille beads and applied machine engraved tactile graphics. Window for paper insert.

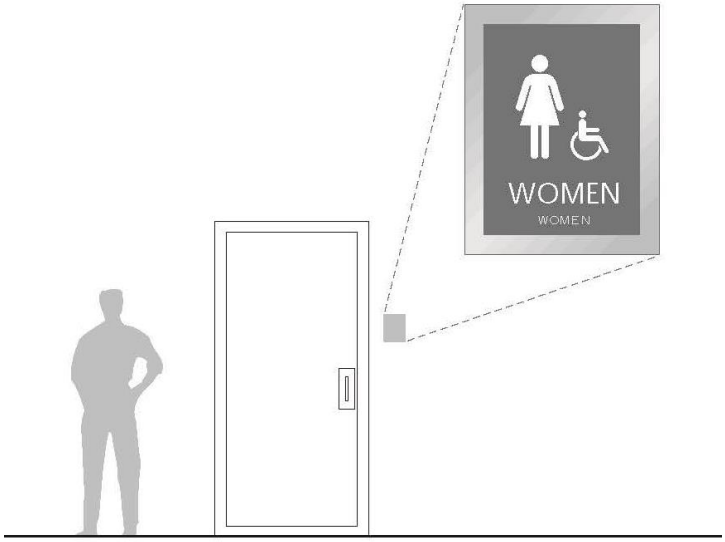
iv. Sign Type A5/00 – Medium Door ID / Changeable. Painted acrylic backer with square edges and multi-layered modified acrylic sign face with routed window and square edges, Braille beads and applied machine engraved tactile graphics. Window for printed paper insert.



SIGN TYPE A5/00 - Medium Door ID / Changeable

Painted acrylic backer with square edges and multi-layered modified acrylic sign face with routed window and square edges. Braille beads and applied machine engraved tactile graphics. Window for paper insert.

v. Sign Type A7/00 – Restroom ID / Women. Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.



SIGN TYPE A7/00 - Restroom ID / Women

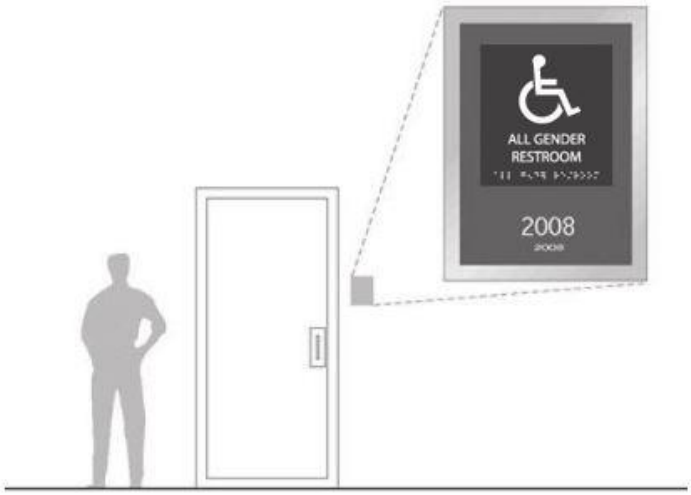
Painted acrylic backer with square edges and modified acrylic sign face with square edges. Braille beads and applied machine engraved tactile graphics.

vi. Sign Type A11/00 – Stair Code Sign. Modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics.

SIGN TYPE A11/00 - Stair Code Sign

Modified acrylic sign face with square edges. Braille beads and applied machine engraved tactile graphics.

vii. Sign Type A12/00 - Single Use Restroom (family or assisted use) Sign. Lettering shall state “All Gender Restroom”. Painted acrylic backer with square edges and modified acrylic sign face with square edges, Braille beads and applied machine engraved tactile graphics. Corners may be radius or square to match other sign types.



SIGN TYPE A12/00 – Medium Door ID / Changeable

Painted acrylic backer with square edges and multi-layered modified acrylic sign face with routed window and square edges. Braille beads and applied machine engraved tactile graphics. Window for paper insert.

H. Custodial Closets

(1) General Requirements

a. Square or rectangular closets are required.

b. Space for three separate custodial closet functions shall be included in every building. Individual rooms shall be provided for one or more wet closets, one or more dry closets, and one office closet.

c. For existing buildings, the A/E’s design responsibilities for building alterations and/or additions shall include a review of the entire building’s custodial conditions with regard to the requirements described herein. The project scope for the remodel and/or addition shall include additional custodial space where needed to meet the building’s overall custodial space requirements.

d. Access to each custodial closet/office shall be along a direct route from a main hallway.

e. Each custodial closet/office door shall have means to hold the door in the open position (*i.e.*, door stops, or closers with a ‘hold-open’ feature) as allowed by code.

f. Closet floors shall be quarry or ceramic tile (preferred); or concrete with an appropriate sealed surface treatment.

(2) Wet Closets

a. Each wet closet shall be centrally located in its service area.

b. The minimum footprint for each wet closet shall be no less than 100 square feet with the shortest wall length no less than 6 feet.

c. The door width for each wet closet shall be 36-in unless requested otherwise by Campus Custodial Services. All wet closet doors shall swing out, not into the custodial space.
d. For floor areas per level equal to, or less than 40,000 gross square feet, provide one wet closet per floor level.
e. For floor areas per level greater than 40,000 square feet, the project design must include additional wet closets (one for each 40,000 gross square feet or portion thereof).
f. When multiple wet closets are provided on a floor level, divide the floor into equal service area segments and locate each closet centrally in its service area, preferably near restrooms.
g. The design shall include a floor mounted service sink with a minimum size of 15 square feet. The edge of the sink shall be no higher than 6-in above the finished floor.
h. The design shall include a wall mounted hanger rack for wet mops (minimum of four hangers) which shall be installed over the service sink.
i. The design shall include adequate wall space for a chemical dispensing system which will be located over the service sink. Minimum wall space required is 2-ft x 2-ft, located directly over the hose bibs.
j. The design shall include adequate clear wall space (at least 5-feet linear) for hangers to store brooms, ladder, etc.
k. Installed along one wall of the closet, the design is to include a minimum of five (5) adjustable height shelves (adjustable from floor to ceiling). Shelves shall be 14-in deep. Do not locate the shelving system behind a door.
l. Include a minimum of one electrical outlet in each wet closet, installed in an approved location.

(3) Dry Closets

a. Each dry closet shall be centrally located in its service area.
b. The minimum footprint for each dry closet shall be no less than 200 square feet with the shortest wall length no less than 8-feet.
c. The door width for each dry closet shall be 42-in unless requested otherwise by Campus Custodial Services. All dry closet doors shall swing out, not into the custodial space.
d. For buildings equal to, or less than 150,000 gross square feet, provide one dry closet per building.
e. When the building exceeds 150,000 gross square feet, a second dry closet of the same size shall be provided. Divide the building into equal service area segments and locate each dry closet centrally in its service area.
f. The design shall include adequate clear wall space (at least 6 lineal feet) for hangers to store brooms, equipment, ladder, etc.
g. Installed along two adjoining walls of the closet, the design is to include a minimum of five (5) adjustable height shelves (adjustable from floor to ceiling), suitable for storing heavy items. The University Project Manager will provide to the A/E the required shelf depth for each dry closet, as directed by Campus Custodial Services (depth will generally be either 14-in or 18-in). Each wall's installation of the two

adjoining shelving systems shall be no less than 6-feet long. Do not locate the shelving system behind a door.

h. The design is to include a 6-ft high x 5-ft wide x 14-in deep (minimum size) lockable cabinet that is designed specifically to store and secure cleaning chemicals.

i. Include two (2) GFCI four-plex electrical outlet boxes located in approved locations. These outlets require dedicated circuits due to the nature of their use.

(4) Custodial Office

a. Each building shall have one custodial office.

i. For floor areas per level equal to or less than 150,000 gross square feet, the minimum footprint for the custodial office shall be no less than 120 square feet with the shortest wall length no less than 8 feet.

ii. For floor areas per level equal greater than 150,000 gross square feet, obtain the required minimum space dimensional requirements from Facilities Management through the University Project Manager, who will coordinate with Custodial Services. This information must be obtained early in design to avoid space and usage conflicts as the building floor plans are developed.

b. The design is to include either a built-in desk or sufficient room for a 60-in x 30-in desk with a three drawer filing cabinet, furnished and installed as part of the project.

c. The design is to include a shelf installed on the wall above the desk. The shelf shall be 48-in long and 12-in deep. Do not locate the shelf where it will conflict with the door.

d. The design is to include a wall mounted staff locker system in the custodial office.

i. For buildings with an overall floor area (the sum of all levels) up to 20,000 gross square feet, specify four (4) full height wall mounted staff lockers in the design.

ii. For buildings with an overall floor area greater than 20,000 gross square feet, specify ten (10) half-height lockers in a wall mounted system.

e. Include electrical outlets located in approved locations for computers and electronic equipment.

f. The design is to include wall connections for computers, internet access, and phone service.

g. The custodial office may be located adjacent to a dry closet if approved by Facilities Management and Campus Custodial Services, through the University Project Manager.

i. This arrangement will require separation by a wall and a door, with each space forming a complete dry closet and a complete custodial office.

ii. Any consideration for adjacency shall be submitted to Facilities Management early in design. A proposed layout and location for this arrangement shall be reviewed in a meeting between the A/E, the University Project Manager, and the Campus Custodial Services.

I. Lactation Rooms

(1) The design for new construction, major building alterations or major building additions (defined as having a total project budget of $10 million or more) shall comply with the lactation room requirements provided herein.

(2) One lactation room shall be provided on the first floor of each building.

(3) Access to the lactation room shall be along a direct route from a main hallway.

(4) The minimum footprint shall be no less than 9-ft x 6-ft.

(5) Doors shall be equipped with a privacy lockset.
(6) Walls shall be insulated for sound.
(7) Flooring shall be carpet.
(8) Walls are to be painted.
(9) A countertop 2-ft depth shall be provided along one wall. The space beneath the countertop shall be open. A hand sink shall be provided in the countertop.
(10) Lighting levels shall be between 30 to 50 foot-candles
(11) A 110v GFI outlet shall be provided at the countertop and at the wall nearest the chair placement.
(12) Each room should have the following furnishings and equipment:
    a. One Upholstered non-caster chair with arms.
    b. A wall mounted mirror above the counter
    c. Soap and Paper Towel dispensers
    d. Waste Receptacle
    e. Wall Mounted Clock
    f. Wall or Door Mounted Robe Hook
(13) Door Signage shall be a room number

J. Concrete
(1) For exposed concrete to receive a smooth rubbed finish within one day after form removal, moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. No cement grout other than that created by the rubbing process will be allowed.
(2) Interior concrete floors to be left exposed shall be sealed with a moisture cure urethane.
(3) Install exterior concrete stairs with tooled nosings only.

K. Masonry
(1) Unit Masonry
    a. 4-ft x 4-ft sample panels of each exposed masonry wall type shall be constructed on-site by the contractor for review and approval by Facilities Management through the University Project Manager.
(2) Campus Face Brick
    a. There are three accepted manufactures for face brick, they are:
        i. Baja Brown, matte texture as manufactured by Interstate Brick Company of Salt Lake City.
        ii. Desert Brown, wire cut texture as manufactured by Interpace Industries, Inc.
        iii. Colorado Rose, as manufactured by Robinson Brick Company.

L. Metals
(1) Structural Steel Framing
    a. In laboratory or shop spaces, where steel framing is exposed, make provision for additional loading of traveling cranes, etc.
(2) Steel Floor Deck
    a. Provide ducts for telecommunications in all offices and classrooms where requested by Facilities Management.
(3) Cold Formed Metal Framing

a. All exterior wall studs shall be minimum 18-gauge galvanized steel. Rough buck openings for door frames shall be constructed with double 18-gauge stud columns extended to structure.

(4) Metal Fabrications

a. All ferrous metal fabrications designed for exterior exposure shall have all surfaces galvanized after fabrication. Painting for these items will need to address the problems associated with galvanized metal.

(5) Steel Bollards

a. Steel bollards shall be minimum 6-in diameter standard steel pipe, set in minimum 24-in diameter x 48-in concrete footings, painted black with two rows of white Scotchlite reflective tape spaced 2-in apart and placed 4-in below the top of the pipe. Pipe shall be a minimum of 48-in above finish grade and filled with concrete full height, with concrete mound at top, painted white. Provide sealed expansion joint around steel pipe and asphalt or concrete paving.

(6) Exterior Pipe and Tube Railings

a. Guardrails

i. In addition to the A/E's general responsibility to consider the safety implications of design, for any circumstance in which a design is proposed that utilizes horizontal members for the guardrail infill, the A/E shall consider the safety implications associated with the location, use and ongoing performance of the proposed guardrail system. Any use of horizontal members shall be noted by the A/E when submitting plans for review.

b. Ramp Handrails

i. 1.66-in diameter stainless steel handrails are to be anchored to 2.5-in square stainless steel tube posts spaced at a minimum of 4-ft on center to a maximum of 6-ft on center.

ii. Provide a 1.66-in diameter stainless steel bottom rail centered 4-in above finish grade between vertical posts. All connections to be welded. Handrails to be 36-in clear between rails.

iii. Provide handrail extensions per code and return handrail ends to posts. See details below.

c. Handrail Post Caps

i. Anti-Skateboard handrail post caps shall be .375-in x 2.5-in x continuous stainless steel plate with .25-in radius edges and be welded to a 1.9722-in diameter x .375-in steel tube cap plate welded to a 1.8722-in diameter x 0.120-gauge x 2-in steel tube welded to a stainless steel cap plate welded to the top of each vertical post. See detail below.

d. Handrail Post Anchoring

i. 2.5-in square stainless steel handrail posts shall be set into 4-in diameter x 6-in deep core drilled holes in concrete paving with cementitious anchoring compound full height of core drilled hole.

ii. Posts shall be set a minimum of 3-in back from the paving edge or joint.

e. Handrail Profile

i. 2.5-in square stainless steel handrail post caps shall extend a minimum of 4-in above handrails. Anchor 1.66-in diameter stainless steel handrails to posts with .75-in diameter stainless steel rods, welded both ends.

ii. Provide handrail extensions beyond vertical posts as required by code and return to vertical posts 12-in below top of handrail. Use 3-in radius bends at handrail changes of direction. See detail below.

f. Exterior Stair Handrails

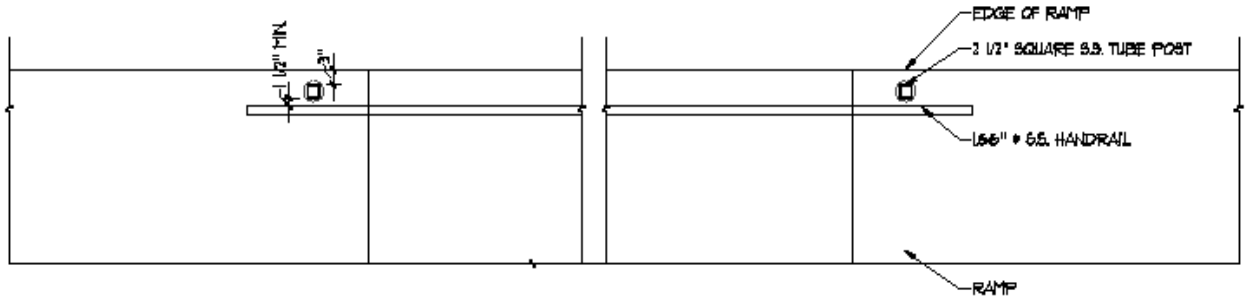
i. 1.66-in diameter stainless steel stair handrails to be anchored to 2.5-in square stainless steel tube posts at a minimum of 4-ft on center and maximum 6-ft on center.

ii. Anchor 1.66-in diameter stainless steel handrails to posts with .75-in diameter stainless steel rods, welded both ends.

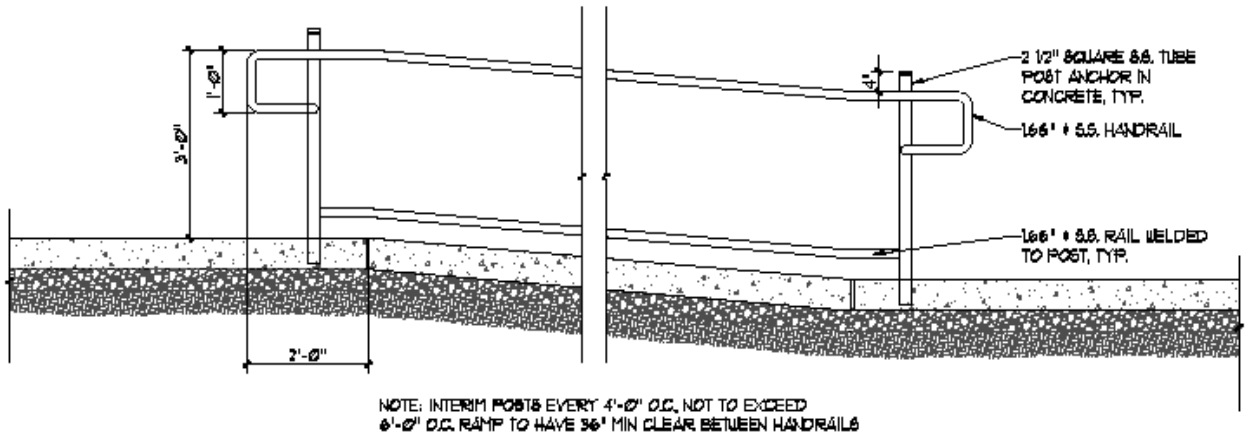
iii. Provide handrail extensions beyond vertical posts as required by code and return to vertical posts 12-in below top of handrail. Use 3-in radius bends at handrail changes of direction.

iv. Provide Anti-Skateboard post caps as described above. Set posts in core drilled holes as described above. Provide handrail extensions per code and return handrail ends to posts. See detail below.

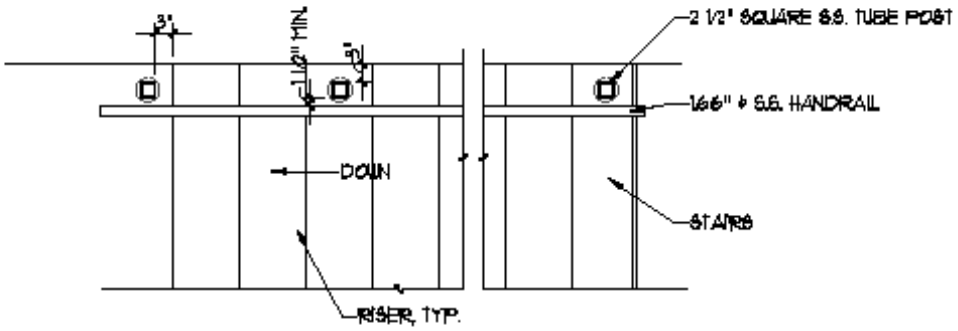
g. Handrail Details



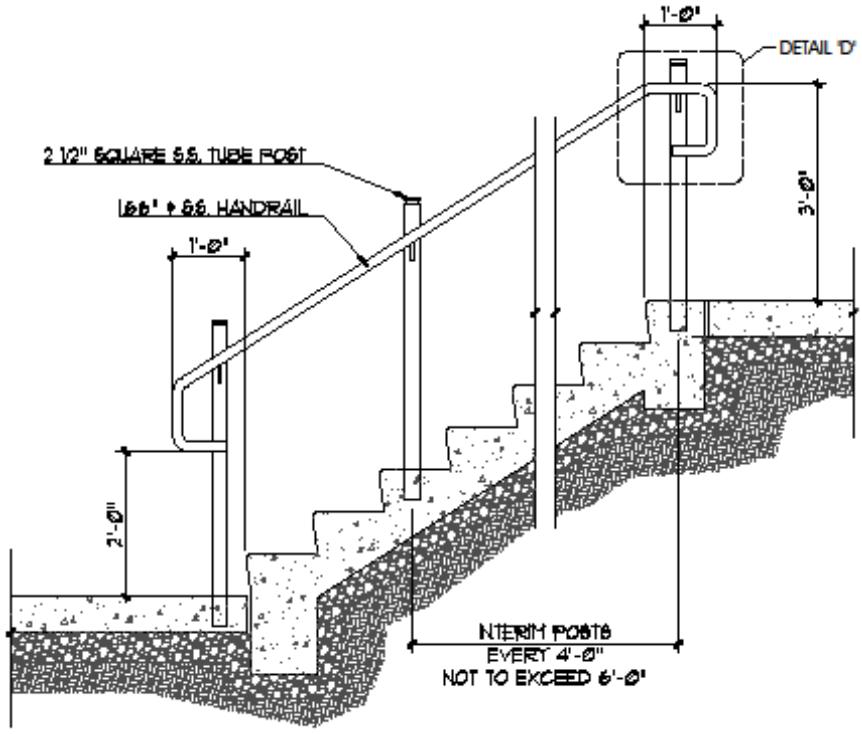
PLAN - HANDRAIL AT RAMP



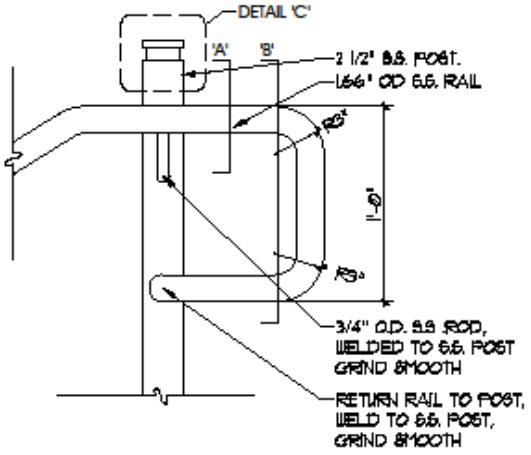
SECTION - HANDRAIL AT RAMP



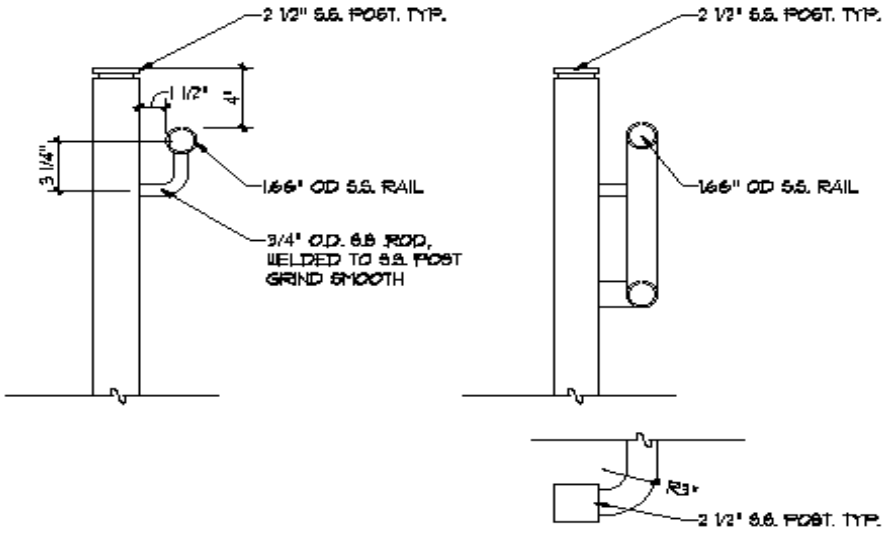
PLAN - HANDRAIL AT STAIRS



SECTION - HANDRAIL AT STAIRS

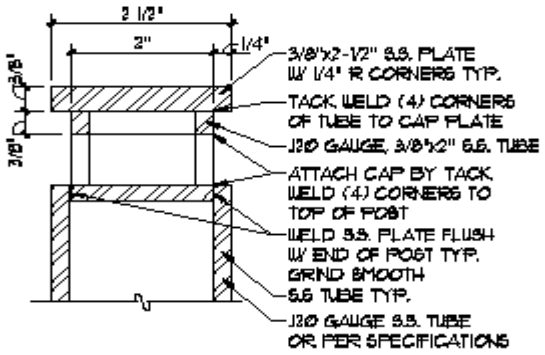


DETAIL 'D' - PIPE HANDRAIL



SECTION 'A'
PIPE HANDRAIL

SECTION 'B'
PIPE HANDRAIL



DETAIL 'C' - PIPE HANDRAIL POST CAP

M. Wood, Plastics, and Composites

(1) Rough Carpentry

a. All interior partitions shall receive a fire treated wood sill except where the finish flooring on both sides of the partition is carpet. In lieu of a fire treated wood sill, sheet metal backing behind the sill may be specified. The sheet metal backer shall be the same gauge thickness used in metal studs and shall extend from the floor to 6-in above the floor.

b. Any necessary wood framing, blocking, furring, etc. shall be fire treated.

c. Provide sheet metal backing at sill to 6-in above the floor.

d. Standards: AWPA P49, AWPA M2 and AWPA U1.

(2) Plastic-Laminate-Clad Architectural Cabinets

a. All plastic laminated tops and shelves shall be minimum 1-in thick and edge banded.

b. All cabinetry shall be designed and constructed to meet or exceed, the latest AWI Quality Standards, Custom grade or better. The University requires the following upgrades to the AWI Quality Standards:

i. No composite materials (particle board, fiber board, Masonite, OSB, etc.) shall be allowed within 4-in of the finish floor in laboratories, classrooms, restrooms, janitorial closets, or any area where water may be present. Specify pressure treated lumber, exterior grade plywood, or lumber rated by AWI for exterior use.

ii. All interior joints in cabinets where sinks will be installed shall be caulked.

iii. The front bottom edge of countertops and aprons where sinks are installed shall be edged in accordance with one of the following requirements:

(a) The countertop shall have a raised no-drip bullnose edge flush with the front apron.

(b) The countertop shall have a 1.5-in self-edge projecting .75-in beyond the face of the apron.

(c) The countertop shall have a bullnose edge flush with the face of the apron.

c. Cabinets shall be designed and fabricated to meet the following additional criteria (for laboratory countertops, see 3.3 Q (3), for laboratory cabinets see 3.3 R (1)):

i. Cabinet design shall be modular to the greatest extent possible to facilitate reuse in the event of future remodeling. Modules of 18-in, 24-in, 36-in etc., are to be used.
ii. Include allowances in the base cabinet to allow for minor vertical adjustments.
iii. Material selection shall be based on the intended use. Sinks shall be in accordance with 3.3 Q (3).
iv. Individual components shall be as follows:
(a) Hinges shall be 5 knuckle types.
(b) Slides shall be full length with nylon or stainless steel bearings
(c) Wood cabinets are acceptable for bio-safety less than level 3. Melamine or plastic laminate is acceptable.
(d) Door fronts shall be edge banded on all four sides and sealed with a durable finish for easy clean-ability.
(e) Consider "Sustainable Building Products" in the design and fabrication of cabinets. The A/E is expected to evaluate the possibility of such products and submit recommendations to the University Project Manager.

N. Openings
(1) Metal Doors and Frames
a. General
i. Frames, anchored every 16-in or less vertically in masonry and grout solid.
b. Interior Metal Doors
i. Interior - 18-gauge minimum, SDI A250.8, Level 2.
ii. Physical Performance: Level A according to SDI A250.4.
c. Interior Metal Frames
i. Interior - 16-gauge minimum, SDI A250.8, Level 3.
ii. Physical Performance: Level A according to SDI A250.4.
d. Exterior Metal Doors
i. Exterior - 16-gauge minimum, SDI A250.8, Level 3.
ii. Physical Performance: Level A according to SDI A250.4.
e. Exterior Metal Frames.
i. Interior - 16-gauge minimum, SDI A250.8, Level 3.
ii. Physical Performance: Level A according to SDI A250.4.
(2) Wood Doors
a. Wood Doors: Solid core doors faced with minimum of 1/16-in veneer finish are recommended. No wood doors to be used as exterior doors.
b. Sliding doors are not recommended.
c. Kick plates for doors in heavy traffic areas. This is to include classroom doors.
d. Mineral filled doors are not recommended.
e. Standards: Architectural Woodwork Institute (AWI/AWS).
(3) Plastic Doors
a. Sliding doors are not recommended.
b. Kick plates for doors in heavy traffic areas. This is to include classroom doors.
c. Mineral filled doors are not recommended.

(4) Coiling Doors and Grilles
   a. All roll-up fire doors shall be motorized and have automatic self-closing closing device or holder-release mechanism and governor unit complying with NFPA 80 and an easily tested and reset release mechanism. Testing for manually operated doors shall allow resetting by opening the door without re-tensioning the counterbalancing mechanism. Release mechanism for motor- operated doors shall allow testing without mechanical release of the door. Automatic-closing device shall be designed for activation by the following:
      i. Building fire-detection, smoke-detection, and -alarm systems.
   b. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
   c. Obstruction Device
      i. External entrapment device consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.
   d. All motorized roll up doors must have safety bar or motion sensor device to prevent door from closing on vehicles, equipment or persons.
   e. Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel. For fire-rated doors, activation delays closing.

(5) Metal Windows
   a. No ventilated windows to be operated with crank mechanisms unless windows are in tandem and heavy industrial crank mechanisms are used.
   b. Provisions made to facilitate easy washing of windows from inside building.

(6) Roof Windows and Skylights
   a. Must be a manufactured product complying with State adopted codes.
   b. No custom made skylight will be accepted.

(7) Door Hardware
   a. General:
      i. Fire-Rated Door Assemblies
         (a) Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
      ii. Smoke- and Draft-Control Door Assemblies
         (a) Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   b. Provide lock sets as follows:
      i. Bored Locks: BHMA A156.2; Grade 1.

ii. Mortise Locks: BHMA A156.13; Security Grade 1.
iii. Classroom function for all classroom doors.
iv. Turn button function for all offices.
v. Rigid function for custodial closets and mechanical rooms with 2-3/4 backset.
vi. DO NOT key restrooms.
vii. Securing the building and rooms within the building during construction is the Contractor's responsibility.

c. Electronic Locks
i. The University has adopted a campus wide security system. All new buildings will be designed with the CCure system, in accordance with 3.11 Communications and Security Wiring.
ii. All exterior doors on new or existing buildings shall have the CCure system. See 3.11 for alarm wiring, conduit and other rough-in requirements to be installed during construction.
iii. For interior doors in buildings that already have a CCure system installed, a compatible lock will be installed and tied to main system in the building.
iv. If any door will have electronic security devices, those devices should be supplied and installed by the security contractor to insure coordination of devices.
v. For interior doors in existing buildings without the CCure system, and where central monitoring by the University Public safety department is not needed, a Kaba Ilco with key bypass entry system will be installed. The system is to be operated, managed and maintained solely by the requesting department.
vi. Where power at interior door is prohibitive in existing buildings without the CCure system, and where central monitoring by the University's Public Safety Department is not needed, Locknetics keyless entry system will be installed; and, operated, managed, and maintained solely by the requesting department.
vii. All electronic locking systems shall comply with current specifications provided by the University's Alarm Committee. Upon request, the University will loan the A/E a confidential copy of the U of U Alarm Committee Approved Alarm Equipment document for use in the room security design.
viii. On security drawings, require the coordination between the electronic hardware installer and the electrical contractor for power wiring to the devices. The A/E is responsible to coordinate drawings and verify that power to the devices is provided for on the appropriate electrical drawings.

d. Cylinder Locks
i. High-Security Lock Cylinders: BHMA A156.30; Grade 1. Doors with cylindrical locks are to be specified with heavy duty Schlage or prior approved equal. As a minimum standard, specified locks are to conform to Schlage "standard 6 pin cylinders". Smaller formats are not acceptable. Interchangeable cores are not acceptable.
(a) Doors fitted for cylinder locks are to be specified with a 2.75-in backset.
(b) Panic bars shall be specified Von Duprin 99 Series, or 33 Series on exterior doors where a narrow type device is necessary. All panic bars shall be rim type with removable mullions on double doors.

(c) It is recommended that exterior doors have panic hardware installed, unless approved otherwise.

ii. On all new buildings, or on large remodel projects that require a large number of new locksets, the locksets are to be provided without cylinders or blanks. The University will furnish and install the cylinders in the locksets and provide the keys. Facilities Management will schedule and fund the installation of the keys and cylinders through the University Project Manager.

iii. On all new buildings and remodeling projects, specify a lever handle equal to Schlage L Series with return leg meeting ADA requirements.

(a) The minimum standard shall be Schlage "ND" series to fit Schlage 6 pin cylinders.

e. Hinges

i. BHMA A156.1 Use 4.5-in x 4.5-in ball bearing butts on all doors with jamb hinges.

f. Latch Rods

i. All top and bottom latch rods, where required on doors, are to be attached and secured at the top and bottom of the door.

g. Door Sweeps

i. All door sweeps on doors without a raised threshold must use mechanical or automatic type door sweeps.

h. Finish.

i. Match existing finish on remodeling projects.

i. Door Closers

i. BHMA A156.4 All doors leading to halls must open at least 140-degrees. Provide rated hardware as required by the code. Provide appropriate door stops in floor or wall as approved by Facilities Management through the University Project Manager.

ii. All exterior and interior doors shall have LCN closers with durability matching or exceeding that of closer type LCN 4041 “Series” (domestic manufactured).

iii. Floor type closers are acceptable with the following stipulations:

(a) Alignment of the pivot points shall be such that the original installation in line and that building movements, due to expansion and contraction, shall not cause excessive wear on the door closer.

(b) Door closers shall not be located so that they are exposed to the weather. This is intended to reduce or eliminate the effect of water, snow, ice, salt and freeze upheaval on the door.

iv. All surface mounted closers installed on mineral fill or particle board, chip board must be mounted with 1/4-in 20 thru bolts.

v. All steel doors 18-gauge or less must have backing plates to support mounting of door closer or door closer must be installed with thru bolts.

vi. All doors that have a wall at a 90-degree to that door, the door closer must have a back check feature and must be adjusted properly.

(8) Automatic Door Openers

a. Automatic door openers shall be required on at least one door in all accessible entries.
b. Automatic door opener push pads and any other opening device shall be hard wired. Wireless devices shall not be specified unless approved by the University Facility Management through the University Project Manager during design and prior to bid.
c. Automatic door opener manufacturer shall have a minimum 10-year history as a company and a 5-year history manufacturing similar door opener products.
d. Require the automatic door opener to have a two-year installer service warranty on parts and labor.
e. Specify that the automatic door opener replacement parts are to be available within the United States.
f. Approved automatic door opener manufacturers are:
    i. LCN #4611 or #4622.
    ii. Pre-approved manufacturer.
g. All control devices on automatic doors, such as pneumatic operators must be accessible with not more than an 8-ft ladder.

(9) Glazing
a. Glass Glazing
    i. Glass to be cleaned by Contractor at job completion.
    ii. Tinted Glass. Guarantees shall provide for perpetual inventory stock of matching glass for replacements.
    iii. Considerable difficulty has been experienced with water leaking through the caulking or gaskets around window glass. Specifications should provide for either a water leak test at a pressure equal to 50-mph winds or provide a 10-year guarantee against leakage through the caulking or gaskets.
    iv. For non-stock glass items which must be fabricated to size and generally not readily available in Salt Lake City (such as tempered or spandrel glass), specify two extra pieces or 2% over the total quantity installed, whichever is greater, of each non-stock glass size which shall be provided to the University in storage crates. Coordinate with the University Project Manager for delivery instructions.
    v. For projects where tempered or spandrel glass will be specified, obtain a list of common glass unit sizes currently installed and stocked on campus from Facilities Management through the University Project Manager, and determine if common sizes are applicable to the project. The University desires to limit special glass sizes to those currently installed and stored in order to reduce the number of sizes which must be managed in maintenance stock.
b. Curtain Walls and Glazed Assemblies
    i. The A/E shall exercise caution in specifying metal curtain wall systems to minimize any visible "oil canning" on exposed finished metal surfaces.

O. Finishes
(1) General Design Recommendations: Selection of wall and floor finishes and types must carefully consider maintenance issues. Wood paneling in areas where hard surfaced floors are located must consider the effect of floor maintenance on wall surfaces.
(2) Non-Structural Metal Framing

a. All interior wall studs shall be minimum 20-gauge galvanized steel. Rough buck openings for door frames shall be constructed with double 18-gauge stud columns extended to structure, or an engineered equivalent.
b. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly by an independent testing agency.
c. Framing Members, General: Comply with ASTM C 754-00 for conditions indicated. Steel Sheet Components: Comply with ASTM C 645 - 13 requirements for metal unless otherwise indicated.
d. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
e. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 - 09 and classified according to ASTM E 413 - 04 by an independent testing agency.
f. Where doors that swing into an adjacent wall there must be a backing plate or fire treated wood blocking installed between studs to support sheet rock at the location where the door handles meet the wall to prevent damage and allow better mounting for wall mounted door stops.
g. All interior partitions shall receive a fire treated wood sill except where the finish flooring on both sides of the partition is carpet. In lieu of a fire treated wood sill, sheet metal backing behind the sill may be specified. The sheet metal backer shall be the same gauge thickness used in metal studs and shall extend from the floor to 6-in above the floor.

(3) Gypsum Board
a. Gypsum Wallboard: ASTM C 1597M – 04(2009)e1.
b. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly by an independent testing agency.
i. Fire rated walls to be full height from finish floor elevation to bottom of structure above with 5/8-in Type – X Gypsum Board full height both sides.
ii. Provide U.L. Design fire rated penetrations.
iii. Provide U.L. Design fire rated wall details.
c. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 - 09 and classified according to ASTM E 413 - 04 by an independent testing agency.

(4) Terrazzo Flooring
a. Colors of stairs and floors should be of intermediate to lighter shades in color so as not to show foot scuffs.
b. Protective nosings for stairs.
c. Design treads to facilitate sweeping.
d. Corrugated treads not recommended in any public space.
e. Aggregate to be clean and free from shavings, etc.

(5) Resilient Flooring
a. Use lighter shades where traffic is heavy. Color tones such as tan or beige preferred. 12-in x 12-in vinyl composition tile, 1/8-in thick is preferred.

b. Clean and wax floors before turning building over to the University for occupancy. Cleaning and waxing to be done according to manufacturer's recommendations. Floor finish should match that which is currently being used by the University. Concrete floors to be sealed with concrete sealer.
c. Recommended minimum height of base is 4-in.
d. Rubber tile has maintenance problems, especially with the lighter colors and deep ribbed or embossed patterns.

(6) Carpeting
a. General
i. The type of carpeting (category types I, II, or III, IV & V) will be determined by specific project requirements.
ii. Carpeting of stairs is not recommended.
iii. Carpet color and type needs to consider maintenance issues such as staining and cycles of cleaning.
b. Samples
i. Upon request, samples shall be submitted to the University Project Manager for approval prior to ordering. Samples complete with specifications shall be submitted in a manner timely to avoid any delays in installation.
(a) 13.5-in x 18-in sample of each broadloom carpet or 18-in x 18-in sample of any carpet tile proposed for use shall be submitted in the quality, pattern and color specified.
(b) A 12-in x 12-in sample of cushion (pad) in exact product, weight and manufacturer shall be submitted (where applicable).
(c) Metal or vinyl edge molding together with fasteners proposed for securing the molding to the substrate shall be submitted. Sample shall be approximately 9-in long (where applicable).
(d) A 9-in section of the specified base material shall be submitted prior to ordering (where applicable).
c. Preparatory Work
i. It shall be the responsibility of the general contractor or installation contractor to present the floors in a condition to receive the carpet. The substrate shall be thoroughly clean, free of any foreign matter, dry and dust-free. All cracks wider than 1/16-in, depressions, etc. must be fixed with a Portland cement based patching compound. Where carpet is to be glued directly to the floor, or double-stick cushion is specified, all waxes, old adhesives, etc. must be removed prior to installation. The installation contractor shall notify the University in writing of any conditions which will be detrimental to the carpet installation. The start of carpet installation shall be an indication of acceptance of the floor by the installation contractor.
d. Guarantee
i. The Contractor shall guarantee in writing to reinstall (if necessary) or re-stretch any carpet that is wrinkled and to correct any other condition due to faulty installation, such as "peaks" or "valley" in seaming or seam failure.

ii. The guarantee shall be effective for a period of one year where broadloom products are used and two years where tile is used following final acceptance of the installation.

iii. Any repairs or replacements made under the guarantee shall be provided by the Contractor at no additional charge.

iv. The carpet product used shall be guaranteed in accordance with manufacturer's standard guarantee for category type from substantial completion date.

e. Donated Carpet

i. All carpeting donated to the University shall comply with the current State Carpet Contract specifications.

f. Materials for New Carpet

i. Meet or exceed current State Carpet Contract specifications for each category type. The University Project Manager will review and approve the carpet specification.

g. Carpet Cushion

i. Carpet cushion shall be specified as one of the following, depending upon the needs of the requesting agency. Cushion shall meet following requirements for normal cushion application as indicated:

(a) Attached cushion is the preferred specification.

(b) Where approved by the University Project Manager: Cushion shall be 3/8-in thickness, no less than 4-pound density in moderate traffic areas; 1/4-in thickness and no less than 7-pound density in heavy traffic areas. Cushion can be rebound rubber, having no clay products in its composition.

h. Rubber Base

i. Wall base shall be RUBBER BASE such as Johnsonite, Burke, Roppe or VPI. It shall be constructed of first quality materials properly vulcanized and shall be smooth and free from imperfections which detract from its appearance. The base shall conform fully to the requirements of ASTM F-1861, Type TP, Group 1 (solid) standard specification for resilient wall base.

ii. All Cove Base shall have a standard toe of 5/8-in, a height of 4-in, and shall be available on roll basis.

iii. Cove base shall be used with all hard surface floors.

iv. Prefabricated corners are to be avoided unless specifically approved by the University Project Manager. All other outside corners are to be installed without product deformation or discoloration.

(7) Painting and Coating

a. No varnish to be used on surface of interior brick. If sealant is desired, the A/E shall submit a recommendation with manufacturer's data to Facilities Management through the University Project Manager for approval.

b. Remove hardware before painting doors, windows, frames, etc.

c. Acceptable Paints:

i. Provide best quality grade of various types of coatings regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be accepted. Paints should carry at a minimum a 5-year warranty.

ii. Provide primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

iii. Provide paints with low to zero VOC content. All paints specified for interior use should be able to meet LEED requirements of VOC.

iv. Toilet Rooms and other wet areas where paint is specified shall have semi-gloss or higher sheen.

v. Marker board paints shall be applied with a single roller coat or spray application. The paint specified shall be odorless and of low VOC. It shall be a solvent based dry erase coating that works with standard dry erase markers and accessories. Paint shall be supplied with a 10-year warranty.

d. Color samples are to be approved by Facilities Management through the University Project Manager before instructions are given to the Contractor for all color selections.

e. In remodel or paint patching work, any paint patching must be done between closest break points. For example, from corner to corner or from corner to a door.

(8) Wall Coverings

a. General

i. Shall comply with Federal Specification CCC-W-408B using test methods given in the Federal Specification CCC-T-191-G except as modified herein.

ii. Shall be produced by quality manufacturer such as "Vicretex" or "Essex."

b. Description

i. Shall be Type II, Medium Duty, Class A Vinyl Coated Fabric Wallcovering for Institutional or Commercial use, conforming in all respects to CFFA Quality Standard for Vinyl Coated Fabric Wallcovering CFFA-W-101-A, developed and published in May 1984.

ii. Shall meet the following average weight and thickness requirements:

(a) Total Weight (oz/lin. yd) 54-in width average - 20.0

(b) Total Weight (oz/sq. yd) - 13.3

(c) Vinyl Weight (oz/sq. yd) - 10.8

(d) Fabric Weight (oz/sq. yd) - 2.5

(e) Fabric Type Osnaburg or Osnaburg Blend

(f) Total Average Thickness - 0.024

c. Fire Hazard Classification

i. Products shall bear the UL label or Manufacturer's Letter of Certification indicating fire hazard classification with flame spread in compliance with adopted codes and amendments in the State of Utah.

P. Specialties

(1) Visual Display Surfaces

a. Acceptable Boards: ADP Lemco or other boards with ten year warranties.

b. In any one room, the combination of chalkboards and marker boards will not be allowed. Chalkboards will only be allowed if the requesting entity agrees to the known increased maintenance requirements of chalk dust.

c. All chalkboards/marker boards shall be mechanically fastened

(2) Toilet Compartments
   a. Urinal Screens
      i. Urinal screen wall mount brackets shall be anchored to a minimum 16-gauge full height steel backer plate bolted to the wall studs with minimum 1/4-in anchor bolts at maximum 4-in on center, both sides.

(3) Wall and Door Protection
   a. Remodeling projects and new construction shall have wall guards at chair rail height in areas within which there is movable furniture. Vinyl or composite rails are preferred in all areas except in Class “A” office space where hardwood stained or painted rails should be considered. This should be reviewed with the University Project Manager on each project.

(4) Toilet, Bath and Laundry Accessories
   a. General
      i. The following items will be supplied & installed by the University. The General Contractor shall install all blocking, rough framing, nailers, etc., necessary to support these items.
         (a) Towel Dispenser: Steiner SST Single Service Cloth Towel Cabinet.
         (b) Soap Dispenser: Ultimatic Soap Dispenser System, Model No. L-3.
         (c) Toilet Paper Dispenser: Ultimatic 2-roll Tissue System Dispenser, Model No. S-44C.
   b. The following items will be supplied and installed as part of the construction contract. All bathroom fixtures, including but not limited to, partitions, mirrors, feminine napkin disposers, sanitary seat cover holders, vanities etc., must be mounted using expandable hollow wall anchors such as zip togs or butterfly bolts. Conical plastic friction anchors or double stick tape will not be allowed. Specification for products to be as follows:
      i. Mirror Units: This is up to the A/E's discretion with the University's approval. Typically, single unit mirrors are installed above each lavatory to allow soap dispensers to be mounted alternating between them. A shelf is provided on mirrors installed over wall hung or free standing lavatories. No shelf is required when a counter is installed.
      ii. Grab Bars
      iii. Mop and Broom Holder
      iv. Shower Curtain Rod
      v. Shower Curtain and Hooks
      vi. Infant Changing Stations
      vii. A fold down diaper changing station shall be installed at either a unisex toilet room or in one each of the main floor men’s and women’s toilet rooms.
   c. Quality Assurance
      i. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry; coordinate design of wall construction with Facilities Management through the University Project Manager for University supplied items.
      ii. Accessory Locations: Coordinate accessory locations with other work to avoid interference and to assure proper operation and servicing of accessory units.

iii. Stud Walls: Stud walls must have a 20-gauge minimum strap on solid blocking at all accessory locations for mounting.

d. Products for Accessories specified above:

i. Subject to compliance with requirements, provide toilet accessories by one of the following:

(a) American Specialties, Inc.

(b) Bobrick Washroom Equipment, Inc.

(c) Bradley Corporation.

Q. Equipment

(1) Loading Dock

a. General: Loading docks shall be subject to the following requirements:

i. Dock Width: 10-ft from face of wall to edge of dock.

ii. Roof Overhang: Roof overhand shall be flush with dock edge.

iii. Vertical Clearance: 12-ft from dock surface to underside of overhang.

iv. Dock Height: 4-ft from paving to dock surface.

v. Deck Plate: Size to be 6-ft wide x 6-ft 8-in deep electrically operated to raise and lower plate to match truck bed heights.

vi. Dock Doors: Size shall be 10-ft wide x 9-ft high roll-up type doors, electrically operated with manual override option.

vii. Dock Bumpers: Substantial dock bumpers shall be installed at appropriate spacing along dock edge.

(2) Vending Machines

a. Each building shall include a separate room or alcove for vending machines.

b. Space for refuse and empty bottle containers should be provided.

c. Floor and walls must be constructed of washable materials. Ceramic tile preferred.

(3) Laboratory Equipment

a. The University prefers wood laboratory casework unless metal is specifically requested for a limited use. Prior to design, the A/E is to meet with the University Project Manager to determine whether modular or custom casework should be specified, and identify the corrosive chemicals to be used in the lab sinks. The Plumbing Shop Supervisor will assist in the selection of lab sinks.

b. Acceptable manufacturers of lab casework are Sheldon, Hamilton and Kewaunee or prior approved equal. The Graniteline plastic clad equipment as manufactured by the Granite Mill is also considered satisfactory as laboratory furniture.

c. Laboratory tops shall be Molded Epoxy Resin tops as manufactured by either Prime Industries; Laboratory Tops, Inc.; Durcon; or, Epoxyn Products; and shall be cast from thermal setting modified epoxy resins and inert fillers. Tops, splashes and curbs shall be a uniform mixture throughout their full thickness. Tabletops shall be 1-in thick with drip grooves provided on the underside at all exposed edges. Further, all exposed edges, except as indicated below, shall be rounded to a 1/4-in radius at front top edge and at vertical corners. Curbs and splashes shall be 3/4-in thick, bonded to the surface of the laboratory top to form a square joint. Backsplash curb height is to be 4-in minimum (or greater as required by the end use). Sink cutouts shall be smooth and uniform without saw marks and the top edge shall have a

uniform radius conforming to the sinks radius and shape. Where indented benches and table tops are required, specify 1-in thick at the outer edge, indented 1/4-in to provide a raised rim 1-in wide all around all exposed edges. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded to a 1/8-in radius. Fume hood work surfaces shall be 1-in thick at outer edges, indented 1/4-in to provide a raised rim around all edges. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded to a 1/8-in radius. The juncture between the raised rim and the top surface shall be coved to a 1/4-in radius.

d. Acceptable Manufacturers
   i. Laboratory tops shall be Molded Epoxy Resin tops as manufactured by either Prime Industries; Laboratory Tops, Inc.; Durcon; or, Epoxyn Products.
e. Laboratory sinks shall be:
   i. Molded Epoxy Resin to match Laboratory Tops
   ii. Stainless Steel where radioactive isotopes are to be used in any quantity.
f. For laboratory waste and drain lines, the A/E is requested to design and specify the under-sink fittings in Pyrex glass. However, "Durcon" and "Duriron" will be acceptable substitutes. Refer to 3.7 C (10) for additional requirements.
g. Laboratory benches shall be designed and installed to facilitate maintenance on all utilities serving the bench. This will require the provision of removable panels so that all fittings can be reached without disassembling the bench.
h. Paper towel dispensers shall be provided in laboratory areas over each sink. Scott Model #995 (white enamel) or equal.

R. Furnishings
(1) Laboratory Casework
   a. All cabinetry shall be designed and constructed to meet or exceed, the latest AWI Quality Standards, Premium grade. Refer to 3.3 M (2) for typical requirements.
   b. Laboratory cabinets shall be designed and fabricated to meet the following additional criteria:
      i. Material selection shall be based on the intended use.
      ii. Laboratory tops and sinks shall be in accordance with 3.3 Q (3).
   c. Individual components shall be as follows:
      i. Wood cabinets are acceptable for bio-safety less than level 3. Melamine interiors or plastic laminate is acceptable.
(2) Window Blinds
   a. Adjustable blinds shall be manufactured by Bali - Classic Blind Series 3000, or an approved equal. They must have one-inch wide virgin aluminum alloyed slats. The wand shall be a clear plastic rod.
(3) Floor Mats
   a. Entry mats shall be a roll-up, polypropylene type floor mat, non-recessed, 3/8-in thick, permanently crimped denier polypropylene pile fused to solid vinyl. University Project Manager to approve installation and coordination with Custodial Services.
(4) Systems Furniture
   a. Landscape partition systems shall accommodate power, telephone, computer hook ups and transportation.

b. Specify compliance to current Utah State adopted codes, in particular, but not limited to, the flame spread and smoke contribution, and seismic restraint requirements.

(5) Fixed Audience Seating

a. All fixed seating regardless of intended use or location must have a 10-year manufacturing and installation warranty on parts and labor from the manufacturer.

(6) Interior Recycling Bins

a. Below is a list of areas and the materials that are required for new state funded facilities. To be ordered thru the Waste Management Department.

i. Office areas: One 13-qt office pack bin for each desk, and one 23-gal mixed pack bin for each room/cubicle area.

ii. Classrooms: One 28-qt mixed pack bin.

iii. Conference/Break Rooms: One 28-qt mixed pack bin

iv. Copy Rooms: One 23-gal office pack bin and one 28-qt mixed pack bin.

v. Labs: The type of lab determines the bin type, size and quantity. For example, a chemistry lab would only require a 23-gal mixed paper bin while a computer lab would require two 23-gal office pack bins and one 23-gal mixed paper bin. This decision is made by the Waste Management and Custodial Departments.

vi. Building Entrances: One for bin recycling center at all major entryways.

vii. Hallways: One 4-bin recycling center on each floor, this does not include the recycling centers provided at major entryways. Vending machine areas required 30-gal recycling bins for plastics and /or aluminum depending on the type of beverage container dispensed by the machine. Mixed paper recycling bins are also required in hallways and common areas. The size, type and quantity of the paper recycling bins are decided by the Waste management and Custodial Departments.

viii. Restrooms: Recycling bins are not required in restrooms.

ix. Café Areas: Recycling in café areas is the responsibility of the vendor.

x. Dock Area: A cardboard recycling trailer is to be provided. The trailer can be purchased thru the Waste Management Department. If the trailer is purchased independently it must follow the specifications provided by the Waste Management Department.

S. Vivariums

(1) Planning and design of Vivariums should be in close coordination with the University Director of Comparative Medicine. The A/E shall coordinate a vivarium planning meeting with the University project manager and the University director of comparative medicine during the planning stage of the project.

a. The meeting shall specifically cover and plan for the required surface finishes, space requirements, need for special behavior rooms, sound proofing, mechanical systems, security requirements, and Facilities for cleaning.

b. Notes from this meeting shall be distributed to the planning team and kept as part of the project record.

(2) Common Work Results for Special Construction

a. Epoxy treatment of walls and floors has proven advantageous in some areas on previous projects.

b. A monolithic type flooring, similar to "Dex-O-Tex" produced by Crossfield Products, with its own elastic membrane and the necessary coves at walls and corners appears advisable in areas where a waterproof, washable floor is mandatory.

c. Plain, sealed concrete has proven unsatisfactory. Floor cracking creates serious problems.

d. Vivarium design shall be in accordance with the guidelines outlined in the latest edition of the “Guide for the Care and Use of Laboratory Animals” and Section 2-4 of NIH Policies and Guidelines. Specifically referencing the guidelines for physical plant design.

T. Elevators

(1) The interior dimensions and features of the specified elevators shall accommodate cleaning equipment and furniture and shall be designed for ease of cleaning and maintenance.

(2) Specify removable full-height bumper blankets for wall protection in elevators primarily intended for freight, supplies, equipment, etc.

(3) LED lighting or fluorescent tubes in specified elevators shall be a standard size, easily obtainable from local distributors.

(4) See 3.11 F (35) for special requirements regarding elevator phones and phone panels, elevator communications connections (traveling cable), access panels, conduit, emergency service lines, etc.

(5) The elevator system shall be maintainable by any licensed elevator maintenance company employing journeymen mechanics, without the need to purchase or lease additional diagnostic devices, special tools or instructions from the original equipment manufacturer.

(6) The elevator design shall include on-site diagnostic functionality capable of identifying faults and malfunctioning components.

a. If “fault diagnosis” requires a separate, detachable device, elevator specifications shall require that the device is to be furnished to the University as part of the Contractor’s bid with complete supporting documentations and appropriate training as part of the elevator start-up/commissioning. If such a device is required for elevator maintenance, it must be an “industry standard” device applicable to other elevator control designs (non-proprietary).

3.4 Structural

A. Concrete

(1) Materials shall comply with the standards specified in the latest addition of ACI 318. All concrete shall meet the requirements of ACI 318 for strength, and the following criteria:

a. All exterior exposed concrete that will be subjected to wetting and deicing treatments shall be of a strength and air content appropriate for those exposures. No exterior exposed concrete allowed less than 4500 psi (see also ACI Table 4.2.2).

i. For stairs or other extreme exposures, adequate life cycle / corrosion resistant design is required to protect rebar.

ii. Concrete cover over reinforcing in elevated slabs and structural members exposed to weather shall be no less than 2”.

b. Reinforcing steel shall be minimum grade 60; fy=60 ksi.

c. Lightweight concrete shall not exceed recommended unit weight for applicable UL-listed assemblies and shall be made of lightweight course aggregates and lightweight and/or normal weight fines.

d. Sidewalks throughout campus are to be rated for heavy vehicle use, refer to 3.2 A (1) for specific requirements. At a minimum, provide a 6-1/2 bag mix. Provide additional reinforcing, thickness, etc. as use requires.

e. Interior slab-on-grade shall have construction or control joints placed in lengths not to exceed 30 times the slab thickness in any direction. Construction joints will not exceed a distance of 12-ft on center in any direction. For walking surfaces along the accessible paths of travel, expansion/construction/control joints shall be no wider than 3/8" with tooled edges of not more than a 1/4" radius. The intent is to provide a joint which does not exceed 1/2" in width for ADA requirements. Other areas not requiring ADA compliance could use the 1/2" wide expansion joint material. Special requirements for campus sidewalks are found in 3.2 A (1).

B. Masonry

(1) Concrete masonry unit assemblies shall be lightweight grade N1 or better (minimum unit strength 1,900 psi average for f'm=1,500 psi).

(2) Hollow clay unit assemblies shall be hollow brick, grade 1 or better (minimum unit strength 6,600 psi average for f'm=2,500 psi).

(3) Solid clay unit assemblies shall be SW or better (minimum unit strength 3,350 psi average for f'm=1,500 psi).

(4) Grout shall be proportioned, tested, mechanically consolidated, and reconsolidated in accordance with State adopted codes. Grout shall attain a minimum compressive strength of 2,000 psi.

(5) Mortar shall be type "S", and tested in accordance with State adopted codes. Mortar shall attain a minimum strength of 1,800 psi.

(6) Reinforcing steel shall be minimum grade 60; fy=60 ksi.

(7) Joint reinforcement may be included in the wall design, but this reinforcement shall not replace the requirement for reinforced bond beams.

(8) Reinforcement that requires welding shall be of the deformed bar anchor type and conform to ASTM A496 or ASTM A706.

(9) Footing stem walls to finish grade or floor shall not be constructed of masonry.

(10) Dowels from the foundation into the supported masonry wall above shall match size and spacing of vertical masonry reinforcement.

(11) Veneer shall have attached seismic anchorage in accordance with State adopted codes.

(12) All anchors and lintels supporting veneer shall be galvanized.

C. Steel

(1) Refer to the latest edition of AISC specifications for steel shape requirements.

D. Special Inspections

(1) The structural engineer shall include in the drawings the structural items which require special inspection according to State adopted codes.

E. Design Loads

(1) Wind Load

a. Refer to IBC 1609 for wind loading based on Risk Category of the structure in question. No exposure below 'C' is allowed.

(2) Roof Loads.

a. Rain on Snow: An additional 5-psf rain on snow surcharge; this surcharge may be disregarded where roof slopes exceed 1/2 inch per foot. Rain on snow does not need to be included in seismic calculations.

(3) Floor Loads

a. Office Areas: Due to the nature of offices where there is a need for many filing cabinets, open office landscaping, etc., all office floors shall be designed for 80-psf minimum uniform load plus 15-psf for removable partitions. This requirement is in lieu of the 50-psf currently required in State adopted codes. Alternative floor load requirements may be approved by the University when deemed appropriate for the expected use of the building over its lifetime.

F. Footings and Foundations

(1) Frost Depth: Refer to soils investigation report for depth of footings. No footing shall be less than 30" below grade.

(2) Design of footings and foundations shall be based on the recommendations of the soils investigation report and the specifications shall reflect said recommendations. The following requirements shall also be used in design:

a. Footing shall be designed to resist frost heave, water infiltration, settlement and overturning.

b. Footings shall bear atop undisturbed earth or compacted backfill.

c. Elevation of top of footing and finished grade lines shall be noted on building elevation views.

G. Parking Structures

(1) Minimum Concrete Strength: 5,000 psi for post-tensioned members

(2) Air Entrainment: Severe Exposure

(3) Rebar: Adequate life cycle / corrosion resistant design is required to protect rebar.

(4) Cover on Reinforcing: As required by ACI based on exposure, never less than 1-in.

(5) Top Deck (if no roof): Combine snow load with vehicles. Review with Facilities Management through the University Project Manager those areas of higher loading due to snow removal.

H. High Temperature Water Rooms

(1) High Temperature Water Equipment Rooms shall be entirely designed by an engineer. Calculations shall be provided to support the design solution and justify all materials being specified in the construction of the room.

(2) Design high temperature water equipment rooms accommodate the forces associated with a possible rupture of a HTW pipe operating at 400 + psi and 400 degrees F. Wall and floor construction shall be designed, and doors and hardware shall be selected and specified with sufficient resistive strength to withstand the pressures of a maximum HTW release event.

(3) Exhaust vents shall be sufficiently sized to dissipate the pressures that might occur in a maximum HTW event in a given HTW room.

(4) Doors and hardware shall be selected specifically to withstand maximum explosive HTW release pressures. Latching of these doors should be designed using flush bolts or other

suitable means by which to safely maintain enclosure integrity and security during a HTW breach. The design should allow for normal operation of the doors after an explosive breach.

(5) Note that the HTW equipment room will require an exhaust system and conduit for an emergency HTW shut-off switch outside the room near the door.

(6) Additional design requirements for the HTW system are found in 3.8 D.

3.5 Electrical

A. Lighting

(1) Interior Lighting

a. Maintainability

i. Lighting equipment selected and positioned in the project as part of the A/E's design shall be maintainable. The layout and location of light equipment shall include consideration for lamp, ballast and/or LED driver replacement. Placement of lighting equipment in locations which cannot be reasonably serviced and re-lamped shall not be allowed.

ii. Where lamp replacement will reasonably require the use of special equipment such as telescoping poles, man lifts, or fixture lowering devices, these shall be specified to be supplied as part of the contract.

iii. Placement of lighting above stairways and atriums shall be avoided unless convenient re-lamping provisions are included as part of the design.

b. Spare Fixture Lenses

i. Require the Contractor to provide 10% of each type and size specified with a minimum 2 of each. Coordinate storing and delivery of spare lenses with the University Project Manager.

c. Lighting Control

i. A lighting control system should be provided for the interior lighting of all new buildings. The system shall be compatible with BACnet data communication protocol.

ii. Lighting control systems shall have either an open or direct interface and keyboard, keypad or touchscreen access.

iii. Lighting control systems specified for building additions shall be compatible with existing systems, additions, alterations.

d. Fluorescent

i. Fluorescent ballasts shall be programmed start.

ii. Premium lamps and ballasts shall be specified.

iii. Do not specify, nor allow compact fluorescent downlight fixtures.

e. LED lighting shall be used for following applications:

i. Under-cabinet lighting applications

ii. Task lighting

iii. Cove lighting

iv. Downlights

v. Emergency lighting and exit signs

vi. Dimming applications

vii. Classroom and office lighting

viii. Stairway and/or stairwell lighting

f. Emergency Lighting
   i. Design an LED emergency lighting system for the path of egress.
   ii. In addition to the path of egress, emergency lighting shall be provided in the following locations:
      (a) Where critical experiments or other activities warrant continued occupancy of the space during a power outage.
      (b) Transformer and Switch Pads
      (c) Main Electrical Rooms
      (d) Emergency Generator Areas
      (e) Telecommunication Rooms
      (f) Mechanical Spaces
      (g) Any other specific locations where emergency lighting is deemed necessary.
   iii. Emergency lighting and illuminated exit signs shall be powered from an alternate power source.
      (a) Whenever possible, the alternate power source shall be an engine generator set.
      (b) Emergency lighting in all new buildings shall be connected to a new emergency generator or to an existing generator at a nearby building.
      (c) When the project's emergency power needs will draw from a nearby generator at another building, confirming capacity calculations (starting and load calculations) for the existing off-site generator shall be submitted to Facilities Management through the University Project Manager for review and approval prior to completing the design.
      (d) Remodeling projects at buildings with no access to an emergency generator may warrant the use of rechargeable batteries as the source of alternate power. If battery power is considered, the A/E shall submit a request for its use to Facilities Management through the University Project Manager, and obtain written approval. When used, battery powered systems shall include automatic chargers and exercisers.

g. Emergency Exit Signs.
   i. Emergency exit signs shall be typically specified as long life LEDs.
   ii. Photo luminescent exit signs may be approved in areas where they can be installed in accordance with all applicable UL and/or FM ratings and applications. Photo luminescent products specified for the project must be able to demonstrate minimum illumination to charge the sign.
   iii. Exit signs containing tritium shall not be allowed. Exceptional circumstances warranting their use will require approval from the University Department of Radiological Health through the University Project Manager, and a Project Variance Request

(2) Exterior Lighting

a. Refer to DFCM 3.5 A (5) regarding shorting fuse inserts and common neutral as these generally do not apply to University projects.

b. Where outdoor lighting is specified on University projects, close coordination with Facilities Management will be required during design.

c. The technical standards for exterior lighting applies to all University properties. The aesthetic standard for exterior lighting applies to Lower Campus, Health Sciences Campus and Ft. Douglas. Aesthetics for all other areas should be consistent with the architectural context of the area.

d. Exterior Lighting Controls

i. A lighting control system for building facade lighting and landscape lighting shall be included in the design of all new University buildings. The system shall be compatible with BACnet data communication protocol.

ii. Each outdoor lighting circuit shall be controlled by a magnetically held 50A, 3P, 480V lighting contactor with a hand-off-auto selector switch and a photocell (120 v) in its own enclosure.

e. In-Concrete, In-Ground, and Bollard Lights Not Allowed

i. 'In-concrete' light fixtures (especially in exterior stairs and walls), 'in-ground' light fixtures, and bollard lighting systems are not allowed.

(3) Exterior Pole Lights

a. General

i. Exterior pole lights throughout campus are to be standardized for uniformity in appearance, light pattern, and light distribution; quality of unit fabrication, engineering, and assembly; and, reliability for long term University maintenance. Poles shall be standardized as either 10' for walkways & landscape on Main Campus and the Health Sciences Campus,16' for walkway & landscape at Ft. Douglas or 20' for Parking lots and Roadways. Light pattern and distribution requirements shall be coordinated with the University Lighting Specialist.

(a) Colors of the poles lights shall be determined by the area in which they are located. Health Sciences shall have silver colored fixtures and poles, Main Campus shall have black fixtures and poles, and Fort Douglas shall have bronze fixtures and poles.

(b) Poles shall have a powder coated finish.

(c) Poles on the Main Campus and Health Sciences Campus shall be aluminum, 10-ft tall x 4.5-in straight round with the fixture end fabricated to match the appropriate fixture fitting, and all poles shall have a surface mounted round hinged base. Poles at Ft. Douglas shall be aluminum, 16-ft tall x 4.5-in straight fluted with fixture end fabricated to match appropriate fixture fittings, with decorative base cover shroud.

(d) Exterior light fixtures and poles specified for campus construction projects shall be restricted to the fixtures, equipment, and installation methods described herein.

b. Circuit Conductors/Conduit

i. Circuit conductors shall be 3P, 5W (phases A, B, C, neutral and ground) and extend from the beginning of the circuit through each fixture to the end of the circuit. Minimum conductor size shall be #6 copper with a full-sized neutral and #8 ground.

ii. The incoming electrical conduit at each pole shall be buried at a minimum of 2-ft below grade.

iii. Electrical conduit shall run from pole to pole without in-ground J-boxes.

iv. Require the Contractor to assemble all buried PVC conduit using both primer and glue at every joint. Glue-only joints shall not be approved (glue without primer tends to crack allowing water to flood the conduit).

v. Minimum conduit size for outdoor lighting shall be 1.25-in Schedule 40 PVC.

c. Fusing

i. Each fixture shall be specified with fusing inside of the hinged pole base.

ii. Fusing shall be provided for each ungrounded conductor.

iii. Fusing shall be Cooper Bussman type KTK-6, 6-amp, 600-volt, with a Cooper Bussmann HEB-JJ in-line fuse holder with rubber insulating boots. Crimp style fuses shall not be allowed.

d. Concrete Bases

i. All outdoor lighting concrete pole bases shall be sized to accommodate the weight being supported. The designer shall be responsible for determining proper sizing and reinforcing based on the soil conditions as well as other site specific considerations. As a minimum, the following guidelines shall be followed:

POLE HEIGHT (FEET)	BASE DIAMETER (FEET)	BASE HEIGHT (OVERALL IN FEET)	BELOW GRADE MINIMUM DEPTH (FEET)	#5 REBAR VERTICAL REINFORCING BARS (QUANTITY)
10	2.0	3.0	2.0	8 equally spaced
20	2.0	6.0	5.0	8 equally spaced

ii. The concrete base shall have #3 rebar horizontal ties at 12-in on center. All exposed edges shall have a 3/4-in chamfer. Bases shall be formed using Sonoco Sonotube or equal concrete forms.

iii. Refer to the table below for concrete base height above grade and requirements for a mow strip.

POLE LOCATION	MOW STRIP REQUIRED (6-in W X 3-in D)	BASE HEIGHT ABOVE GRADE (INCHES)
Planting Area	Yes	12.0
Near Sidewalk or Curb (Planting Area)	Yes	12.0
Near Sidewalk or Curb	No	12.0
Parking Lot	No	30.0

iv. Require the Contractor to install light poles a minimum of 36-in from center of base to edge of from sidewalks to avoid damage by snowplows.

v. Bases in or adjacent to parking areas shall be painted yellow.

e. Hinged Bases

i. A hinged base is required for each pole light.
ii. The folding direction of each hinged base shall allow for a full 90-degree tilt.
iii. Hinge direction shall not be directed onto a slope or into traffic. Coordinate hinge direction to allow for future maintainability with minimum interference to landscape, obstacles, pedestrians or vehicular traffic.
iv. Pole and hinged base shall be either Sterner Lighting by Hubbell Lighting, Inc. or LSI Industries, Inc.

f. Walkway Lighting Fixtures
   i. All walkway lighting fixtures on the Main Campus and the Health Sciences Campus shall be LED Fixtures.
   ii. Fixtures shall be Dark-Sky compliant.
   iii. Approved LED walkway fixtures for the Main Campus and Health Sciences Campus are as follows:
      (a) Cree – Beta Edge (60 LED, 350mA, 4300k) ARE-EDR-3M-R5-06-D-XX-BK-350-43k
      (b) Hubbell – AAL Largent (60 LED, 350mA, 4200k) LVT-T3-60LED-NW-BLK
      (c) Cooper – Mesa LED (63 LED, 350mA, 4000k) MSA-B03-LED-E1-XX-T3-BK
   iv. Walkway fixtures on the Ft. Douglas campus shall be a 175 watt, metal halide, acorn type fixture.
      (a) An approved walkway fixture for the Ft. Douglas campus is the Hadco R52 GANN2XNNG175MH.
      (b) Approved Equals of other manufacturers will be considered.
   v. LED fixtures shall have individually focused LEDs without prisms and without flat lenses.
   vi. Fixture optics shall typically be IESNA Type II, but shall be designed for the proper application.
   vii. Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.
   viii. All fixtures shall be required to have 60 LEDs, 4000-4500K color temperature, and a driver producing 350mA

g. Roadway/Parking Lot Lighting Fixtures
   i. All Parking Lot lighting fixtures shall be LED Fixtures
   ii. Approved LED Parking Lot fixtures are as follows:
      (a) Cree – Beta Edge (120 LED, 350mA, 6000k) ARE-EDR-5M-R3-12-D-XX-BK-350
      (b) Hubbell – AAL Largent (56 LED, 350mA, 5000k) SLVT-T5-56LED-5K-700
      (c) Cooper – Mesa LED (126 LED, 350mA, 6000k) MSA-B06-LED-5xx-T3-BK-7060
   iii. Fixture optics shall typically be Type V (symmetric), but shall be designed for the proper site application.
   iv. Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.
   v. All fixtures shall be required to have, 5000-5500K color temperature, and a driver producing 350mA.

h. Parking Terrace Lighting Fixtures
    i. All Parking Lot lighting fixtures shall be LED Fixtures
    ii. Approved LED Roadway/Parking Lot fixtures are as follows:
        (a) Cree – 304 Series, PKG-304-5M-XX-04-X-UL-SV-350-ML
        (b) Lithonia – D Series, DSXPG LED-30C-350-40K-TM-MVOLT-XXX- PIR360SS-DWHXD
        (c) Cooper – VPL VALET, VPL-B02-E1-SQ-WH-XX-OSX
    iii. Fixture optics shall typically be Type V (symmetric), but shall be designed for the proper site application.
    iv. Specify 277V unless directed otherwise by Facilities Management through the University Project Manager.
    v. Occupancy sensors shall be required as part of the lighting system in all parking terraces.
i. Lighting Fixture Product Data Sheets
    i. The A/E shall submit color catalog descriptions/product data sheets (including fixture materials, dimensions, and maintainability information) both at the Design Development phase submittal and at the Construction Document phase submittal for all exterior lighting fixtures intended for the project.

B. Raceways to 600 V
(1) Conduits and Raceways
a. All conductors shall be run in approved conduits or other approved raceways.
b. Conduit Requirements
    i. Minimum conduit size shall be 3/4-in except for fire alarm door control wiring and CCure security door control wiring where the minimum conduit size shall be 1/2-in.
    ii. Where conduits are exposed to weather, wet environments, or to potential mechanical injury, specify steel galvanized rigid conduit (GRC) or intermediate metal conduit (IMC).
    iii. Minimum conduit size for outdoor lighting shall be 1.25-in Schedule 40 PVC.
    iv. Flexible conduit in lengths greater than six feet shall not be allowed.
    v. Recessed lighting systems shall not be wired with permanent flex conduit running from fixture to fixture. This provision shall not be interpreted to exclude properly installed and supported UL listed plug-in wring systems.
    vi. Conduits will not be allowed for splices or junction boxes.
    vii. All electrical metallic tubing (EMT) conduit fittings shall be fabricated from steel.
    viii. Fittings made from pot metal shall not be allowed.
    ix. Conduit installed in concrete suspended slabs or in concrete walls shall be PVC. If needed for the design of the project, obtain written approval from the structural engineer prior to any design submission.
    x. Conduit installed inside masonry walls shall be PVC or EMT.
c. Fire Alarm Circuits
    i. For raceways containing fire alarm circuits, all conduit couplings, connectors and junction box covers shall be painted red.
d. Signal Conductors (Low Voltage)

i. Low voltage signal conductors (30 V/1,000 V.A., or less) and conductors used for mechanical equipment controls shall be run in raceways.

e. Security Conductors (Low Voltage)

i. Low voltage security conductors shall be specified in conduit. When approved by UCard, security conductors may be routed in a cable tray installed above a UCard approved secured ceiling.

ii. Loose routing of security cables shall not be allowed.

C. Conductors

(1) Aluminum conductors are allowed on University campus between the building transformer and the building main distribution panel.

(2) MC Cable is allowed on University facilities except in the following locations: Laboratories, Research facilities or work areas, Mechanical Rooms, and Electrical Rooms. Where allowed, the MC Cable shall be labeled at each junction box, fixture, and receptacle. MC Cable shall not be used to penetrate floors or be encased in concrete.

(3) Size/Stranded Requirements

a. Minimum size conductors for power and light circuits shall be #12.

b. Conductors for control and fire alarm circuits may be smaller, but shall meet the requirements of the circuits they serve.

c. All conductors #12 and larger shall be stranded.

(4) Neutrals

a. All neutrals on distribution systems shall be sized to handle nonlinear loads.

b. Branch Circuit Neutral Conductors

i. Lighting Circuits

(a) A common neutral shall be allowed to serve not more than three circuits each connected to a separate phase and installed in a single raceway.

ii. Outlet Circuits

(a) A separate neutral shall be installed for each phase conductor.

(b) Not more than three circuits, including separate neutral conductors, may be installed in a single raceway.

(c) Conductor ampacity should be corrected based on applicable de-rating factors.

(5) Splices

a. Splices for wire sizes #10 and smaller shall be screw on type. Crimp on splices designed to be used without wire stripping shall not be allowed.

(6) Color Coding

a. Color coding for conductors on University projects shall follow the following table:

CONDUCTOR	208Y/120V System	480Y/277V System
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Shared/Single Neutral	White	Gray

CONDUCTOR	208Y/120V System	480Y/277V System
Neutral A (dedicated)	White w/Black Stripe	Gray w/Black Stripe
Neutral B (dedicated)	White w/Red Stripe	Gray w/Orange Stripe
Neutral C (dedicated)	White w/Blue Stripe	Gray w/Yellow Stripe
Equipment Ground	Green	Green

D. Grounding
  (1) Insulated Conductors
    a. Specify all ground conductors shall be insulated cables.
  (2) Feeders
    a. 480v Feeders
      i. Raceways used for 480 volt feeders shall include a code sized green insulated ground conductor.
    b. 208v Feeders
      i. Raceways used for 208 volt feeders shall include two code sized insulated ground conductors. These ground conductors include:
        (a) Common or Equipment Ground. One ground conductor shall be used for the common (or equipment) ground, and shall be connected to an electrical panel's bonded ground bus at each end.
        (b) Isolated Ground. One ground conductor shall be used as an isolated ground system for sensitive equipment where applicable. This conductor shall be connected to an electrical panel's insulated ground bus at each end.
  (3) Panels and Distribution Boards
    a. 480-volt panels and distribution boards shall include a bonded ground bus.
    b. 208-volt panels and distribution boards shall include both a bonded ground bus and an insulated ground bus. The insulated ground bus is intended to provide an isolated ground system for sensitive equipment. Required only if sensitive equipment is included in the programming phase of project.
  (4) Branch Circuits
    a. Raceways used for single or multiple branch circuits shall include a code sized green insulated ground conductor.
    b. Circuits used for isolated ground outlets shall be run in separate raceways; or, shall have a separate green insulated ground conductor installed and tagged with identification at all outlet and junction boxes.
  (5) Conduits
    a. All metallic conduits shall be properly grounded and bonded.
    b. Specify a separate code sized insulated ground conductor, terminated to an insulated/isolated ground buss for each of the following applications:
      i. Conduits serving as panel or other feeders.
      ii. Conduits serving branch circuits
      iii. Conduits serving outlets anticipated to power computers or word processors.
      iv. Conduits serving isolated ground receptacles.

v. Full length of all plug strips and other surface wire ways.
vi. All flex conduits.

E. Medium Voltage
(1) General
a. The University's underground medium voltage (MV) electrical distribution system is sectionalized by load break switches. Extensions to the underground distribution system shall be designed with load break switches described herein, mounted on concrete pads, and enclosed by a block wall with a lockable metal gate. Switches shall not be allowed in manholes.
b. MV Transformer and Switch Pads on Campus
i. All medium voltage transformers and switches shall be located outside buildings on suitable concrete pad.
ii. Concrete pad location shall be easily accessible by University maintenance personnel with truck-mounted crane.
iii. Transformers and associated switch gear shall be set on concrete housekeeping pads 6-in above ground level.
iv. Switches and transformers are to be specified with cabinet locks which will suffice for basic equipment security. Refer to 3.5 E (2) c for lock requirements.
c. Enclosure/Screen Wall (Optional)
i. Enclosures and/or screen walls for exterior transformers and switches are optional. The design of the enclosure/screen wall shall be consistent with the architectural design of the adjacent building and/or surrounding environment. Locate the equipment and appropriately screened setting in such a way that it is complimentary to and compatible with its surroundings.
ii. Enclosure/screening requirements described herein apply to both switches and transformers. Switches may be combined with transformers within the same enclosure or screened setting.
iii. Design the enclosure/screen wall with accessibility for maintenance and future removal/replacement of the switch and/or transformer.
iv. Location and screening details shall be submitted for approval during project design to Facilities Management through the University Project Manager.
v. If the equipment must also be placed within a gated secure enclosure, add the following features:
(a) Generally, each unit located within the secure enclosure shall have its own metal access gate facing the unit's primary maintenance access panels.
(b) The gate width for each opening shall be sized sufficiently wider than the unit it faces to allow direct removal and replacement of the entire unit.
(c) The enclosure and metal gate shall be rugged, maintenance free, designed to discourage entry by the public, and include an appropriate no-maintenance drainage system.
(d) Design each gate in the enclosure to be locked according to 3.5 E (2) c.
(2) Medium Voltage Conductors
a. Cables and Terminations

i. Medium voltage cables shall be single conductor cable rated to 15.5kV. Conductor shall be stranded, class B annealed copper, covered with an extruded semi-conducting ethylene propylene rubber (EPR) strand screen, 220 mil EPR insulation extruded EPR semi-conducting insulation screen 5 mil bare copper shielding tape with 12-1/2% minimum overlap, 80 mil flame retardant PVC jacket overall, 15kV type ungrounded neutral with 133% insulation level.

ii. Each cable shall be individually wrapped using fire retardant electric arc proofing tape for its entire length where it is not located inside of a duct bank (i.e., inside each manhole, vault, transformer, switchgear section, etc.).

iii. Each cable shall be individually mounted to the manhole with Unistrut supports (or equal) using porcelain or ZSI, Inc. Cush-A-Grip cable clamps (or prior approved equal).

iv. All feeders entering a manhole shall ring the manhole a minimum of 360 degrees prior to terminating onto a switch or exiting the manhole.

v. Each medium voltage feeder which is part of the main distribution line shall consist of (3) #500MCM 15kV cables with (1) #4/0 THWN Cu ground.

vi. Each medium voltage feeder branching from the main line to a transformer shall consist of (3) 4/0 15kVcables with (1) #4/0 THWN Cu ground.

vii. Each ground conductor shall be grounded at each manhole or transformer/switch vault.

viii. Conductors shall be color coded by phase with colored tape.

(a) The University phasing scheme is: Phase A – Red, Phase B – Yellow, and Phase C – Blue.

(b) Phase designation shall be provided near each entrance or exit point inside a manhole, vault or pad location, at 10’ on center inside a manhole, at any switch section the feeder connects to, and inside the primary compartment of each transformer.

ix. Feeder Identification Tags

(a) Feeder identification tags shall be provided for each cable, attached to phase B using a black weather resistant zip tie, in each manhole or transformer vault.

(b) See 3.5 I (2) for tag requirements.

x. Cable terminations shall be molded product, 600A dead break and 200A load break. Splices shall be either heat shrink or cold shrink style.

xi. Acceptable Manufacturers

(a) Cable: Okonite, Kerite Company, General Cable Corporation, and Superior Essex

(b) Splices: 3M, Raychem TE

(c) Terminations: Thomas & Betts Elastimold, Cooper Power Systems, 3M, and Richards Manufacturing

b. Solid Dielectric Switch Requirements

i. SF6 and oil switches shall not be allowed.

ii. New switches shall be 15kV, 600A, pad style with switching contacts contained within a solid dielectric medium.

iii. Specify combination of 600A dead break and 200A load break “vacuum fault interrupting” (VFI).
iv. Require switch sections with single blade per phase, externally operable, with “quick-make”, “quick-break” mechanism.
v. Specify bushings located on the front of each switch section, disconnecting handle mounted on the side.
vi. Include overcurrent protected ways with a VFI and electronic controller contained in a submersible enclosure.
vii. Require parking stands adjacent to each entry bushing.
viii. Specify a window in each section with visible trip flags.
ix. Require a disconnect handle in each section with provisions for being locked in the “on” or “off” position using the University of Utah standardized cabinet door lock described below.
x. Include contacts for future SCADA switch position monitoring.
xi. Specify entry termination(s) suitable for standard 600A dead break molded elbows for incoming and outgoing lines.
xii. Require VFI ways with entry terminations suitable for standard 200A load break molded elbows.
xiii. Specify that the switch shall be mounted on a stainless steel support structure with adequate seismic bracing.
xiv. Require a painted NEMA 3R enclosure.
xv. Include additional spare ways for future needs of the campus electrical system.
xvi. Acceptable Manufacturers
(a) Thomas & Betts Elastimold
(b) G & W Electric Company
(c) Eaton VisoVac Fault Interrupter

c. Cabinet Door Standardized Locks
i. Specify specific padlocks for each lockable cabinet door. Exterior rated weatherproof industrial grade padlocks shall be ASSA catalog #65190B, #2 padlocks, with re-keyable cores and non-retaining key.
ii. All padlocks shall be keyed alike with the University’s master electrical key.
iii. Require the Contractor to coordinate with Facilities Management Key Shop through the University Project Manager.

d. Labels and Identification Tags
i. A switch identification tag shall be provided to identify the switch and its service information.
ii. See 3.5 I (2) for labeling requirements.

(3) Medium Voltage Duct Banks

a. Spare Ducts in Medium Voltage Duct Banks
i. The A/E’s design shall include spare ducts within the duct bank in consideration of future needs of the campus electrical system.

b. Assembly Requirements for Medium Voltage Duct Bank
i. A duct bank shall be an assembly of conduits with, supports, rebar, etc., encased in concrete and buried as described below.

ii. Primary ducts in a straight-line, or near straight-line duct bank (not at building or manhole entries) shall be 5-in Schedule 40 PVC conduits, spaced a minimum of three inches between ducts.

iii. Duct bank turns greater than 30 degrees shall require 5-in diameter elbows of either galvanized rigid conduit wrapped with PVC tape, or fiberglass sweep elbows, connected to straight length conduit with smooth transitions.

iv. Each conduit in the duct bank at building entry, vault, or manhole entry shall be a 10 ft. length of rigid conduit, wrapped in PVC, connected to up-line conduit with smooth bore couplings, and threaded at the open end. Terminate each conduit opening in the building, vault or manhole with a flush mounted "bell-end" threaded into each conduit opening. Metal bell-ends shall be galvanized, rigid metal, and installed flush in the wall.

v. Each duct bank shall have a minimum of two (2) 1-in Schedule 40 PVC conduits located at the top of the duct bank (for future SCADA and 120V power connections in the manhole). Require these conduits to be terminated with a small extension into the manhole to allow for future connection to or extension of the conduit.

vi. Rebar in the duct bank shall consist of U-shaped #3 cross rebar installed at 36-in on center along the entire length of the duct bank. The cross rebar shall be pounded a minimum of 12-in into the ground below the bottom of the duct bank.

vii. The duct bank shall contain two (2) 4/0 bare copper grounds running throughout its entire length. The ground cables shall be terminated at grounds within each manhole or vault.

c. Concrete Encasement

i. Concrete encasement shall be a minimum of three inches between conduits, and four inches between conduits and earth.

ii. Require the Contractor to either mix red dye in the concrete, or sprinkle red dye on top of freshly poured concrete while still wet.

d. Soil Cover Requirements

i. Coordinate site grading and landscaping to provide a minimum of 36-in cover between finished grade and the top of the duct bank.

ii. Require the Contractor to install a yellow metallic locator ribbon during backfill. The locator ribbon shall be placed directly above the centerline of the duct bank and 12-in below finished grade.

e. After Installation

i. After installation, direct the Contractor to pull a mandrel through each duct to insure that no debris has collected in the duct. The mandrel shall be not less than 12 inches long, and the mandrel diameter shall not be less than 1.5-inch diameter smaller than the duct diameter.

ii. Direct the Contractor to insert a full length polypropylene pull rope in each unused conduit, connect a plastic conduit plug to each end of the rope, and seal the plugs to each end of all unused conduits with silicone sealant.

f. Labeling Requirements

i. Require the Contractor to install a permanent engraved label on each end of the duct bank near the duct bank's placement within the building/manhole/vault.

ii. Additionally, the Contractor shall be required to install a permanent engraved label for each conduit leaving the manhole. Specific instructions are provided in 3.5 I (2).

(4) University Manholes (Medium Voltage)

a. General

i. Manholes will be included in the design of the University's underground medium voltage electrical distribution system in accordance with the requirements below.

b. Site Location

i. The placement of manholes on campus shall be carefully considered with Facilities Management through the University Project Manager.

ii. Manhole placement shall include consideration for reasonable pulling tension.

iii. Access hatches for manholes shall be located in landscaped areas and not in parking lots and roadways.

c. Manhole Size

i. University manholes shall be 10-ft wide x 16-ft long x 9-ft high (inside dimensions).

d. Manhole Fabrication Requirements

i. The manhole shell shall be fabricated with 8-in reinforced concrete walls, roof and floor, either cast in place or pre-cast. Knock out panels shall be provided as needed for the project.

ii. Manhole construction shall be suitable for an H20 highway loading.

iii. Require a full width lift off panel on the roof for equipment access.

iv. The access opening shall be located in the corner of the manhole opposite the location of the medium voltage switch.

v. Grade rings are preferred to be poured in place to match existing grade or slope.

vi. Specify waterproofing for manhole openings, including the manhole entrance, air vents, etc. Require the Contractor to seal openings, grade rings, etc., with Sika "Sikadur Combiflex" sealing system or prior approved equal.

vii. Each manhole shall have openings for two 12-in Schedule 80 PVC air vents. The vent openings shall be located on opposite walls, one located near the bottom of one short wall, and the other near the top of the opposite short wall.

viii. Specify flush mounted cast-in horizontal cable supports, equal to galvanized Unistrut, for the manhole walls.

ix. Specify a minimum of (3) evenly spaced rows of Unistrut supports with the lowest support at 12-in above the finished floor of the manhole, and the remaining two installed at 3'-8" and 6'-4" above the manhole floor.

x. These Unistrut cable supports shall circle the full interior, on all four walls of the manhole.

xi. Each manhole shall have four (4) iron ring pulling eyes cast into the manhole walls, one near the floor of each wall, centered on the wall.

xii. Each manhole floor shall be sloped to a grate drain and matching frame in the center which will drain to a rock sump provided under the manhole floor.

e. Manhole Accessory Requirements

i. Entry Hatch

(a) Specify a 4’ x 4’ galvanized steel “floor/vault/sidewalk” style hatch with two (2) 2’ x 4’ doors.

(b) Cover and frame shall be 1/4-in galvanized steel.

(c) Cover shall be diamond-patterned with a hot-dipped galvanized finish.

(d) Specify a formed channel frame with full anchor angle welded around the perimeter, designed for the collection and draining of water. The hatch frame shall have a 1.5-in drain coupling welded under the frame assembly, suitable for connection to an auxiliary drain pipe. The collection system shall be adequately sized to divert storm water or landscape irrigation from entering the manhole.

(e) Hatch operators shall be compression springs enclosed in telescopic tubes to provide lift assistance for each cover door. An automatic hold-open arm with grip release handle shall be specified for each door.

(f) Specify 3/8-in forged brass heavy duty hinges with stainless steel hinge pins. Hinges shall be recessed into the doors to provide a flush surface.

(g) Specify a stainless steel slam lock with fixed interior handle and removable exterior turn/lift handle. The access cover for the exterior handle shall be a screw plug insert which is gasketed and flush with the cover.

(h) Require the Contractor to connect a full size drain from the frame drain coupling to a gravel sump (separate from the manhole air vent drywells).

(i) The access hatch covers and entire assembly shall be designed to withstand an H-20 wheel loading.

ii. The manhole ladder shall extend from floor to hatch entry point. The ladder shall be all stainless steel, 14” wide, with 1.5-in x 1/2-in runners and 3/4-in knurled risers at 12-in on center. The ladder shall be securely bolted to the structure at the top and bottom of the manhole with stainless steel bolts.

iii. Design a full width lift off panel in the manhole roof for equipment access.

iv. University manholes shall have two (2) 12-in Schedule 80 PVC air vents attached to opposite short walls.

(a) Air vent entries shall be located near the bottom of one short wall, and near the top of the opposite short wall.

(b) Each air vent riser shall extend below the manhole wall entry into a gravel drywell (1 cubic yard of gravel). This extension will allow rain and irrigation water flowing down from the topside air vent termination box to bypass the manhole wall entry and continue down into the gravel drywell.

(c) The A/E’s design shall show the location of the joint air vent termination box. Both air vents shall be routed into a 24-in x 24-in concrete box with a powder coated expanded metal top (color to match or blend with the landscape surroundings). The vents shall extend up into the concrete box 12-in above finished grade, flush with the expanded metal top. The vent

outlets and concrete box shall be located in landscaped areas (sidewalks and parking areas must be avoided).

v. Include specifications for an appropriate rock sump under the manhole grate drain.

vi. In addition to the flush mounted "cast-in" horizontal Unistrut supports, require the Contractor to install vertical, surface mounted, cable supports over the cast-in horizontal supports, equal to galvanized Unistrut. Vertical cable supports shall be installed in a minimum of four (4) columns along each long wall, and two (2) columns along each short wall.

vii. Require the Contractor to install a grounding ring, consisting of a 4/0 bare copper conductor, circling the entire manhole. Require the following connections to this ground ring:

(a) Two (2) 3/4-in x 10-ft copper clad ground rods located in opposite corners.

(b) All Unistrut support racks.

(c) Each bell end at each duct bank.

(d) Each ground conductor running through the duct bank.

viii. Each manhole shall have two (2) evenly spaced, ceiling mounted, vapor tight, wet location, 120V, LED, cast aluminum "jelly jar" light fixtures with cast guard. A light switch, enclosed in a cast iron box with weatherproof flip cover, shall be located near the manhole entrance.

ix. Each manhole shall have one (1) 20A, 120V duplex receptacle in a cast iron box with weatherproof flip cover, located on a wall near the top.

x. Require the Contractor to install a University furnished manhole identification tag at each manhole. Specific instructions are provided in 3.5 I (2).

xi. Cable entering/leaving the manhole shall enter/exit through 10-ft rigid conduit with bell ends at the manhole interior wall.

xii. Require the Contractor to ring the manhole with each cable before terminating.

xiii. Support each cable in the manhole at Unistrut cable supports with rubber cush-grips.

xiv. Specify and/or detail all required safety connections (i.e., deadbreak connectors with cable clamps, drain wire, neutral grounds, etc.).

F. Motor Controllers

(1) Motor Control Centers (MCC)

a. All motor control centers shall be specified with:

i. Copper busing.

ii. CU/AL rated lugs.

iii. Circuit breaker type.

iv. Two normally open and two normally closed spare contacts for all controllers.

v. No external control wiring. Auxiliary contacts shall be used.

b. Specify wiring standard to be Class-B.

c. Require the Contractor to install a permanent engraved label(s) to clearly identify each controller and any spares/spaces. Specific instructions are provided in 3.5 I (2)

d. Acceptable Manufacturers

i. Eaton Corporation Cutler-Hammer

ii. GE Energy
iii. Schneider Electric Square D
iv. Siemens AG

(2) Variable Frequency Drives

a. General Requirements

i. VFD specifications shall require complete schematic drawings, catalog sheets and wiring diagrams showing actual components, including part numbers, and how they are all interconnected. All of these items shall be included in the Operation and Maintenance Manuals with test certificates, warranties and a listing of qualified service personnel responsible for all warranty work.
ii. Specifications shall require a five-year warrantee for parts and labor.
iii. Vendor start up shall be specified for each variable frequency drive system.
iv. Require the capability to connect each VFD to the University's Building Automation System, see DFCM and University Supplement 3.8 F.

b. Specific VFD Requirements

i. Each drive shall be specified as a complete system and shall be assembled in a single NEMA rated enclosure suitable for the conditions in which it is to be located.
ii. Where multi motor units are used, each motor shall have separate overload protection.
iii. Variable frequency drives shall be rated for continuous operation at 10 percent (minimum) over the full load current rating of the motor served.
iv. Inverter shall be altitude compensated, and sized for the elevation at which it is installed. Inverter shall be mounted on a removable panel to facilitate maintenance. Inverter shall be VT rated.
v. Specify remote signal connection terminals (0-10 VDC = 0-100% speed, or, 4-20 mA = 20-100% speed). Label the VFD cabinet specifying which control signal is used.
vi. AC line reactors shall be specified.
vii. Specify surge suppressors for the line side conductors feeding each variable frequency drive.
viii. Specify reactive filters for the load side conductors feeding each variable frequency drive.
ix. Cooling fans and filters are required in all variable frequency drive enclosures. Filters are to be replaced with new at Substantial Completion.
x. Short circuit protection shall be provided through an externally operated, door interlocked fused disconnect, circuit breaker, or motor circuit protector (MCP). MCP shall allow for trip adjustment sufficient to start the motor across the line in the bypass mode and normally will be set at a minimum setting for maximum protection in the VFD mode. The door interlocked handle must be capable of being locked in the off position and be pad lockable.
xi. Overcurrent protection shall be provided in the VFD system through electronic motor overload (MOL) circuits with instantaneous trip, inverse time trip, and current limit functions which shall be adjustable and optimized for the application.

xii. Over- and under-voltage protection, over-temperature protection, ground fault protection, and control/microprocessor fault protection shall be provided. These protective circuits shall cause an orderly shutdown of the VFD, provide indication of the fault condition, and require a manual restart, except for an under-voltage condition. Under-voltage from a power loss shall be set to automatically restart after a time delay and return to normal power.

xiii. Control power for operator devices shall be 120 volts with primary and secondary fuses.

xiv. The VFD shall have a three contactor bypass arrangement.

xv. All wiring for the VFD will be hot emboss marked for ease of troubleshooting.

xvi. Each complete variable frequency drive package shall be listed and carry the label of at least one of the following:

(a) UL - Underwriters Laboratory

(b) ETL - ETL Testing Laboratories, Inc.

c. Inverter Protective Features/Required Alarms

i. Overcurrent Shut-Off

ii. Regenerative Overvoltage

iii. Electronic Thermal Protector

iv. Heatsink Overheat

v. Instantaneous Power Failure

vi. Ground Fault

d. Door Mounted Operator Devices

i. Door mounted operator devices shall be industrial oil tight similar to those found on motor control centers.

e. Required Door Mounted Operator Controls

i. Hand/Off/Auto switch

ii. Local/Remote switch

iii. Frequency Setting Speed Pot

iv. Power On light

v. VFD Enable light

vi. VFD Fault light

vii. External Fault light (safeties interlock)

viii. Bypass switch (for motors over 5-hp)

f. Required Termination Points on Field Connection Terminal Strip

i. Safeties Interlock (N.C. contacts located remote)

ii. Remote Start/Stop Contact (N.O. contacts located remote)

iii. Remote VFD Fault Contacts (N.C.)

iv. Remote VFD/Bypass Enable Contacts (N.O.)

v. Remote Electronic Signal Input

g. Environmentally Controlled Room

i. Each motor controller shall be installed inside the building in an environmentally controlled room. Written approval shall be obtained from Facilities

Management for any exterior installation, including controllers serving rooftop equipment.

h. VFD Local Vendor Requirements
   i. The vendor shall be actively engaged in supplying pulse width modulated adjustable speed (variable frequency) drives and custom built up systems as a certified manufacturer's representative, and shall have a minimum of two years of experience in supply and manufacturer authorized installations.
   ii. The vendor shall maintain full time service personal on call 24 hours/day as well as authorized parts and service facilities within 250 miles of the University with a demonstrated record of satisfactory service for at least the last two years.
   iii. When a project requires "built-up" assemblies which are not "factory-standard" products, require the installing vendor to have UL 508C or ETL certification. Certification is to be submitted with the shop drawings.

i. Label Requirements
   i. Require the Contractor to install a permanent engraved label mounted to the exterior face of the controller. Specific instructions are provided in 3.5 I (2)

j. Acceptable VFD Manufacturers – No Others Approved
   i. Danfoss
   ii. GE Energy
   iii. Mitsubishi Electric Automation
   iv. Rockwell Automation Allen Bradley
   v. Yaskawa Electric America

(3) VFD Manual Bypass
   a. A manual isolation bypass switch shall be specified for VFD's rated over 5-hp, where motor redundancy is not provided. The manual isolation bypass switch shall be on the line side of the inverter allowing maintenance operations to be safely performed while the system is operating in bypass mode. The bypass shall include minimum of two (2) mechanically interlocked contactors.

(4) Combination Starters
   a. Combination starters shall be specified as full voltage, non-reversing magnetic type. Disconnect shall be quick make, quick break. Starters shall have electronic resettable thermal overload elements for all three phases. Minimum starter size shall be NEMA 1. Starters shall be specified with hand-off-auto selector switch.
   b. Acceptable Manufacturers
      i. Eaton Corporation Cutler-Hammer
      ii. GE Energy
      iii. Siemens AG

(5) Electronic Solid State Starters (where applicable)
   a. An electronic soft start system shall typically be specified for each motor 10HP and above. Soft start systems shall incorporate the features of the combination starter in addition to the following:
      i. 18 Pulse converter design to maintain minimal AC line distortion.
      ii. Adjustable ramp start of 0.5-180 seconds.
      iii. Adjustable current limit of 0-85% of locked rotor current.

iv. Adjustable soft stop from 0-60 seconds.
v. Electronic timing relay adjustable from 0.1-60 seconds.
vi. Automatic fault isolation.
vii. Elapsed time meter located on the front door of the starter.

b. Acceptable Manufacturers
i. Eaton Corporation Cutler-Hammer
ii. GE Energy
iii. Schneider Electric Square D
iv. Siemens AG

G. Electrical Distribution

(1) General Requirements

a. Overcurrent and Ground Fault Protection
i. For all electrical distribution systems at the University, selective coordination and short circuit studies shall be completed by the A/E and submitted as part of the Construction Documents phase submittal. The A/E shall assume an infinite bus on the primary side of all building transformers. Settings for all adjustable trip breakers shall be provided to the Contractor prior to electrical system startup.
ii. Electrical service to all University buildings shall be 120/208V, 3P, 4W or 277/480V, 3P, 4W, or both.

b. Protective Device Coordination
i. The electrical design shall include a protective relay coordination study for new buildings and for the main service upgrades at existing buildings.
ii. The protective relay coordination study shall extend to distribution panels rated at 225 amps and above.
iii. The proposed settings shall be submitted through the University Project Manager to the Facility Operations staff electrical engineer and Electric Shop and for review and approval.

c. Short Circuit Selective Coordination
i. Short circuit selective coordination shall be required for emergency circuits.

d. Commissioning
i. Commissioning of electrical systems shall be required on new projects with estimated electrical cost over $250,000.

(2) Arc Flash Study

a. The A/E shall perform or model an arc flash study as part of its design services to meet requirements of NFPA 70 and NFPA 70E.

b. Results of the study shall be submitted to the University, and appropriately applied to the review documents.

c. The arc flash analysis shall include the following at each distribution bus:
i. Bolted Fault Current
ii. Arc Fault Current
iii. Protective Device Settings
iv. Protective Device Characteristic and Arc Fault Duration

v. System Voltages and Equipment Class
vi. Working Distances
vii. Calculated Incident Energy

d. Calculated Arc Flash Protective Boundary
i. The results of the study shall be used to specify appropriate labels specific to each panel, identifying the ARC flash hazard class based upon NFPA 70E.

(3) Transformers

a. Distribution Transformers for University Buildings
i. Transformers shall be pad mounted on the exterior of the building, see 3.5 E (1) b for additional requirements.
ii. Transformers shall meet the following requirements as a minimum:
(a) All copper windings with a delta primary and wye secondary.
(b) FR3 insulation fluid (vegetable oil based) with nitrogen blanket.
(c) Four (4) 2-1/2% full capacity primary winding taps, with two above and two below the rated primary voltage with an externally operated de-energized tap changer.
(d) Transformer primary shall have two (2) sets of three (3) 200A bushing wells (loop feed style) that will accept load break elbows or lightning arrestors. Lightning arrestors shall be provided and in0stalled on second set of bushings.
(e) Each transformer shall be capable of being readily and easily locked. See 3.5 E (2) c for lock requirements.
(f) Transformer sound levels shall comply with NEMA Standard TR.
(g) For transformers larger than 750 KVA/208-240V secondary, and 1500 KVA/480V secondary, the low voltage bushings shall be wall mounted with additional insulated support for the bushings.
iii. Transformers shall have a 12470V primary rating. If fed from an existing feeder that is not on the new campus standard 12470V system, the transformer shall be specified to be dual rated to allow for future transition to 12470V.
iv. Each transformer is to be protected on the primary side by a separate solid dielectric vacuum fault interrupting switch. The specified VFI shall coordinate with the existing University electrical distribution, and settings shall be provided to the Contractor.
v. Require the Contractor to install a permanent engraved label mounted to the exterior of the transformer. Specific instructions are provided in 3.5 I (2)
vi. Acceptable Manufacturers
(a) Cooper Power Systems
(b) GE Energy
(c) Eaton Corporation Cutler-Hammer
(d) Schneider Electric Square D
(e) MGM Transformer Company

b. Step Down Transformers for University Buildings

i. When electrical power is needed at a voltage other than that provided by the building's electrical service, the needed voltage may be provided by including a step down transformer in the system design.

ii. Step down transformers shall be specified with the following requirements:

(a) Dry-type, K rated.

(b) Pad mounted.

(c) Copper windings.

(d) Specify a K-20 rating with 200% neutral for transformers smaller than 300kVA intended to handle nonlinear loads.

(e) Specify a K-13 rating with 200% neutral for transformers 300kVA and above intended to handle nonlinear loads.

(f) Temperature rise rating shall be 115 degrees through 15kVA and 150 degrees for 30kVA and larger.

(g) Fan-assisted transformers shall not be allowed.

iii. Require the Contractor to install a permanent engraved label mounted to the exterior of the transformer. Specific instructions are provided in 3.5 I (2)

iv. Acceptable Manufacturers

(a) Eaton Corporation Cutler-Hammer

(b) GE Energy

(c) Schneider Electric Square D

(d) Siemens AG

(e) Synergy Energy, Inc.

(4) Utility Metering

a. Refer to DFCM HPBS, 5.10 B.

(5) Switchboards and Distribution Boards

a. Switchboards/distribution boards for University projects shall be specified with:

i. Copper busing.

ii. CU/AL rated lugs.

iii. Circuit breaker type.

iv. Fully rated.

v. Minimum of 25% space capacity.

b. For remodeling projects, match new switchboards and distribution boards to the manufacturer/style of existing units in the building.

c. Include with the panel schedule, where applicable, information identifying the conductor insulation color for all ungrounded conductors, grounded conductors, and equipment and isolated grounding conductors.

d. Labeling Requirements

i. Specify a permanent engraved label for all switchboards mounted on the outside face of switchboard.

ii. Specify a permanent engraved label to clearly identify each switchboard breaker and spare/space.

iii. Specific instructions are provided in 3.5 I (2).

e. Acceptable Manufacturers for Switchboards/Distribution Boards

i. Eaton Corporation Cutler-Hammer
ii. GE Energy
iii. Schneider Electric Square D
iv. Siemens AG

(6) Panel Boards
a. University panel boards shall be specified with:
i. Copper busing. Aluminum alloy bus bar is allowed in Building Main Distribution Panels rated 800 amps and above.
ii. CU/AL rated lugs.
iii. Circuit breaker type with bolt-on style breakers.
iv. Fully rated.
v. Minimum of 25% space capacity.
vi. Equipment and isolated ground bus.
b. For remodeling projects, match new panel boards to the manufacturer/style of existing units in the building.
c. Panel board covers shall be hinged door-in-door style. Each door shall have a flush, stainless steel cylinder lock with catch and coil spring loaded door pull. All panels shall be keyed alike, but inner and outer doors shall not be keyed alike.
d. Panel boards shall have a sufficient number of spare conduits stubbed into ceiling spaces (or alternate locations approved by the University Project Manager) to allow for full future utilization of the spare capacity available in the panel board.
e. Panel boards shall have sufficient space inside the cabinet for future cable pulls.
f. Provide a permanent engraved label for all panel boards mounted inside the door for flush panels and on the outside face of the door for surface panels. Specific instructions are provided in 3.5 I (2).
g. Acceptable Manufacturers for Panel boards
i. Eaton Corporation Cutler-Hammer
ii. GE Energy
iii. Schneider Electric Square D
iv. Siemens AG

(7) Disconnecting Means for University Projects
a. Equipment disconnecting means (thermal switch, disconnects, fused disconnects, circuit breakers, etc.) are to be provided at the unit or immediately next to the unit served. Installation of the disconnecting means at a remote location from equipment, or using a circuit breaker at the power panel as disconnecting means for equipment are not acceptable installation methods.
b. Final location of the equipment disconnects and controllers (air handlers, condensing units, exhaust fans, roof top units, pumps, etc.) are to be coordinated with the Facility Operations staff electrical engineer and Electric Shop through the University Project Manager prior to issuing construction documents.
c. The A/E's design shall facilitate compliance to OSHA CFR 1910.147, Control of Hazardous Energy (Lock Out Tag Out).

(8) Outlets

a. Outlets shall utilize standard NEMA configurations. Minimum outlet rating shall be 20A.
b. A minimum of one electrical convenience outlet powered from the emergency electrical system shall be provided at each transformer vault/pad, main electrical room(s), and generator location.
c. Special purpose outlets (208V, 1p, 20A) shall be provided for University supplied pressure washers at each air handler, roof top unit, or any other mechanical equipment with heating/cooling coils.
d. Outlets shall be color coded based on the power source and size of the device as follows:
    i. Normal power – White
    ii. Emergency power – Red
    iii. UPS Power – Blue
    iv. Isolated Ground (Clean Power) – Orange
    v. All devices greater than 20A – Black
    vi. The entire body of the wiring device should be the same color (i.e., a wiring device with an orange triangle on a white body is not an acceptable wiring device for isolated ground receptacle).

(9) Engine Generator Sets for University Projects
a. Each new building on campus shall be designed with an emergency generator to provide power for life safety, legally required standby systems, and optional standby systems.
b. A secure enclosure or area shall be designed around the generator.
c. Each generator shall meet the following requirements as a minimum:
    i. Diesel fuel operated.
    ii. Skid mounted fuel tank providing capacity for 24 hours of operation at full load.
    iii. Four pole automatic transfer switch (ATS) with manual bypass. A separate ATS shall be provided for each type of emergency load served.
        (a) During design, consideration should be given to adding a secondary transfer switch for generator testing at buildings with critical research equipment. The monthly generator test normally interrupts building power for approximately 10 seconds. This could adversely affect research activities so a second transfer switch for non-life safety systems is required at buildings with critical research equipment.
    iv. Waterproof, level II sound attenuated enclosure.
    v. Critical silencer including flexible exhaust fitting.
    vi. Meet the latest EPA Tier Standard.
d. Generators shall not be installed in transformer vaults or switch rooms.
e. Each generator installation shall be tested at full load for a minimum of 2 hours using load banks.
    i. Fuel and suitable load bank equipment shall be specified as the responsibility of the Contractor for the test.
    ii. Follow testing requirements found in NFPA 110 (tested under load, transfer switch operation verified).

iii. Require the Contractor to schedule inspection(s) by the code official(s) for code compliance, including verification of testing under load and transfer switch operation.

iv. For 'research critical' buildings, design the transfer system such that operation of the secondary transfer switch will easily protect non-life safety research processes/systems during the monthly generator test.

f. Require generator emission data to be submitted through the University Project Manager to the University Department of Occupational and Environmental Health & Safety for review and generator approval.

i. During design, coordinate early with the University Project Manager to establish a timeline and application/submittal requirements for generator approval by the jurisdiction having authority.

g. Acceptable Manufacturers for Engine Generator Sets

i. Caterpillar

ii. Cummins Onan

iii. Detroit Diesel

iv. Generac Power Systems

v. Kohler Power Systems

(10) Uninterruptible Power Supplies for University Projects

a. Uninterruptible power supply (UPS) systems shall not be designed for whole building or overall project applications. Any intent to design a building-wide or large UPS system must be approved in writing early in the design phases by Facilities Management.

i. Local UPS units are generally the responsibility of the end user department which will occupy the completed project. Each user department will typically furnish and install its own electronic systems and include local UPS units with their in-house purchases.

b. If approved for large system applications:

i. UPS systems shall include all equipment to automatically provide the specified voltage, current and frequency at its output terminals when utility, generator or battery power is available at its input terminals.

ii. The system shall be rated for continuous duty at full load.

iii. The system shall include local and remote monitoring and alarm facilities to provide advance warning of UPS equipment failure or power system failure to allow computer shutdown.

iv. The system shall be designed to be serviced where it is installed without removal of any part for return to manufacturer or service facility.

c. UPS Vendor Requirements

i. The vendor supplying the UPS system shall be "local" with office and staff based along the Wasatch Front.

ii. The vendor shall be actively engaged in supplying UPS systems as a certified manufacturer's representative, and shall have a minimum of two years of experience in supply and manufacturer's authorized installations.

iii. The vendor shall maintain full time service personal on call 24 hours/day as well as authorized parts and service facilities within 250 miles of the University with a demonstrated record of satisfactory service for at least the last two years.

d. Acceptable Manufacturers for Large UPS Systems
   i. Emerson Network Power Liebert
   ii. MGE UPS Systems, Inc.
   iii. Mitsubishi Electric Automation, Inc.
   iv. Toshiba Corporation

H. Power Quality
   (1) Performance Approach
      a. No additional University design requirements.
   (2) Prescriptive Approach
      a. No additional University design requirements.
   (3) Miscellaneous Electrical
      a. Building Clock Systems for University Projects
         i. A self-correcting clock system will be installed in University buildings either as called for in the project program, or to extend/replace existing building clock systems.
         ii. Clocks and Clock System Controls
            (a) Self-correcting clocks will operate on A/C power, shall correct via a wireless signal and be compatible with the current University system. Battery operated clocks will not be approved.
            (b) The clock system shall be limited to the products of SimplexGrinnell; Primex Wireless; or, Sapling, Inc. All other manufacturers shall be reviewed and approved by University Facilities Management prior to bid.
            (c) The clock system will be furnished and installed by the Contractor; however, the Contractor is required to coordinate with the University Electronics Shop prior to ordering/installing the equipment.
         iii. Front-End Controller
            (a) The clock system's wireless front end controller shall be located in one of the building's telecommunications rooms where an Ethernet connection is available. Coordinate with the Electronics Shop for an approved location to install the device. The front-end controller will monitor the precise time from an internet based master clock and relay time signals wirelessly to building clocks.
         iv. Installation and Set-Up
            (a) The University's Electronics Shop shall be contacted for coordination.
            (b) The Electronics Shop will review the intended system for approval prior to the Contractors' initial material order, coordinate with the Contractor for equipment location prior to installation, and work with the Contractor during system set-up.
      b. Spare Fuse Cabinets

i. Provide spare fuse cabinet(s) in the design, located in the vicinity of the building main switchboard. Provide 10% spare fuses of each type and size specified with of minimum of three of each.

c. Communication Protocols

i. Data communication protocol for integration of electrical systems with the building management system shall be compatible with BACnet data communication protocol. This requirement shall be applicable to all electrical systems, including, but not limited to, lighting control systems, non-local UPS systems, emergency generators, transfer switches, paralleling switchgear, power monitoring, power metering, VFDs, motorized shade controllers, etc.

(4) Structured Cabling

a. Refer to 3.11 Communications and Security Wiring Systems.

(5) Fire Alarms

a. General

i. Fire alarm systems shall be fully addressable, analog and shall operate as non-coded, continuous sounding systems.

ii. All necessary provisions shall be made in the design of the fire alarm system to allow for automatic reporting of all alarms from the project fire alarm system to the remote station receiving console in University's Public Safety Building (Bldg 301).

b. Compatibility

i. All equipment, devices and installations shall be compatible with the existing system of operation.

c. Approved Manufacturer/Installer

i. Fire Alarm System

(a) The only approved manufacturer shall be FCI (Honeywell Gamewell Fire Control Instruments). No other manufacturers will be approved.

ii. Fire Extinguisher Electronic Notifying Pressure Switch Monitoring System

(a) Specify an electronic notifying pressure switch fire extinguisher monitoring system. The approved manufacturer shall be MIJA, Inc., model en.Gauge. No other manufacturer will be approved.

d. Fire Extinguisher Monitoring System

i. During design, coordinate with the University Fire Marshal through the University Project Manager to determine type of fire extinguishers (A, B, C, D, CO_2, Halon, etc.,) to be used in the project.

ii. For new buildings, design a hard wired fire extinguisher monitoring system, supervised through the building's fire alarm system.

iii. The system will signal an alert when the portable fire extinguisher falls below a preset, specified pressure level, removed from its designated location, when access to the extinguisher is obstructed or when the battery voltage drops to a preset rating. The system shall meet all code requirements and listed by Underwriters Laboratories, Inc.

iv. For existing buildings provide fire extinguishers with wired monitoring systems.

e. Control Panel General Requirements

i. The fire alarm control panel shall detect the operation of any signal initiating device, display the description of the device and the area of the alarm, and print out the alarm type, location, time, and date.
ii. The panel shall operate all alarm and auxiliary devices and close all fire and smoke doors.

f. Required System Features
i. Trouble lamp and buzzer.
ii. Self-restoring silencing switch.
iii. Automatic locking of all alarm signals until the device is returned to its normal condition and the panel manually reset.
iv. Supervision of circuits such that a fault condition in any circuit, or group of circuits, will not affect the proper operation of any other circuit.
v. Circuit fuses for each signal initiating and alarm circuit which, if blown, shall cause the audible and visual trouble signals to operate.
vi. Digital transmitter with terminals and other necessary hardware/software to permit the transmission of trouble and alarm circuits over telephone lines to a remote station receiving panel.
vii. A key operated “Drill Switch” to simulate the operation of an initiating device. The switch shall not trip the device which transmits a signal to the fire department, operates elevator return systems or operates fire doors.
viii. Fire alarm panels shall be red, baked enamel, lockable, 16-gauge steel, with hinged door cabinets.
ix. Batteries shall be gel cell type. The system will be provided with an automatic tester and charger.
x. The battery system shall have an additional 25% spare ampere-hour capacity above that required.
xi. The battery system shall be capable of operating the fire alarm system at full load for 24 hours and still provide five minutes of alarm sounding at the end of the 24-hour period.
xii. Visually indicating call stations.
xiii. Horn/strobe indicating devices with a minimum rating of 97dB and a temporal pattern signal. Electron indication devices are not acceptable.
xiv. External indicating appliances allowing for notification in the direction of parking lot, playground, or other people space areas.
xv. Uniquely addressable detectors, removable base, with indicating lamps.
xvi. Connection of all fire protection systems within the building, including special extinguishing systems and elevator lobby detectors.
xvii. A Fire Marshal approved key plan drawing of the entire building graphically displaying the location and address of all initiation and notification devices. The key plan drawing shall indicate area occupancies and smoke separation walls. Key plan(s) shall be mounted in a high quality plastic sign holder at the main fire alarm control panel.
xviii. Pre-signal systems of any type will not be allowed.
xix. Wiring Requirements

(a) Unless otherwise specified, minimum wire size shall be 16-gauge for audible alarm circuits, and 18-gauge for signal initiating circuits.

(b) Strobes shall be wired separately from audible devices, including combination horn/strobe units.

(c) Speaker and strobe wiring shall be installed in separate raceways.

g. System Test

i. A complete system test, including all connections into the fire alarm panel, comprehensive operational review, and testing of all fire alarm devices and wiring shall be accomplished by a representative of the equipment supplier or manufacturer, qualified by the manufacturer to perform such work.

h. Labeling

i. Provide permanent engraved labels at each fire alarm control, notification appliance (NAC), power supply, transponder, and speaker system panel. Specific instructions are provided in 3.5 I (2)

ii. Provide self-adhesive labels for all initiation and notification devices. Specific instructions are provided in 3.5 I (3)

i. Final Inspection

i. Upon completion of the work, require the Contractor to request a final inspection through the University Project Manager to the University Fire Marshal and University Building Official. During the final inspection, all fire alarm devices shall be tested by the Contractor and witnessed by these University officials.

j. Warrantee Period

i. Specify that the accepted fire alarm system shall carry a full three year parts and labor warrantee. Require the Contractor, the equipment supplier, and the installer to provide continued emergency response services (responding within four hours of any reported system failure) through the full term of the warrantee.

(6) For Miscellaneous Systems refer to 3.11 Communications and Security Wiring Systems.

I. Labeling & ID Tags for Medium Voltage Systems

(1) General Requirements

a. The A/E shall include the information provided below in project electrical specifications and drawings, requiring the Contractor to provide and install appropriate labels and tags throughout the project's electrical system.

b. The purpose of the labels and tags is to provide clear indications of the function of each item, the loads served, routing information, etc., for primary and secondary elements comprising the electrical system.

(2) Permanently Engraved Lamicoid Nameplates

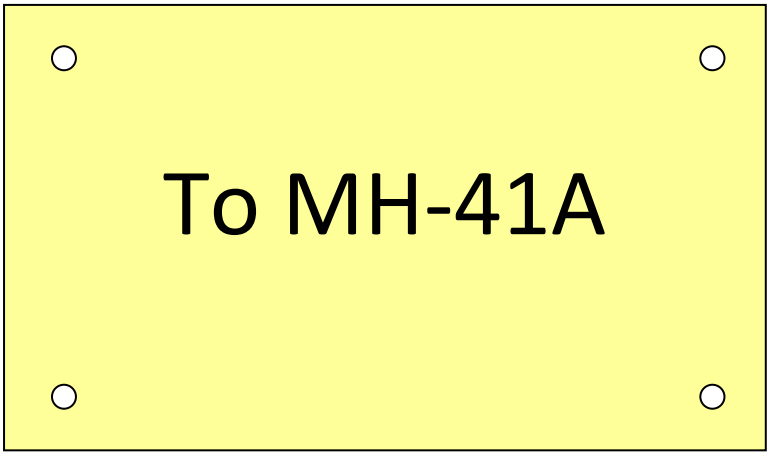
a. Lamicoid nameplates shall be three-ply plastic, 1/16 inch thick. Letters shall be formed by engraving into the outer colored ply, exposing the white or black center-ply. Lettering shall be a minimum of 5/8-inch high, except as noted in individual sections.

LAMICOID NAMEPLATE COLORS		
NAMEPLATE	**OUTER PLY**	**CENTER PLY (Lettering Color)**
Master Nameplate	Black	White
Normal Power	Black	White
Emergency Power	Red	White
UPS Power	Blue	White
Medium Voltage	Yellow	Black

b. Provide permanently engraved nameplate labels/tags for the master nameplate, for each manhole, duct bank, all distribution equipment, devices, etc., listed below as well as all other similar equipment. Other electrical sections in this supplement may have additional labeling requirements.
   i. Each label shall include the arc flash hazard class based upon NFPA 70 E, where applicable.

c. Master Nameplate
   i. Provide a permanently engraved lamicoid master nameplate at the main distribution location affixed with double sided adhesive tape covering the back of the nameplate, to identify the project, the engineer and the installation date.

d. Duct Bank Identification Nameplates
   i. Permanently engraved lamicoid nameplate labels must be placed adjacent to each entering/leaving duct at the duct banks in the man hole.
   ii. Labels are to be 3-in x 5-in yellow with black engraved letters.
   iii. Labels are to include a 1/4-in hole in each corner. Each label shall be affixed to the wall using plastic anchors and screws.
   iv. Lettering shall indicate the conduit's next destination point or last departure point (e.g., To MH #123, From Pad #123, To Vault #123).
   v. Example: Duct Bank Identification Nameplate



e. MV Cable

i. Feeder identification tags shall be attached to each feeder near entrance or exit points inside manholes, vaults or pad locations; at any switch section the feeder connects to; and, inside the primary compartment of each transformer.

ii. Lamicoid tags shall be 2.5-in x 2.5-in x 1/16-in, diamond orientation (not a square), and shall be yellow with black engraved letters.

iii. Lettering shall be 3/8-in high, centered, and shall indicate the substation and feeder number.

(a) Example: F-71 (indicating substation 7, feeder #1)

(b) Example: RB F-10-2 (indicating the Red Butte Substation, Substation 10, feeder #2).

iv. Lamicoid tags shall be attached to phase B using a black weather resistant zip tie. Tags are to include a 1/4-in hole in the top corner to allow attachment by means of the zip tie.

v. Tags shall be located where lettering will be readily visible. The zip tie attachment must not be pulled too tight, allowing for minor adjustment by maintenance personnel.

f. MV "Switch Cabinet" Identification Nameplates

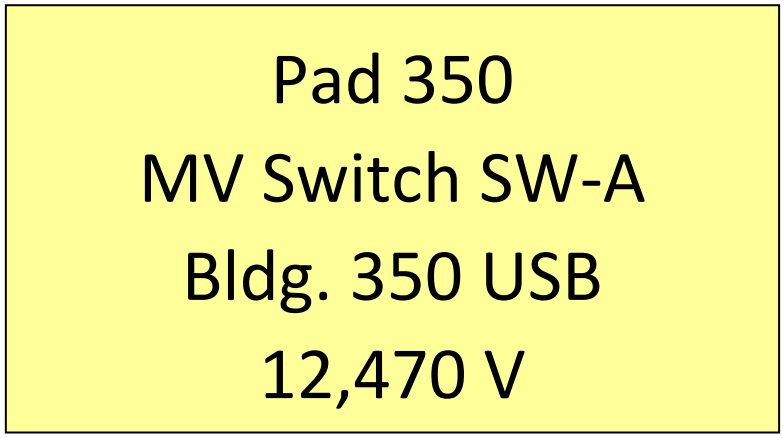
i. Permanently engraved lamicoid nameplate labels shall identify each switch cabinet.

ii. Labels are to be 3-in x 5-in yellow background with black engraved letters.

iii. Each label shall be affixed to the cabinet with double sided adhesive tape covering the back of the nameplate.

iv. Each nameplate shall include the pad number, switch number, the building name and number served by the switch, and voltage.

v. Example: MV Switch Cabinet Identification Nameplate



g. MV "Switch" Identification Nameplate

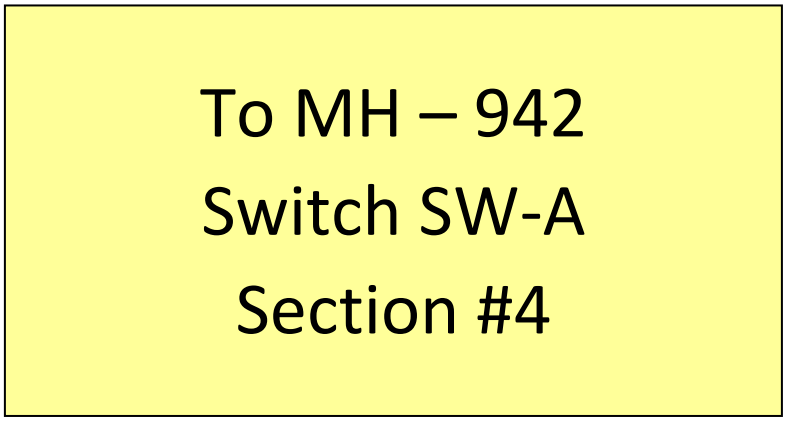
i. A permanently engraved lamicoid nameplate label shall:

(a) Identify the device the switch will operate; or,

(b) Identify the destination manhole, vault, or pad number; the switch number; and, section it serves; or,

(c) Identify the destination switch and the section the feeder serves.

ii. Labels are to be 3-in x 5-in yellow background with black engraved letters.
iii. Each label shall be affixed to the switch with double sided adhesive tape covering the back of the tag.
iv. Example: MV Switch Identification Nameplate:



h. Distribution Transformer Identification Nameplates
   i. Permanently engraved lamicoid nameplate labels shall identify each transformer and its location.
   ii. Labels are to be 3-in x 5-in yellow background with black engraved letters.
   iii. Each label shall be affixed to the cabinet exterior with double sided adhesive tape covering the back of the nameplate.
   iv. Each nameplate shall designate the pad number (same as the building number), transformer number, primary and secondary voltages, KVA rating, and the building name/number served by the transformer.
   v. Example: Transformer Identification Nameplate

i. Step Down Transformer Identification Nameplate
   i. A permanently engraved lamicoid nameplate label shall identify each transformer.

ii. The nameplate shall be 3-in x 5-in with yellow background and black engraved letters.

iii. Each label shall be affixed to the cabinet with double sided adhesive tape covering the back of the nameplate.

iv. The nameplate shall designate the transformer, electrical source feeding the transformer, load supplied, size (kVA), and the primary and secondary voltages.

(a) Example: Transformer T-1, Source PH1-1, 3, 5; Load PL1, 150kVA, 480:208/120.

j. Manhole Identification Nameplates

i. Manhole identification nameplates will be supplied to the Contractor by the Facility Operations Electric Shop through the University Project Manager.

ii. A manhole identification nameplate is required for each manhole, installed at existing and new manholes associated with the project.

iii. The nameplate shall be mounted on the north side of the concrete ring as you enter the manhole, and shall be easily visible both from ground level outside and from the floor level inside the manhole. This standard will be followed for all manholes on campus, and provides a means for convenient orientation by observing the nameplate in a known location, either while entering or when established inside the manhole.

iv. The nameplate shall be affixed to the concrete ring using plastic anchors and screws.

k. Switchboards, Distribution Boards, and Panel Boards

i. Permanently engraved lamicoid labels are required for each switchboard, distribution board, and panel board, as described below.

ii. For normal power, labels are to have a black background with white engraved letters.

iii. For emergency power, labels are to have a red background with white letters.

iv. Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

l. Switchboard Label

i. The switchboard label shall include the switchboard name, electrical source feeding the switchboard, voltage, size (amps), number of phases, number of wires, and AIC rating.

(a) Example: MDP1, Transformer-1, 480V, 3P, 4W, 65kAIC

ii. If the switchboard contains a main building disconnect, this shall be included on the label.

(a) Example: Main Building Disconnect 1 of 2

m. Switchboard Breaker and Spare Space Labels

i. Switchboard breaker and spare space labels shall be installed to clearly identify each switchboard breaker and spare/space. Each label shall include the breaker number and the load served.

(a) Example: MDP1-1, Panel PH1

ii. For spare/space, the label shall indicate “spare” as well as the size in amps and phase.

(a) Example: Spare, 200A, 3P
(b) Example: Space, 400A max, 3P

n. Panel Board Labels
   i. Panel board labels shall be mounted inside the door for flush panels, and on the outside face of the door for surface panels. The label shall include the panel name, source feeding panel, voltage, size (Amps), number of phases, number of wires, AIC rating, and the arc flash hazard class based upon NFPA 70E.
      (a) Example: PH1, MDP1-1, 277/480V, 225A, 3P, 5W, 42kAIC, Arc Flash Class 1
   ii. Use the following labeling scheme for panel boards

LEVEL	UPS/EMERGENCY POWER	VOLTAGE LEVEL	PANEL SEQUENCE
0 (Level 0/Basement)	U (UPS)	H (277/480 V)	1
1 (Level 1)	E1 (Emergency Life Safety – Connected to ATS-1)	L (120/208 V)	2
2 (Level 2)	E2 (Critical Emergency – Connected to ATS-2)		3
3 (Level 3)	E3 (Optional Emergency – Connected to ATS-3)		4
etc.	etc.	etc.	etc.

   iii. Examples:
      (a) 2E1L1 – Level 2, Emergency Life Safety Power, 277/48120/208V0V, 1st panel on level 2
      (b) 0UL6 – Level 0, UPS Power, 120/208V, 6th panel on level 0
      (c) 1H2 – Level 1, 277/480V, 2nd panel on level 1
      (d) 3L11 – Level 3, 120/280V, 11th panel on level 3

o. Motor Control Centers (MCC), Motor Controllers
   i. Permanently engraved 3-in x 5-in lamicoid labels are required to identify the MCC and each controller.
   ii. For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.
   iii. Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.
   iv. MCC labels shall identify the MCC, source feeding the MCC, voltage, size (amps), number of phases, number of wires, and AIC rating.
      (a) Example: MCC#1, MDP1-2, 600A, 3P, 4W, 42kAIC
   v. Where applicable, the label shall also include the load served and the breaker size
      (a) Example: EF-1, 125A
   vi. For spare/space, the label shall indicate the size in amps and phase

(a) Example: Spare, 200A, 3P
(b) Example: Space, 400A max, 3P

p. Variable Frequency Drives (VFD)
   i. Permanently engraved 3-in x 5-in lamicoid labels are required to identify the equipment controlled, electrical source feeding the controller, voltage, number of phases, disconnect and fuse sizes in amps where applicable, and equipment horse power.
      (a) Example: AHU-1, PH1-1,3,5, 480V, 3P, 200A/150A fuse, 75HP
   ii. Additionally, require a second label on the VFD cabinet specifying which control signal is used.
   iii. For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.
   iv. Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.

q. Fire Alarm Control Panels (FACP), Fire Alarm Notification Appliance Circuit Panels (NAC), and Other Fire Alarm Panels/Cabinets
   i. Permanently engraved 3-in x 5-in lamicoid labels are required to identify each panel. Require labels for each fire alarm control, notification appliance (NAC), power supply, transponder, and speaker system panel.
   ii. For normal power, labels are to have a black background with white engraved letters. For emergency power, labels are to have a red background with white letters.
   iii. Each label shall be affixed to the cabinet in a readily visible location with double sided adhesive tape covering the back of the nameplate.
   iv. Each label is to include the panel name and the source feeding the panel
      (a) Example: FACP, PL1-1 or NAC-1, PL1-3

r. Additionally, provide permanently engraved lamicoid nameplate labels/tags for the following, as well as all other similar electrical devices and equipment.
   i. UPS and Surge Protection Devices
   ii. Safety Disconnects
   iii. Generators
   iv. Automatic Transfer Switches
   v. Paralleling Switchgears
   vi. Electrical Contactors and Relays
   vii. Lighting Control Panels, Lighting Contactor Panels, Dimming Panels
   viii. Time-clocks
   ix. Security Panels
   x. Power Supplies

(3) Self-Adhesive Labels
   a. Specify self-adhesive labels for the devices and equipment as required.
   b. Self-adhesive labels shall have black lettering with a clear (see through) background, and a self-adhesive sticky back.

c. Each label shall identify the applicable circuit number feeding the device. The label shall also display “EMERGENCY” or “UPS” as applicable next to the circuit number for devices fed from Emergency or UPS power.
    i. For example, a receptacle fed from circuit 2 in panel 1P1 would read “1P1-2” on the label.
d. Require the Contractor to apply self-adhesive labels to the following devices and equipment, and all similar equipment.
    i. Thermal Switches and Manual Starters
    ii. Power Outlet Receptacles
    iii. Light Switches
    iv. Wall Mounted Occupancy Sensors
    v. Wall Mounted Time Switches
    vi. Dimming Switches and Wall Mount Dimming Controllers
    vii. Fire Alarm Initiation Devices (Smoke Detectors, Heat Detectors, Pull Stations, etc.) and Fire Alarm Notification Devices (Horns, Strobes, etc.).
        (a) Require self-adhesive labels for all initiation and notification devices.
        (b) Each initiation device label shall indicate the addressable node, the addressable loop number, device type (S=sensor, M=monitor), and device number (i.e., N1-L1S001, N1-L2M001).
        (c) Each notification device label shall indicate the device type (S=speaker, L=strobe), the circuit number, and the device number (i.e., S1-1 or L1-2).

(4) Handwritten Labeling
a. Specify legible handwritten labeling for all junction boxes containing power and fire alarm wiring.
b. Require the Contractor to use a permanent chisel tip black marker, and write the required information in a neat and clearly legible manner clearly visible from the floor.
c. Label each junction box with the applicable circuit number(s) for the cables contained within.

(5) Word Processor Generated Branch Panel Schedules
a. Specify typewritten branch panel schedules incased in clear, transparent covers for each branch panel.
b. Require the Contractor to label every breaker or available space.
c. Actual room designations (room name and room number) assigned by the University shall be used. Instruct the Contractor to verify room designations. Room identifiers on project drawings may be different than final room assignments.
d. When the project requires changes in, or additions to existing panels, distribution boards, etc., provide new schedules and labeling to accurately reflect the changes.

3.6 Mechanical – General

A. Standards

(1) Compliance Verification in Operation and Maintenance Manuals
a. American Society of Mechanical Engineers (ASME) Stamp shall be required on all items required by code or specified to conform to the ASME Code, and certificates will be included in the O&M manuals.

b. Form U-1, the manufacturers' data report for pressure vessels, is to be included in the operation and maintenance manuals. National Board Register (NBR) numbers shall be provided where required by code, and included in the manuals.

c. Underwriters Laboratories (UL) or equivalent ETL labels shall be applied to manufactured equipment represented by a UL classification and/or listing. Included certification in the O&M manuals.

B. Criteria

(1) Outside Design Temperatures

a. Outside design temperatures shall be 0° F (-18° C) winter heating and 97° dry-bulb /62° wet-bulb F (36°/18° C) for summer cooling. Cooling tower design shall be based on 70° F (21° C) wet-bulb.

(2) Site Elevation

a. Equipment selections shall account for a site elevation of 4,750 feet (1,500 meters) above sea level, and equipment schedules shall indicate "sea level" capacity.

(3) Indoor Design Temperatures

a. Unless otherwise required, the indoor design temperatures shall be default 72° F dry-bulb for heating and 75° F dry-bulb for cooling. 60% Relative Humidity upper limit for cooling if evaporative cooling is to be employed (no lower or upper limit unless dictated by University Project Manager).

b. Temperature set points shall be approved by Facilities Management.

(4) Ventilation Requirements

a. Ventilation air shall conform to the latest ASHRAE Standard 62 for Natural and Mechanical Ventilation. Specific buildings may have more stringent requirements on proximity of fresh air intakes to contaminated air.

b. At Health Care related buildings, ventilation, exhaust, room pressurization design shall conform to ASHRAE Standard 170 in addition to all other applicable codes.

(5) Heating Systems

a. The design for space heating will generally require the use of the University's high temperature water (HTW) system, see 3.8 D, or a secondary central steam system. In buildings located a distance from the high temperature water distribution lines, or which are unsuitable for connection to the system, heating may be provided by boilers (or hot air furnaces in small buildings). The primary fuel for such shall be natural gas. Boiler sizes are limited by current pollution regulations.

(6) Refrigerant Relief Piping

a. Evaporator coils located near heating coils; and, pressure relief devices and fusible plugs shall have relief piping, sized and routed per the requirements of ASHRAE Standard 15 "Safety Code for Mechanical Refrigeration".

(7) Mechanical Rooms as Return Air Plenums

a. Mechanical rooms containing refrigerant compressors, coils, tanks, piping, etc., shall not be used as return air plenums.

(8) Power for Controls

a. The electrical contractor shall be directed to have breaker circuits designated specifically for control power functions.

b. Provide an emergency power circuit for the control panels and individual room controls where emergency power generators are available.

c. The A/E should coordinate to provide control transformers supplying 24V AC control power for zone controls. Install transformers as needed to meet the requirements of the individual controllers.

(9) Start-Up Strainers

a. When start-up strainers are replaced with specified strainers prior to test and balance, require the Contractor to place each removed start-up strainer near the pump or Y-strainer it served for inspection by the University of Utah Facility Operations staff.

(10) Factory Witness Tests of Equipment

a. The University Project Manager shall determine the need for a factory witness test of major equipment items.

(11) Equipment, Pipe and Duct Identification

a. All plumbing, heating, air conditioning, automatic temperature control equipment (excluding thermostats and relays), and distribution systems shall be labeled. Electrical switches and starters for mechanical equipment shall also be labeled.
   i. Equipment labels shall be 1/8-in thick plastic black face with white engraved lettering 3/16-in high or larger, and shall be attached securely.
      (a) All labels associated with high temperature piping and in high temperature equipment room shall be as required in valve section below. No non-metal labels allowed.
   ii. Equipment nameplates shall include the following minimum information:
      (a) Plan identification
      (b) Capacity specified at designed operating conditions
      (c) Actual capacity as balanced at site operating conditions
      (d) Area or zone served
   iii. All valves, regardless of size, shall have brass tags at least 1-in by 3-in in size and 0.051 inches thick. Lettering on the tag shall be engraved at least 1/8-in high. Each valve on the drawing shall be identified separately, and valve tags shall match the drawing identification.
   iv. Valve tags shall be connected to valve stems by steel rings and include the following minimum information:
      (a) Plan identification
      (b) Normal position
      (c) Duty
      (d) Area served
      (e) Valve type
   v. Additionally, heating water valves, steam valves, and all valves located in the secondary (low pressure) side of HTW heat exchangers shall include the manufacturer, size, grade, and pressure-temperature service rating.

b. All accessible duct and piping shall be color coded and identified with wording and arrows every 50-feet, at each riser, at each junction, at each access door, and where required to easily identify the medium transported.

c. Duct and piping systems shall be identified by:
   i. Background color

ii. Lettering color, and
iii. Flow direction arrow

d. Duct and piping background color shall be applied to all exposed piping (either over bare pipe or the insulation) in mechanical rooms. Identifying lettering and arrows shall then be added as indicated above, and as necessary to be visible from anywhere in the room.
   i. For duct in mechanical rooms, chases, and other exposed areas, as well as piping routed in other exposed areas such as chases, background color shall be applied in a two foot (2'-0") wide band with identifying lettering and a flow direction arrow.
   ii. Background and lettering shall be semi-gloss enamel paint. The colors specified herein shall not vary. The table below lists the closest matching Pantone® color code for reference.

COLOR	PANTONE® MATCHING SYSTEM COLOR
Safety Red	485 C
Safety Orange	152 C
Safety Yellow	109 C
Safety Green	3415 C
Safety Blue	2945 C
Safety Purple	259 C
Brown	168 C
Gray	430 C
Black	Black
White	White

   iii. Identifying lettering shall be painted or stenciled on duct or pipe over the background color. Self-adhesive or glue-on type labels are acceptable. Letters shall be 2" high for duct and larger piping 3" or more, 1" high for 1-1/4" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.
   iv. Arrows to indicate direction of flow shall be painted over the background color in the same color as the lettering. The arrow shall point away from the lettering. On duct and large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
   v. Piping and duct shall be identified with the following colors:

MEDIUM IN PIPE OR DUCT	BACKGROUND COLOR	IDENTIFYING LETTERING	LETTERING COLOR
COMPRESSED AIR			
Lab Service	Gray	Compressed Air	Black
Automatic Controls	Gray	Control Air	Black
COMPRESSED GAS			
Hydrogen	Brown	Hydrogen	Black
Natural Gas	Brown	Natural Gas	Safety Yellow
Nitrogen	Gray	Nitrogen	Black
Oxygen	Brown	Oxygen	Black
REFRIGERANT			
Freon	Black	Freon	White
STEAM – LOW PRESSURE (0 – 15 PSIG) (NOTE: NO BANDS FOR LOW PRESSURE)			
Steam – Low Pressure	Safety Orange	Low-Press. Steam	Black
STEAM – HIGH PRESSURE (OVER 15 PSIG) (NOTE: TWO BLACK BANDS REQUIRED FOR HIGH PRESSURE)			
Steam – High Pressure	Safety Orange	Hi-Press. Steam	White
VACUUM			
Vacuum	Gray	Vacuum	Black
WATER **NOTE: DIRECTIONAL ARROWS ARE REQUIRED ON HTW PIPING.			
Boiler Blow-Off	Safety Yellow	Blow-Off Water	Black
Chilled Water Supply	Safety Blue	Chilled Water Supply	White
Chilled Water Return	Safety Blue	Chilled Water Return	White
Condenser Water Supply	Safety Blue	Cooling Water Supply	White
Condenser Water Return	Safety Blue	Cooling Water Return	Black
Condensate Return (Note: One white band is required for Steam Condensate Return.)	Safety Orange	Condensate Return	Black
Cold Water (Potable)	Safety Green	Domestic Cold Water	White
Non Potable	Safety Green	Unsafe Water	Black
Domestic Hot Water (Potable)	Safety Green	Domestic Hot Water	White
Domestic Hot Water Return	Safety Green	Domestic Hot Water Return	White
Fire Protection Water	Safety Red	Fire Protection	White
Glycol Solution	Safety Purple	Glycol Solution	White
High Temperature Supply	Safety Yellow**	High Temperature Water Supply	Black

MEDIUM IN PIPE OR DUCT	BACKGROUND COLOR	IDENTIFYING LETTERING	LETTERING COLOR
High Temperature Return	Safety Yellow**	High Temperature Water Return	Black
Secondary Heating Water Supply	Brown	Heating Water Supply	White
Secondary Heating Water Return	Brown	Heating Water Return	White
Deionized	Safety Green	Deionized Water	White
Distilled Water	Safety Green	Distilled Water	White
Reverse Osmosis	Safety Green	Rev. Osmosis Water	White
Softened	Safety Green	Softened Water	Black
Roof Drain	Safety Green	Roof Drain	White
System Make-Up	Safety Green	Make-Up Water	White
Treated Water	Safety Green	Treated Water	Black
WASTE			
Acid-Resistant	(unpainted)	Acid Waste	White
Building Waste	(unpainted) or Black	Waste	White
Polluted Water	Black	Polluted	Safety Yellow
ALL EQUIPMENT OR PIPING LOCATED OUTSIDE BUILDINGS			
All Equipment or Piping Located Outside Buildings	Brown	- - -	- - -

(12) System Commissioning

a. The A/E shall cooperate fully with the commissioning agent during all phases of the project from inception of design through final seasonal testing. Support shall consist of but not be limited to the following items:

i. Provide technical material and project documentation to the commissioning agent

ii. Respond to project issues in the commissioning issues log on a timely basis

iii. Participate in commissioning meetings and inspections

iv. Collaborate with the commissioning agent and contractor to resolve commissioning findings

(13) Refrigerants

a. R410a only is allowed for new equipment. R22 is only allowed to maintain current equipment. Use of all other refrigerants is to be approved by facilities through the University Project Manager.

b. All applicable health and safety requirements for specified refrigerants shall be included in the design. These requirements shall include, but not be limited to,

ASHRAE safety items noted in Standards 34 and 35, and NIOSH Workplace Guidelines.

C. High Performance Building System
   (1) No additional University design requirements.
D. Operability and Maintainability
   (1) Access for Maintenance
      a. For elevated equipment design an appropriate platform for convenience and safety. If an access platform is not practical, coordinate with Facilities Management through the University Project Manager for an approved design of a lifting point or other means of maintenance access.
      b. Pumps 3 HP and above, which are elevated overhead such that the distance from floor to top of pump/motor assembly is 8-feet or higher, shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.
      c. Air handlers with elevated access doors such that the distance from floor to bottom of the door is 3-feet or higher shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.
      d. All ductwork and piping at walking level that must be crossed for equipment maintenance and service shall have a cross-over ladder.
      e. Fans with a motors 3 HP and above, which are elevated such that the distance from floor to any maintenance point (access door, belt, motor, *etc.*) is 6-feet or higher, shall have an appropriate access platform with permanent ladders or steps designed and shown on the design drawings.
E. Alterations in Existing Buildings and Historic Structures
   (1) Heating Systems
      a. Where existing steam systems must be extended or revised, verify the existing demand and generation capacity before adding any steam equipment to the system. The A/E shall detail the locations for each connection point for the Contractor.
   (2) Extensions / Modifications of Existing Systems
      a. Building heating and cooling systems which are to be extended or modified will require analysis of the existing mechanical systems to determine the capacity available for expansion.
   (3) Review of Existing Systems
      a. Existing Systems to Original Working Capacities
         i. Modifications or extensions to an existing system require a thorough analysis and understanding of the impact on the original system. The A/E shall insure that its design includes adjustments to the original building systems (including record (as-built) drawings with modified performance values shown) to return all adjacent systems to original working capacities. If the original condition cannot be determined, then the A/E shall include the services of balancing technicians in his fee to determine the actual status of the existing systems.
         ii. Verify with facilities as to the current set-points of the system. Do not rely solely on record drawings for system set-points.
   (4) Existing System Commissioning

a. Any HVAC system that is modified shall be rebalanced and recommissioned, see DFCM Design Requirements 5.12 for additional requirements. If the unit modified serves more than the area under the current scope of work, the entire area served by that unit must be re-balanced and recommissioned. If this presents un-due hardships on the project scope/budget, an exception may only be granted in writing by Facilities through the University Project Manager.

3.7 Plumbing

A. Domestic Water Supply System

(1) Generally, the water pressure on campus exceeds 80 psig. Refer to 3.2 C for the University's water distribution system requirements.

(2) All pressure regulators shall be adjustable, diaphragm type, globe style valve.

(3) All pressure reducing valves (PRVs) are to be located in an accessible space 5 feet above finished floor for servicing. Strainers should be Class 250 rated, with a cast bronze or iron body, threaded ends, solid retainer cap. Install ball valve on strainer to allow for draining.

(4) Ball valves shall be Class 250 rated, with bronze construction, bubble tight PTFE seats, with hard chrome plated brass or stainless steel ball.

(5) Check valves shall be bronze, Y-pattern, and Class 250 rated.

(6) Valves shall be domestically manufactured.

(7) Valves 2.5-in and larger shall be flanged.

(8) Specify valve stem installation to be horizontal or higher than the valve.

(9) Install two (2) full size reduced pressure backflow preventers piped in parallel at the building water entry of lab and research buildings. Install one (1) full size and one (1) half size reduced pressure backflow preventer in parallel at the building water entry of office and classroom buildings.

(10) Atmospheric vacuum breakers shall be provided on all sink outlets in lab areas; or, a branch line backflow preventer may be installed in a water line supplying an area of a lab or labs. When a branch line backflow preventer is used, the water piping downstream of the device shall be labeled as "non-potable water".

(11) The University does not allow plastic (PEX) piping on Campus.

(12) Water supply systems scheduled for removal or demolition shall have their supply (and return) piping removed and capped at an active main or branch line to prevent stagnation in an idle branch pipe. All abandoned piping shall be removed.

B. Hot Water Service

(1) Where a building is provided with HTW or steam from the University's distribution system, this shall be the source for heating the domestic hot water. Alternate energy sources considered to heat domestic water shall be approved in writing by Facilities Management.

(2) Provide two pumps on the domestic hot water for HTW domestic water converters. Two pumps allow for standby and alternating use. Maintain domestic water circulation through the HTW converter at low use times to prevent damage and extend the life of the converter. Provide lead/lag controls for pumps.

(3) Domestic hot water systems using HTW heat exchangers are to be designed with multiple storage tanks to allow maintenance on one tank while the system remains in service. Refer to 3.8 D for heat exchanger requirements.

(4) Water conditioning systems shall be designed for all buildings which supply potable (or non-potable) hot water for classroom sinks, toilet room lavatories, laboratory sinks, etc. These shall be provided with water softening equipment for this hot water.

a. All water conditioning systems shall have built in totalizing water meters on the inlet line and on the conditioned water supply line.

b. The design of all water conditioning systems shall include a hose bib in close proximity to installed equipment for mixing and tank filling activities. Include a floor drain when chemicals will be used in the equipment.

c. Water softeners shall have duplex resin tanks, a single brine tank which shall not exceed 48" in height, and an automatic regeneration system activated by the amount of flow, not by time clock. Blow in salt delivery systems are required.

d. Water softening or conditioning equipment shall be based on GE Osmonics, Pacific Water Incorporated, Water Specialties, or Fluid Treatment Systems, or approved equal. All other manufacturers shall be reviewed and approved by Facilities Management prior to bid.

e. Additionally, water conditioning equipment shall be provided for secondary steam and water systems connected to HTW generators and converters. Include water conditioning of makeup and feed-water to HTW steam generators.

f. On buildings where large quantities of water are consumed, the design engineer shall consider the use of an exterior brine pit.

g. Many applications such as laboratories or research buildings on campus require conditioned water other than softened water. Requirements may include deionized water, reverse osmosis water, filtered water, or a combination of these to achieve the proper degree of purity or polishing. The level of water purity needed shall determine the type of pipe material required.

C. Sanitary Waste and Vent Systems

(1) Plastic drain, waste, and vent piping is not allowed on the University Campus.

(2) Drain, waste, and vent piping scheduled for removal or demolition shall be capped at the main. All abandoned piping shall be removed and not left in place.

(3) Indirect piping shall be Type L hard drawn copper pipe with wrought copper fittings and lead free solder.

(4) Vents shall extend full size through roof and shall project minimum 18-in above the roof.

(5) Auto-vents are not allowed as a substitution for normal venting through the roof in plumbing and drainage systems.

(6) Special venting for island sinks is discouraged. If an island sink is required, it should discharge into an approved floor sink below the counter, except acid waste is not be allowed to be drained in this manner.

(7) No sanitary sewer or sanitary waste systems shall be pumped except with permission of the University Facilities Management. A duplex pump system shall be used if approved.

(8) Floor drains, floor sinks, etc., shall be provided with minimum 30-in square safety pans.

(9) All floor sinks shall be provided with at least a half grate.

(10) Acid Resistant Waste Systems shall be provided in all lab areas or other areas such as lecture rooms, etc. using chemicals. The designer is responsible for choosing suitable piping material based on the type of acids which will be used in the pipe. For lab remodels or additions, match existing pipe material.

a. Acid resistant waste systems shall be directly connected to drain. Indirect drain systems are not acceptable.
b. Neutralization tanks shall be used on systems less than eight (8) fixture units or 30 gallons per day.
c. Dilution tanks shall be used on system greater than eight (8) fixture units or 30 gallons per day.
d. Support horizontal acid waste piping with a continuous full length channel or angle iron.

D. Rainwater Drainage System
(1) The A/E's design shall include an evaluation of an option to capture the roof runoff for beneficial reuse (either for outdoor landscaping or indoor toilet flushing) to reduce potable water use, slow the time of concentration, and reduce the size of storm drainage facilities.
(2) All roof drains shall drain to pervious area or be captured for reuse.

E. Plumbing Fixtures
(1) Fixtures in one building shall be of one manufacturer.
(2) Plumbing fixtures in toilet rooms shall be wall hung.
(3) Provide 3-in waste line risers to all urinals with approved fittings.
(4) All waste piping exposed below sinks or fixtures shall be chromium plated.
(5) All lavatories shall be provided with open grid strainers and not pop-up or other type of closeable drains.
(6) Manual flush valves shall be specified except for urinals and ADA toilets which are to be specified with automatic flush valves.
(7) Automatic faucets are not allowed except for ADA lavatories, and only for no more than one lavatory in each restroom. The automatic faucets are to be provided with integral battery packs and not hard wired.
(8) Eye wash and emergency shower designs are not to include drench hoses. Specify fixed fixtures only.
(9) Specify eye wash and emergency shower fixtures with manual open and closing ball valves. Flushometer or self-closing valves are not acceptable. Accessible isolation valves are to be provided near each station.
(10) New laboratories requiring emergency showers shall be designed with floor drains located under the emergency shower.
(11) Emergency eye wash and shower fixtures shall be specified as Haws, Bradley or Guardian Equipment.

F. Natural Gas Systems
(1) The University requires the gas meter to be installed outside the building at an easily accessible and well vented area away from any building air-intake.
(2) No gas lines shall be run underground downstream of the building regulator/meter set.
(3) Natural gas supply systems scheduled for removal or demolition shall have the piping removed and capped at an active main or branch line. All abandoned piping shall be removed.

G. Fuel Oil Systems
(1) No additional University design requirements.

H. Compressed Air Systems

(1) Specify Type L hard drawn copper with wrought copper solder fittings and lead free solder; or, ASTM A53 Grade A or B, Schedule 40 galvanized steel with 150-lb galvanized malleable iron screwed fittings.

(2) Ball valves for use in compressed air piping shall follow the University's requirements for domestic water applications.

(3) Butterfly valves for use in compressed air piping shall be ductile iron body, 200# WOG valve with bronze disc and type 304 stainless steel stem. The seat shall be specified Buna N rubber. Note that valves 5-in and smaller are to be specified with 10-position locking levers; and valves 6-in and larger are to be specified with manual gear operators. Butterfly valves shall be rated for temperatures up to 180° F maximum and shall be capable of tight shut-off at rated pressure without the need for downstream blind flanges.

I. Vacuum Piping Systems

(1) Vacuum Piping Systems shall be designed to prevent extraneous liquids in the system from exiting out through the vacuum hose cocks into the labs. Horizontal branch lines shall grade down 1-in per 40-ft towards the mains and shall enter into the top of the mains.

(2) Hose cock shall connect into the top of the branch lines and back-to-back hose cocks are not allowed.

(3) Vertically dropped lines shall be used only where no other routing method is available, and all remaining piping shall be sloped back to the vacuum source. If terminal vacuum lines are to drop vertically to terminal outlets, such outlets shall be trapped with convenient access and accompanying written instructions describing when and how to clear the trap.

(4) A receiver tank shall be required upstream of any vacuum pump or set of vacuum pumps to prevent liquids or solids from entering the pump.

(5) Specify Type L hard drawn copper with wrought copper solder fittings and lead free solder; or, ASTM A53 Grade A or B, Schedule 40 galvanized steel with 150-lb galvanized malleable iron screwed fittings.

(6) Ball valves for use in vacuum piping shall follow the University requirements for domestic water applications.

(7) Butterfly valves for use in vacuum piping shall follow the University requirements for heating and air conditioning water service, except that all sizes are to be specified for non-leakage performance up to and including 29.9 inches of mercury (Hg).

3.8 HVAC Systems

A. Air Distribution Systems

(1) VFD By-Pass Switch

a. Variable frequency drive systems shall be supplied with a by-pass switch allowing full speed operation upon VFD failure, refer to 3.5 F (3) for requirements.

i. Bypasses are not required on systems where redundant capacity is installed, each individually supplying the system design flow rate.

(2) VFD Fan System Pressure Relief Door

a. Fan systems served by VFD's shall have a pressure relief door installed in the supply main, set to relieve duct over-pressure when the VFD fails to full speed, and thereby

protecting the duct seams downstream of the fan. The damper shall be a 12-gauge frame and door with polyurethane foam seals around the door perimeter.

(3) Dual Duct Constant Volume Systems

a. As existing/preserved constant volume dual duct systems are encountered, provide true constant volume controls on a single constant volume supply box (twin VAV boxes will not be approved).

b. New constant volume dual duct systems will not be approved.

(4) Fan powered VAV boxes are not to be used.

(5) Motors for HVAC

a. Refer to 3.5 F for motor requirements. The most stringent requirements apply based on conditions.

b. Proper protection and control for all motors shall be provided. Starters for 3 phase motors shall have overloads on all three phases. Provide fused protection utilizing properly sized dual element fuses. Starter control circuits shall have properly sized fuse protection. Soft starting systems shall be provided for motors 25 HP and larger and as appropriate for the function they serve. Starting characteristics of motors shall be reviewed with Facilities Management (especially Campus Utility Services) through the University Project Manager during design.

c. All motors 1 HP and larger shall be specified as follows:

i. Class B motor temperature rise

ii. Class H insulation

iii. Designed and warranted for inverter duty use, (Nema MG-31 certified) for VFD motors

iv. Premium efficiency rated

v. 1.15 Service factor

B. Piping System

(1) Common Piping for Hot / Chilled Water

a. Two pipe or three pipe systems utilizing the same piping for hot water and chilled water shall not be used.

(2) Glycol Systems

a. Glycol systems shall be contained within mechanical rooms. Piping throughout the building shall contain no glycol. Any remote systems requiring glycol, service water shall be routed to the location with a plate and frame heat exchanger in a mechanical space with glycol introduced at that point.

(3) Hydronic Flow Control Balancing Devices

a. Flow control devices shall be provided at all major terminal devices such as coils, converters, etc. Flow control devices are to have marked memory stop and handles are to be removed after balancing. Additional isolation valves are to be provided to prevent the use of flow control devices as shut-off valves. Pumps with variable speed drives shall not have flow control devices installed on them.

(4) Triple duty valves are prohibited.

C. Steam

(1) No additional University design requirements.

D. High Temperature Water

(1) The Campus Master Plan intends that new heating systems shall be hot water heat exchangers utilizing high temperature water (HTW) from the campus HTW distribution system. Low temperature (180° F) hot water heating systems are the preferred medium for heating all new or remodeled buildings.

(2) Design Requirements

a. HTW System Availability

i. The consultant shall coordinate with the University Project Manager to determine if HTW is the best application for the heating system, including availability of HTW before design.

b. Consultant Experience

i. The campus high temperature water system requires a unique expertise. The University reserves the right to limit the selection of consultants to those experienced in high pressure/high temperature piping design with associated maintenance and safety design capabilities, and require evidence of such experience.

c. Design Parameters for System Calculations

i. System Operating Pressure = 460 psig for both “upper” and “lower” zones.

ii. System Operating Temperature, “Upper Zone” = 390° F.

iii. System Operating Temperature, “Lower Zone” = 435° F.

iv. Minimum Approach Temperature:

APPROACH TEMPERATURE = (HTW RETURN TEMP ˚F) - (SECONDARY SUPPLY TEMP ˚F)

d. HTW steam generators:

i. 10° F (for 45 psig to 100 psig steam operating pressures)

ii. 15° F (for 44 psig and lower steam operating pressures)

e. HTW water-to-water converters and water heaters, 15° F

(3) Maximum Pressure Drop

a. The maximum allowable pressure drop from the HTW building entry through each mechanical room including piping, equipment, and controls shall be 20 psig.

(4) Equipment Ratings

a. All equipment, valves and piping shall be pressure and temperature rated based on requirements listed in this section.

b. HTW to heating water heat exchangers must be approved by Facilities Management prior to bidding and final selection.

(5) Blowdown Heat Recovery on Humidifier Steam Generators

a. Steam generators used for humidification shall be designed with heat recovery on the blowdown line. The recovered heat shall temper the makeup water to the steam generator to avoid shocking the generator.

(6) Piping System Design

a. Use Fanning or other equally acceptable formulae to calculate flow, velocity, and resistance of the water piping.

b. Shall conform to most current version of ASME B31.1

c. Consultant shall direct the Contractor to provide a weld-map including a copy of each welder's certification.

d. All valves are to be pneumatic, normally closed with spring return.

(7) The maximum allowable pressure drop in branch lines from the main to building equipment and returning to the main shall be 2 psi per 100 equivalent feet of pipe, with a maximum water velocity of 7 feet/second.

(8) Minimum pipe size shall be NPS 3/4 for HTW lines above ground and NPS 2-1/2 for underground branch lines.

(9) The minimum bury depth to the insulation wrap shall be no less than 5 feet between the top of the insulation and the ground level for plain pipe. Thermacor Process L.P. Duo Therm "505" pre-insulated pipe requires a minimum bury depth of 24-in. If conditions require a shallower depth, the minimum bury can be 12-in for Thermacor "505" pipe if under a concrete slab on grade. The minimum insulation depth to the top of the pipe shall be 6-in (and varies to 10-in).

(10) Buried pipe crossing over or under high temperature water lines.

a. Routing of new HTW piping may require revisions to existing underground utilities. New buried utility piping will require special considerations for crossing HTW piping.

b. To prevent damage to pipe and/or contents from the elevated temperatures expected at crossing high temperature water lines, the following requirements apply (with the exception of pre-insulated piping):

i. Buried piping systems which shall cross over or under HTW lines shall be metal pipe (no plastic) for at least 5 feet either side of the cross point of the HTW pipe line.

ii. A buried water, sewer, or storm sewer pipe which crosses HTW piping shall be constructed of a 20-foot section(s) of ductile iron pipe, with the middle of the ductile pipe section centered over or under the crossing HTW pipe(s). The angle of crossing shall not be less than 60º. Any storm drain entry box, or piping joints within five feet lateral clearance of a crossing point over or under high temperature water piping shall have an epoxy concrete envelope around the storm drain joints.

iii. Buried pipe which crosses HTW piping shall have adequate vertical clearance; a minimum of two feet (2') is allowed without a copper guard. If the clearance between the crossing pipes shall be closer than two feet, design a 4' wide, 1/4" copper plate(s) midway between the crossing piping and the HTW piping. The copper plate(s) shall extend a minimum of 3 feet either side of the HTW piping.

iv. Buried electrical and telecommunications duct banks which cross HTW piping shall have adequate vertical clearance; a minimum of one foot (1') is allowed without a copper guard. If the clearance between the duct banks shall be closer than one foot, design a 4' wide, 1/4-in copper plate(s) between the duct banks and the HTW piping. See Detail HTW-18.

(11) If new Thermacor Process L.P. Duo Therm "505" pipe system is to be installed, and a connection to an existing Gilsulate insulating fill system or a Z-Crete cast-in-place insulation system is required, design a transition which may include a vault, foundation, or doghouse. Direct connections between the differing pipe/insulation systems shall not be permitted.

(12) Minimum size shall be NPS 3/4 for drains and NPS 1/2 for vents. Refer to drawing details provided herein. Gate valves shall be used on all HTW drains and vents.

(13) Due to the high potential for high pressure water to flood adjacent areas, rooms shall be designed to contain water and quickly drain it away. All instrument air tubing in the HTW equipment rooms shall be copper.

(14) HTW Vent Lines

a. Vent valves are to be installed at the highest point of the HTW system inside the building. Vent valves are also to be installed at the high point of each high temperature water converter (HTW side of each water and steam converter/generator) in both the supply and return piping.

(15) Design to Minimize Shock

a. If the length of HTW piping between the control valve and the converter/generator exceeds 20 feet, include a bypass line near the converter/generator to allow HTW circulation which will serve to keep the idle HTW consistently hot and thereby prevent start-up shock.

b. When selecting heavy wall pipe (*i.e.* Schedule 80), the A/E shall account for the smaller inside pipe diameter in design calculations.

c. Submit detailed calculations to Facilities Management for review. The calculations used in the design of all HTW extensions shall be approved by Facilities Management prior to construction.

i. Fathom model shall be updated, refer to utility section for modeling and delivery requirements.

d. Piping insulation thickness shall be shown in table form on the drawings or in the specifications.

(16) Avoid Pad Support Under Heat Exchangers

a. Do not specify a housekeeping pad under HTW heat exchangers. Hydraulic lifts are used to remove heat exchanger heads and a minimum of 3 feet clearance is required at the floor behind the heads for proper access.

(17) HTW Equipment Rooms

a. See 3.4 H for special structural design requirements.

(18) Emergency Shut-Off Control Valve at Building Supply

a. Include an emergency shut-off control valve at new buildings and new installations of a high temperature water system. Manual remote operation of the valve is to be located outside of the HTW equipment room near the door. The purpose of the emergency shut-off control valve is to protect the equipment room from destruction after a tube rupture or head gasket failure. The HTW emergency shut-off control valve shall have the following characteristics:

i. The control valve shall be installed inside the building on the HTW supply line and shall be full line size with a full port.

ii. Cast steel valve body conforming to ANSI Class 600 specifications. Flange surface shall match ANSI Class 600.

iii. The seat leakage shall be limited to the requirements of ANSI B16.104, Class IV. Control valve shall close against a 500 psi pressure difference and shall be suitable for 450° F.

iv. The control valve shall be specified normally closed, failing to the closed position on loss of control air. The valve shall be a rotary ball design with a side mount actuator that can be right or left of the pipe. Actuator shall be air operated with spring return. The maximum air to operate the valve shall be 60 psig. The maximum allowable air to actuator to be 125 psig.

v. Control valve shall have remote control for opening and closing through the campus automation system.

(19) Blowdown Heat Recovery on Steam Generators

a. Steam generators shall be designed with heat recovery on the blowdown line. The recovered heat shall temper the makeup water to the steam generator to avoid shocking the generator.

(20) System Review by Facilities Management

a. In all cases, piping design, equipment selections, and controls are to be reviewed with Facilities Management through the University Project Manager at each design phase.

E. Natural Gas

(1) Refer to 3.7 F for natural gas system requirements.

F. Building Automation

(1) Manufacturers: Subject to compliance with requirements, provide products by the following:

a. “Honeywell” controls as furnished and installed by Wasatch Controls

b. Trane US, Inc.

c. “Metasys” by Johnson Controls

G. Chilled Water System

(1) Refer to 3.10 G for additional chiller requirements.

(2) Campus Chiller Loop

a. New or replacement cooling coils intended for areas served by a University chiller loop shall be sized for low flow and high temperature rise in the coils.

i. Design the coils for multiple rows and 60° F return water temperature (16° rise), even if the actual use and intended operation may only require an 8° F rise. Computer coil selections shall certify coil operation at both conditions (8° rise and 16° rise).

ii. Size supporting piping for 8° F temperature rise, effectively providing adequate size for the higher gpm.

iii. Design the coil controls with tight shut-off two-way valves which connect the coil to the central loop. Three-way coil valves will not be approved.

H. Boiler Plant

(1) No additional University design requirements.

I. Condenser Water System

(1) No additional University design requirements.

J. Roof-Mounted Equipment

(1) Roof-Top Units Require Approval

a. Refer to 3.3 B (10) for the use of any rooftop mounted equipment.

b. Refer to 3.10 A (2) for Rooftop Units

K. Water Treatment System
   (1) By-Pass Feeders
      a. Minimum five-gallon by-pass feeders shall be designed for each secondary heating system, each chilled water cooling system, and each condenser water system.
   (2) Automated water treatment is required for condenser water systems and other systems as required by facilities.
      a. Consultant shall investigate the use of solid separator on the condenser water system.

L. District Steam Heating
   (1) No additional University design requirements.

M. Special Area HVAC Systems
   (1) Back-Up Systems
      a. Back-up systems shall be provided for projects where critical research, experiments, etc., require un-interruptible heating. Coordinate with the University Project Manager for decisions pertaining to standby fuels or back-up systems. If the scope of the project does not already include electrical design, the electrical facilities shall be engaged to ensure back up power to critical HVAC equipment as required by the facility.

N. Laboratory Ventilation
   (1) Basis of Design
      a. The American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5 – latest version (www.aiha.org) shall be the basis of design for Laboratory Ventilation Systems. The following exceptions and or amendments shall apply:
      b. Requirements which are noted as ADDED or CHANGED or CLARIFICATION are special University of Utah requirements supplemental to The American National Standard for Laboratory Ventilation ANSI/AIHA Z9.5-2012.
      c. Where there is a conflict between the latest adopted version of the ANSI/AIHA Z9.5, International Building and Mechanical Codes and requirements of this Laboratory Ventilation section, the most restrictive shall govern, upon approval by the Authority Having Jurisdiction.

1.4 ADDED Alternative Design

Codes, Ordinances, and Industry Standards: In accordance with the latest adopted version of the International Building Code, Section 104.11, and the University Building Official has approved this Laboratory Ventilation chapter as an Alternative Design which meets all enforceable Code (IBC, IFC, IMC, etc.) requirements.

The Alternate Design is to provide a continuously exhausted laboratory ventilation system for new and existing research and educational laboratories under fire alarm and loss of primary building power conditions.

This Alternate Design will apply only to laboratories classified as Group B occupancies where the types and quantities of hazardous materials both stored and used per Control Area do not exceed quantities listed in Tables 307.71 (1) and 307.71.(2) of the IBC. Laboratory ventilation system supply and exhaust systems may be allowed to penetrate fire-rated exhaust shafts without fire and smoke dampers upon approval of an engineered system. Upon activation of the

fire alarm and notification system or loss of primary electrical building power, the laboratory ventilation system supply and exhaust systems will operate at 50% of their maximum capacity.

Prescriptive Code requirements specify installation of fire and smoke dampers at the penetration of fire-rated shafts and floor assemblies with few exceptions. The intent of the Code for the installation of fire and smoke dampers is to prevent the spread of fire, smoke and fumes through these penetrations to other parts of the building. This requirement effectively cuts off the supply and exhaust air for laboratory ventilation systems under both alarm and loss of primary power conditions. The closure of fire and smoke dampers, when actuated, would prevent the exhausting of hazardous materials thus creating a more hazardous condition by allowing these materials to permeate the laboratory. The Comparison Chart identifies specific Code requirements and the equivalent design characteristics of the Alternate Design. As noted in the Comparison Chart, the Alternate Design will not deviate from the Code Requirements except for the provisions of the IBC Section 716.5.3.1.

In summary, the following outlines the required characteristics of the Alternate Design.

- The Alternate Design applies only to Group B occupancy laboratories.
- Fire and smoke dampers shall not be installed at the penetration of fire rated shafts and horizontal assemblies serving laboratory ventilation systems.
- The laboratory ventilation systems for new buildings shall include an adequate power source for the laboratory ventilation system, which will operate at 50% of their maximum capacity for a 90-minute time period following loss of primary building power.
- Alterations or additions to laboratory ventilation systems in existing buildings shall be connected to an existing alternate power source where available and where spare capacity exists. Otherwise, connection to the building's primary power is permitted.
- Alterations to an existing laboratory ventilation system that affect 50% or more of a floor or building shall be connected to an alternate power source.
- Any laboratory ventilation system associated with a Group H Occupancy shall comply with all prescriptive code requirements found in the International Code Council set of codes as adopted by the State of Utah.

3.1.1.4 CHANGED Auto Sash Closers

Automatic Sash Closers: Automatic sash closers are not required.

3.1.1 ADDED Backflow Protection

Whether or not non-potable water is supplied to the hood, a spill-proof pressure vacuum breaker for high hazard application, with test ports shall be provided on the supply line outside each laboratory ventilation system. The backflow preventer shall be visible and easily accessible for testing. The backflow preventer shall be located 18" to 24" below the ceiling on the outside of the laboratory ventilation system or on an adjoining wall, and its critical line shall be a minimum of 6" above the highest outlet. The installing contractor shall test the backflow preventer and submit results to the University Project Manager.

3.1.1.4 ADDED Existing Auxiliary Supplied Air Hoods

Existing auxiliary supplied air hoods currently installed shall be converted to conventional or bypass hoods.

3.1.3 ADDED Vacuum Breakers

Vacuum breakers shall not be installed inside laboratory ventilation systems.

3.1.4 ADDED Work Surface

Existing laboratory ventilation systems shall be retrofitted to include provisions for spill protection.

3.2.3 CHANGED Auxiliary Supplied Air Hoods

Auxiliary supplied air hoods shall not be installed.

3.2.7 ADDED Hood Manufacturers

Hood shall be Labconco (or approved equal).

3.2.8 ADDED Radioisotope Hoods

Radioisotope hoods shall be conventional hoods or bypass hoods. The University Radiological Health Department (RHD) shall be informed of each new radioisotope hood being planned for a project, or any such hoods to be modified or upgraded to radioisotope status. RHD will review the hood application and determine if any special treatment is required, such as charcoal or HEPA filters, nonstandard face velocities, etc.

3.3.1 CHANGED Face Velocity

The face velocity basis of design shall be 100 fpm at a sash height of 18" above the work surface.

The final product shall provide containment below a control level of AU (As Used) 0.1 ppm as determined by methods described in the ANSI/ASHRAE 110-1995 *Method of Testing Performance of Laboratory ventilation systems.*

3.3.3.1 ADDED Air Flow Monitoring

Air Flow Monitoring shall be mounted on the hood so as to be readily seen by the hood user. The indicator shall sense face velocity either directly or indirectly (belt driven sash sensors are not acceptable). The device shall provide digital display indicating face velocity with low/high flow audible and visual alarms (adjustable). Approved manufacturers include Phoenix Controls, TSI, or approved equal.

3.3.4 CHANGED Hood Location

All hoods should be located to minimize cross currents and turbulence from laboratory furniture arrangements and busy walkways.

3.4 ADDED Asbestos

Do not use materials containing asbestos in new hoods and cabinet installations. Existing laboratory ventilation systems containing asbestos materials can remain provided the asbestos is in good condition. All modifications to a hood that impact the asbestos materials shall be performed by a certified asbestos contractor.

3.5 ADDED Venting

Corrosive and flammable storage cabinets installed under laboratory ventilation systems shall be as follows:

- Corrosive Cabinets

Provide a vent pipe from the back of the cabinet to the work surface. The pipe must be located in the space behind the baffle. The vent pipe shall extend 0.5” above the work surface.

- Flammable Cabinets

Two vent pipes shall be connected to the back of the flammable cabinet through factory-installed bungs, one high and one low, and joined at a common vent pipe (minimum NPS 1-1/2 steel) which shall extend to the hood exhaust duct. The vent pipe shall be connected between the venturi damper and exhaust fan rather than between the laboratory ventilation system and the venturi damper.

- Install a flame arrester in the flammable cabinet’s vent opening.

5.2.4 ADDED System Capacity

New makeup air systems are required in all existing buildings where sufficient make-up systems do not exist. Transfer air from other portions of the building is not an acceptable source of make-up air. A thorough investigation of make-up air sources shall be performed prior to installing new laboratory ventilation systems.

5.2.5 ADDED Hoar Frost

Make-up air systems shall include provisions to prevent hoar frost build-up at intake louvers and pre-filters.

5.2.6 ADDED Hydronic Coils

Cooling and heating coils installed in make-up air handlers shall have a glycol solution to prevent the coil from freezing. See 3.5 Mechanical Part 1 for glycol systems requirements.

5.2.7 ADDED Electric Heating Coils

Electric heating coils are discouraged due to the higher energy cost. If electric heat is necessary, minimum two stages heating is required.

5.2.8 ADDED Air Filters

Energy Recovery coils in exhaust fans shall have air filters and access to service filters.

5.3.1.2.1 ADDED Duct Material

Duct material shall be 16 or 18-gauge Stainless Steel Series 316, welded with "MIG" or "TIG" method. Screwed slip joint connections sealed with silicone sealant are acceptable. Other duct material may be used, with prior approval.

5.3.1.3 ADDED Fans in Series

Series exhaust fans shall not be installed.

5.3.1.4 ADDED Velocities

Transport duct velocities shall be 1000-2000 FPM for gases and 3500-4500 FPM for particulates, depending on the particle size and specific gravity.

5.3.1.5 ADDED Dampers

Install a single blade volume control damper with locking quadrant in the hood duct between the hood and venturi damper for all laboratory ventilation system systems.

5.3.1.6 ADDED Elbows

Use long radius elbows to reduce resistance. Three-piece stainless steel elbows are acceptable.

5.3.1.7 ADDED Flex Duct

Flex duct shall not be used on laboratory ventilation systems.

5.3.2.9 CLARIFICATION Fire Dampers

The accidental activation of a fire damper will shut off airflow from one or more laboratory chemical hoods and may cause worker injury or exposure.

The activation of a fire damper caused by a fire in a laboratory chemical hood will shut off airflow from that hood making it impossible to remove the combustion products from the hood and forcing the hood to become positively pressurized. This condition makes it likely the fire will escape the fire resistant hood into the laboratory.

With the exhaust flow from one or more hoods shut off, the laboratory may become positively pressurized with respect to the corridor, encouraging the spread of the combustion products, and perhaps the fire, from the laboratory to adjoining spaces.

5.3.2.12 CHANGED Constant Suction, Redundancy, Emergency Power

- Manifold Exhaust, New Construction

Manifold exhaust and makeup air systems shall be connected to an emergency power supply to ensure hood performance during power outages.

- Manifold Exhaust, Remodel or Renovation

Emergency power is not required.

- Individual Exhaust Systems (single-hood/single-fan)

Emergency power is not required.

5.3.3.1 ADDED Exhaust Fan Components

- Shaft Seals

The case penetration at the shaft is to be sealed with a corrosion resistant flexible seal.

- Motors

The motor may be non-explosion proof if it is located out of the air stream and sealed off from any possible exposure to the fumes being handled by the fan. If it is located in an enclosed room, the room must be adequately ventilated.

- Coatings

Non-stainless steel fans, sheet-metal, flexible connectors, dampers, etc., in contact with the air stream are to be Eisenheiss or Heresite coated, or prior approved equal.

- Back draft Dampers

Stainless steel or coated gravity back draft dampers are to be provided on fan discharges.

- Vibration Isolators

On smaller fans, rubber-in-shear vibration isolators are to be provided. These are inherently seismic rated and need nothing further. Larger fans may require spring type isolators with seismic snubbers.

- Fan Casing Drains

Where the fan discharge is vertical and open to the weather, a drain half coupling should be provided on the bottom of the fan housing. If the fan is located indoors, a trapped drain line is to be run to the outside to avoid blowing hazardous fumes into the building due to the pressurized housing.

- Duct Pressure

Exhaust duct pressure shall be negative with respect to all interior building spaces.

5.3.3.2 ADDED Labeling and Identification

- Laboratory ventilation systems

All laboratory ventilation systems shall be clearly identified and labeled to indicate which fan or ventilation system they are connected to.

- Exhaust Fans

All exhaust fans shall be clearly identified and labeled to show which hood(s) and/or ventilation systems they are serving. Exhaust fan labels shall indicate current and future design airflows and shall be updated whenever changes are made to the systems they are serving.

- Corrosive and Flammable Cabinets

All corrosive cabinets shall be labeled “Corrosive” and all flammable cabinets shall be labeled “Flammable”.

5.3.5.1 ADDED Termination Devices

Horizontal fan discharges, fixed caps, mushroom caps and rotating cap outlets prevent exhausted materials from being freely projected upward into the air stream for removal and are not to be used.

5.3.5.2 ADDED Bird Screens

Bird Screens shall not be installed.

5.3.5.3 ADDED Corrosive Condensate

Refer to ASHRAE 2003 Handbook – HVAC Applications, Chapter 44 recommends a stack velocity of 1000 fpm when corrosive condensate droplets are present and an exit cone to increase the discharge velocity to 3000 fpm to prevent plume downwash.

5.3.6.1 CHANGED General Room Exhaust

Air from the general laboratory containing chemical laboratory ventilation systems (as distinguished from laboratory chemical hoods) shall not be returned back to a central air handling unit where the air is re-circulated to other areas of the building.

8.10.3.1 CLARIFICATION Automatic Fire Dampers

In 2001 at the University of California a fire resulted in an injury and caused approximately $3.5 million in damage. Based on the investigation, it was concluded that not having the fire dampers on the exhaust duct of the ventilation system at the shaft wall appears to have been beneficial in this fire scenario. The investigation observed that the exhaust system was effective at removing significant quantities of combustion products from the building during the fire, thereby reducing the amount of combustion products spreading to other areas of the building.

The shutting down of the supply air by fire dampers did not significantly hinder the exhaust system since fresh air was provided through a broken window. However, if the window had not failed, the team concluded that the exhaust system probably would not have performed as well.

If protection of the openings is desired, one method is to use a subject assembly. Where a branch duct connects to an enclosed exhaust riser located inside a shaft, which has a required fire resistance rating of 1 hour or more and in which the airflow moves upward, protection of the opening into the fire resistance-rated enclosure should be made with a steel subduct turned upward a minimum of .06m (22 in.) in length and a minimum thickness of 22 gauge [0.76 mm (.030)]. The steel subduct should be carried up inside the riser from each inlet duct penetration. This riser should be appropriately sized to accommodate the flow restriction created by the subduct.

COMPARISON TABLE	
CODE	ALTERNATE DESIGN
IBC:	
IBC Tables 307.7(1) & 307.7(2) Hazardous materials in quantities less than Tables 307.7(1 & 2) per Control Area to be classified as Group B occupancy. All others to be a Group H occupancy.	No change to Code requirements.
IBC Section 707.3.1 Fire resistive rated shaft enclosures at openings between stories for more than 2 stories.	No change to Code requirements.
IBC Section 714.3.1 Unprotected openings for penetrations less than 6” in diameter are permitted at shafts.	No change to Code requirements.
IBC Section 717 Penetrations by ducts and air transfer openings of fire resistive rated shaft enclosures are to be protected with approved fire and smoke dampers.	Fire and smoke dampers are not allowed as they would interrupt supply and exhaust air for laboratory ventilation systems. Provides continuous supply air and exhaust for products of combustion and hazardous materials regardless of quantities.
IMC:	
IMC Section 501.4 Exhaust system must maintain negative pressure and make-up air.	No change to Code requirements.
IMC Section 502.1 Exhaust system required for laboratories using hazardous materials.	No change to Code requirements.
IMC Section 502.8.2 Hazardous materials in any quantity to be in a negatively exhausted environment.	No change to Code requirements.

COMPARISON TABLE	
CODE	ALTERNATE DESIGN
IMC Section 502.9.5 Flammable and combustible liquids in any quantity shall be provided with an exhaust system.	No change to Code requirements.
IMC Section 510.2 A hazardous exhaust system shall be required wherever operations involving the handling or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create: 1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25% of the lower flammability limit of the substance for the expected room temperature; 2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration; 3. A vapor, gas, fume, mist, or dust with a health-hazard rating of 1,2 or 3 is present in concentrations exceeding 1% of the median lethal concentration of the substance for acute inhalation toxicity.	No change to Code requirements. The design professionals will need to demonstrate that for the given project, chemical inventory quantities and list and the anticipated processes, that this provision is not a concern. Otherwise, a hazardous exhaust system will be required.

3.9 Automatic Sprinkler Systems

A. Fire Extinguishing Systems

(1) The University does not permit automatic fire sprinkler systems to be fabricated in combination with systems for heating or cooling, such as water source heat pumps connected to fire sprinkler piping.

(2) Each valve in the fire protection system shall be provided with an approved supervisory switch or "tamper" switch (including post indicator valves and antifreeze loop control valves) wired into the fire alarm system of the building.

(3) A flow switch shall be required at the main riser and at each isolated zone. New systems shall be separated into a different zone at each floor with a flow control assembly that shall include a flow switch, control valve and main drain tie-in.

(4) Non-glycol fire protection sprinkler systems require drain valves at all low points and a system test/drain valve at the building riser.

(5) The design is to include a floor sink at all drains discharging from sprinkler systems, including the inspector’s test drains, low point drains and the system auxiliary drain at the building riser. Connect the floor sinks to the nearest sanitary sewer and provide an air gap at the floor sinks.

(6) Antifreeze loops shall be separated from the fire extinguishing system with an isolation valve and a check valve.

(7) Do not connect an antifreeze system drain/test line to a storm sewer. Drain and test valves are to be located where a container can be provided to collect the antifreeze solution.

(8) Sprinkler heads in equipment rooms, storage rooms, etc. shall be furnished with guards.

B. Piping Systems

(1) Schedule 40 black steel pipe shall be specified for piping sized 2-in and smaller.

(2) Schedule 10 black steel pipe shall be specified for piping sized 2.5-in and larger.

(3) Dry pipe systems require Schedule 40 black steel pipe.

(4) The use of CPVC pipe is acceptable for use in Residential Occupancies and Light Hazard Occupancies. CPVC pipe shall be used according to its listing as prescribed by the manufacturer's specifications.

(5) For 1.25-in and larger fittings, specify 150-lb malleable iron with mechanical grooved pipe couplings. Approved manufacturers are Victaulic, Gruvlok, and Grinnell.

3.10 Components

A. Air Handling Units

(1) Indoor Air Handling Units: no additional University requirements

(2) Roof-Top Units

a. Refer to 3.3 B (10) for roof mounted equipment requirements.

b. The use of any packaged rooftop mounted equipment is to be approved in writing by Facilities Management through the University Project Manager prior to design.

B. Outdoor Air Intake Locations

(1) No additional University design requirements.

C. Filtration

(1) Refer to 3.8 N for additional laboratory ventilation requirements.

D. Cooling and Heating Coils

(1) No additional University design requirements.

E. Pumps

(1) HVAC Pumps

a. Pumps specified for University projects are to include the following:

i. Base mounted pumps shall be specified to have bases grouted.

ii. Piping design at pumping systems shall be specified and shown to follow pump industry guidelines for pump inlet conditions. A minimum of 5 pipe diameters of straight pipe will be required, or appropriately designed suction diffusers will be used.

iii. Variable frequency drives with a by-pass switch allowing full speed operation upon VFD failure, refer to 3.5 F (3) for additional requirements.

(a) Intent is to allow flow control over the full 20 to 60 Hz range, with 60 Hz being the design point for operating pressure at the flow design point.

(b) Bypasses are not required on systems where redundant capacity is installed, each individually supplying the system design flow rate.

(c) Pumps operating with VFDs shall be tested for maximum design flow rate and pressure developed once installed. If the design flow rate and pressure developed point occurs at less than 54 Hz, require the VFD to be reprogrammed to limit the amp draw

F. Boilers

(1) No additional University design requirements.

G. Chillers
   (1) Replacing Chillers
      a. For chiller replacements, the extent of response to prevailing code issues will be determined on a "case by case" basis. Project designers will be expected to meet with the University Project Manager for a review of code issues which may affect the replacement of chiller equipment. The University is designated as the "Building Authority" and, as such, will determine the extent of building/systems modifications required for each replacement project.

H. Accessories
   (1) No additional University design requirements.

I. Hot Water Piping and Pumps
   (1) No additional University design requirements.

J. Isolation of Piping at Equipment
   (1) No additional University design requirements.

K. Flexible Pipe Connectors
   (1) No additional University design requirements.

L. Meters, Gauges, and Flow Measuring Devices
   (1) No additional University design requirements.

M. Unit Heaters
   (1) No additional University design requirements.

N. Converters
   (1) No additional University design requirements.

O. Do not provide the following components, unless approved by the Director:
   (1) Dual Duct Constant VAV boxes, see 3.8 A for Air Distribution Systems
   (2) Fan powered VAV boxes, see 3.8 A for Air Distribution Systems.

P. Air Delivery Devices
   (1) Refer to 3.8 A for Air Distribution Systems.

Q. Noise Control
   (1) Provide noise control devices as required by the University Project Manager and the department representative.

3.11 Communications and Security Wiring Systems

A. Introduction
   (1) Designer Qualifications.
      a. The University expects a high quality, standards-based communications infrastructure on campus. The design of communications infrastructure for new or remodeled facilities shall be engineered by a qualified Registered Communications Distribution Designer (RCDD) actively affiliated with the Building Industry Consulting Services International (BICSI) organization. Further, engineering designs shall meet all applicable Federal, State, and local codes and standards, and shall be designed in accordance with this Design Manual and University of Utah Supplement.
   (2) Communications Entrance.
      a. The design for new buildings will include a communications service entrance and provisions for running communications conductors to various parts of the building.

The scope of these provisions will be determined in consultation with Facilities Management through the University Project Manager. The communications service entrance will interconnect the building with the University underground communications duct system. The communications service entrance will include a minimum of six 4-in ducts into the building. The service entrance ducts shall be run without bends. Where this is not possible specific approval of Facilities Management electrical engineer(s) through the University Project Manager will be required.

(3) CAD Layering.

a. Telecommunications wiring, conduit, and raceways are to be layered separately from electrical layers.

(4) Installation by UIT.

a. In an effort to maintain a consistent structured wiring system throughout campus, University Information Technology (UIT) department is the only entity on campus authorized to install new communication cabling, both inside and between buildings. Therefore, the designer is to notify contractors that the University of Utah installs their own telecommunications wiring in new and remodeled spaces. Project specifications are to require the Contractor to coordinate the work with the University, thereby properly sequencing the installation of the wiring with the rest of the construction work. Wiring shall be completed prior to the installation of drop ceiling grid.

(5) Total Raceways.

a. It shall not be acceptable to run low voltage wiring as a free air system. All low voltage wiring systems shall be run in conduit in walls up to a raceway system. The raceway system can be specified as J-hooks, cable tray, conduit, or any other approved cable management system.

(6) Cable Tray.

a. Where appropriate cable tray shall be provided to facilitate the installation of communication cable in University buildings. Where provided, cable tray shall be installed in such a manner that free and unobstructed access is provided at all times after completion of construction.

B. Communications Duct Banks

(1) General

a. Duct banks will be provided to house underground communication cables. See Detail Drawing COM-3. Duct banks will be concrete encased round bore plastic duct. Typically, the duct size should be 4 inches. Spare ducts will be provided in duct bank installations in consideration of the future needs of the campus communications system. Duct banks will have a minimum slope of 4 inches per 100 ft. Seal around all cables entering manhole with Virginia KMP Presstite Permagum. Provide plastic plugs in both ends of all unused ducts and seal with silicon sealant. Concrete encasement will be a minimum of three inches between ducts and between ducts and earth. The top of the concrete encasement will be a minimum of 3 ft. below finished grade. Care shall be taken during installation to insure no debris gets into the line. After completion a mandrel not less than 12 inches long and approximately 1 ½ inch diameter less than the duct diameter will be pulled through each duct to insure that no debris has collected in the duct. Mandrel pulls shall be witnessed by the A/E and

University Project Manager. The A/E should inspect duct bank construction before concrete is poured. Provide polypropylene pull rope in each unused duct.

(2) Rigid Galvanized Steel

a. Where duct banks enter manholes, buildings or vaults, a 10-ft. length of rigid galvanized steel conduit will be used for each duct. All elbows and offsets in duct runs will be made of rigid galvanized steel.

(3) Maximum Bend Radius

a. All communications ducts shall be installed in such a manner as to be free of bends, twists, turns etc. Absolutely no 90, 45, 30-degree bends shall be allowed. A maximum bend radius of 5 degrees shall be allowed. Any other bend necessary shall require approval of Facilities Management Electrical Engineer(s) and the Campus Utility Services Electronics Shop (upon request to the University Project Manager). Any bends required greater than 5 degrees shall be rigid steel. The A/E shall provide elevation drawings that show elevation differences.

C. Telecommunications Service Entrance and Termination

(1) General Information:

a. "Telecommunications service entrance" on campus is defined as the means by which connections for Local Exchange Carrier's, Campus Distribution, Interexchange Common Carrier, etc. will enter and terminate in campus buildings. Entrance conduit begins at the communications manhole nearest the structure and ends when terminated in the Equipment Room for that structure, see 3.11 D for Equipment Rooms.

(2) Types of Entrances

a. The acceptable means of service entrance on campus is an underground conduit system. All entrance conduit shall be 4-in PVC conduit, encased in concrete, and buried at a minimum of 24-inches below grade. The actual number of conduits designed for any campus structure will be determined by the University Project Manager and UIT Project Coordinator during the design phase of the project.

b. On each new building, and where approved for each remodel, include a 2-in roof mounted galvanized rigid conduit with weather-head in the system design. The new conduit is to extend 2-ft above the finished roof. The base is to be sufficiently secured to support future electronic equipment which may be attached to the conduit. The designer shall coordinate with the A/E for a location:

i. which is reasonably close to (preferably directly over) a telecommunications room;

ii. which is near a roof access for maintenance and service; and,

iii. which would have walkway approach protection to limit the possibility of roof damage. If possible, this roof conduit should be located directly over the top floor telecommunications room. Extend conduit into the building either to the telecommunications room or to the nearest communications cable tray. Review the design with the University Project Manager and UIT project coordinator for approval at the design development submittal review or prior to completion of the bidding documents.

(3) Bends

a. Bends in service entrance conduit are generally considered unacceptable. However, should bends be unavoidable, they shall be reviewed for approval by Facilities

Management and UIT prior to installation; and, they will be long, sweeping bends with a radius not less than ten times the internal diameter of the conduit. There shall be no more than the equivalent of two quarter bends (180º total) between pull points. All bends and sweeps are to be in rigid conduit.

(4) Preventing Shearing:

a. In order to prevent shearing of conduits, each entrance conduit is required to have 10-feet of rigid steel conduit leaving and entering any structure including buildings, manholes, etc. Ends of metallic conduit shall be reamed and bushed.

(5) Manholes

a. Communication manholes will be provided for the underground communications distribution system.

b. Manholes used for communications will not be used for the distribution or termination of any electrical cables.

c. Communication Manhole Fabrication Requirements

i. Covers will be clearly marked “COMMUNICATIONS”.

ii. Communications manholes will have a minimum of 96 square feet of floor area (unless pre-approved by UIT) with a minimum 8-ft ceiling height; and, are to be reinforced concrete, either poured in place or pre-cast; and, must be suitable for H20 highway loading.

iii. Manholes must be equipped with bonding inserts and struts for racking. Include cast-in provisions for cable supports (equal to Super Strut Series No. C300).

iv. Include pulling eyes cast into each wall of the manhole. Pulling eyes shall be at least 2.2-cm in diameter.

v. Manholes must include a sump of at least one (1) cubic yard of crushed rock with a 3-ft diameter.

d. Required manhole accessories shall include, but not be limited to:

i. Manhole cover and seat shall be in accordance with Detail Drawing COM-4.

ii. Require a minimum of two ground rods for each manhole, each shall be 3/4-in x 10-ft, copper clad steel, and each ground shall extend below the manhole at opposite corners of the manhole floor.

iii. Require complete water proofing of the manhole, entrance structure, and all openings.

iv. Require bell end entrances for all conduits. Specify threaded metallic type Emerson O.Z. Gedney Bell End Entrances (or equal). Require the Contractor to seal all conduit entrances.

v. Require a demountable stainless steel ladder affixed at both top and bottom, but removable from below by the worker if desired.

vi. The ladder system, including all hardware, is to be submitted for review and approval before purchase and installation.

vii. The ladder top shall be hooked to the side of the manhole.

viii. Each bottom rail shall be drilled to receive a security pin which locks the ladder to angle flanges anchored to the concrete manhole floor. Specify both the pin and its associated pin lock to be attached to the ladder rail by stainless steel chain to prevent misplacing the pin locking devices (the required security chain is not shown in the picture below). This assembly will provide a safe entry

descent, and enable workers to unpin the bottom rails and unhook the ladder top when additional workspace is desired while working in the manhole.

ix. All hardware shall be specified stainless steel.

x. The following pictures indicate the approved attachments, except for the required *pin*-to-*pin lock*-to-*ladder rail* stainless steel chains (one for each ladder rail) described above.

e. Spacing of manholes will be carefully considered to allow reasonable pulling tensions for cable pulls between manholes. Spacing between manholes shall not exceed 400-feet.

f. The University of Utah requires all communications manholes to be fitted with a secure access system. Coordinate with the University Project Manager and UIT for current approved details regarding manhole security and access systems. The only approved secure access system is manufactured by the University Metal Shop, with a lock provided by the University Key Shop. When manholes are included in the design, coordinate with the University Project Manager to either:

i. Cover the cost by internal work order, or

ii. Notify Facilities Management Business Services that an allowance of $1,000 is required on the Bid Response Form when bidding documents are being prepared. The work order amount or bid allowance shall be $1,000 for each manhole.

(6) Terminating Conduit Inside a Building

a. Service entrance conduits should enter the communications room without bends. If the conduits enter the building below the finished floor, this is best accomplished by creating a trench for the conduits to enter. The trench must be a minimum of three (3) feet wide to allow the bending of cable inside the trench. The trench must be fitted with a steel grate to cover the entire span of the trench. Knockouts in the grate, for cable entrance and exit, must be provided. The grate must be capable of withstanding weight in excess of 1,000 pounds. If conduits enter from the ceiling, they should terminate 4-in below the finished ceiling. It is imperative that slope and grade be considered in the design and installation of entrance conduits, ensuring

that conduits inside the building are not lower than the conduits leaving the manhole, thus creating drainage problems.

(7) Redundant Entrance Provision

a. All new buildings shall be equipped with dual entrance facilities, originating from separate manhole structures. All standards that apply to the primary entrance facility apply to the redundant facility. Any deviation from this standard shall be approved by both the University Project Manager and UIT Project Coordinator.

(8) Fill

a. All conduit must be concrete encased.

D. Equipment Rooms (ER)

(1) Equipment Rooms (or "ER") provide secure space and maintain suitable operating environments for large communications and/or computer equipment. Equipment Rooms are generally considered to serve a building, where Telecommunications Rooms generally serve only one floor of a building. Any or all functions of a Telecommunications Room may be provided by an Equipment Room.

(2) The Equipment Room is typically the point of demarcation ("dmarc") for the following services:

a. Local Exchange Carrier (Qwest)
b. Fiber Optic Network
c. Building Maintenance Systems
d. Security Systems

(3) Considerations for Design

a. When designing Equipment Rooms, consider incorporating building information systems other than traditional voice and data communications systems (*e.g.* CATV distribution systems, alarm / security systems, and audio/paging systems). In most instances, the Equipment Room may also serve as the entrance facility for the building communication.

b. The design of a new Equipment Room should begin with an assessment that considers each of the factors listed below. The information gathered from this assessment shall be considered by the designer at all stages of the project design, along with guidelines and requirements of applicable local, state, federal standards, this Design Manual and the University of Utah Supplement.

i. Customer Requirements
ii. Telecommunications Pathway Locations
iii. Service Provider (Local Exchange Carrier [LEC]) Requirements
iv. Environment/Facility Conditions and Resources

(4) Locating the Equipment Room

a. The location of the main Equipment Room can have significant impact on all other aspects of communications systems distribution design. Location selection is to include consideration of spaces immediately adjacent to the Equipment Room (beside, below, and above). In general, the main Equipment Room should be located near the building center to minimize cable distance.

b. Design of Equipment Rooms shall take in to consideration:

i. Services to be terminated

ii. Access and proximity to distribution cable pathways
iii. Building facilities and access to the Equipment Room
iv. Local Exchange Carrier (LEC) requirements
v. Proximity to electrical service and EMI sources
vi. Space required for equipment
vii. Provisions for future expansion

c. Do not locate Equipment Rooms in places that are subject to the following conditions:
i. Water infiltration
ii. Steam infiltration
iii. Humidity from nearby water or steam
iv. Heat (*e.g.*, direct sunlight)
v. Any other corrosive atmospheric or environmental conditions

d. Shared use of Equipment Room space with other building facilities shall be avoided. Locations which are unsatisfactory for Equipment Rooms include space in or adjacent to:
i. Electrical Closets
ii. Boiler Rooms
iii. Washrooms
iv. Janitor Closets
v. Storage Rooms
vi. Any space that contains sources of excessive EMI; hydraulic equipment or other heavy machinery that may cause excessive vibration, steam pipes, drains, or clean-outs

e. Avoid locations that are below the water level unless preventive measures against water infiltration are employed. The room shall be free of plumbing and electrical utilities that are not directly required to support the Equipment Room function. A floor drain is required if there is any risk of water entering the facility.

(5) Working Clearances
a. NEC Section 110-16 requires three (3) feet of clear working space around equipment with exposed live parts. This applies to communication Equipment Rooms.

(6) Conduit Accessibility
a. It is essential that clear, unobstructed access to cable trays and conduits be provided within the Equipment Room. Entrance conduit and distribution conduit/cable trays should enter and exit on the same wall. If this is not possible, a cable tray inside the room should be provided for distribution from wall to wall.

(7) Electrical Systems
a. Power for telecommunications equipment in Equipment Rooms should be supplied by feeders dedicated only to supplying that equipment (NEC Article 215). Quadplex power receptacles with separate 20-amp feeders and isolated grounds, should be mounted on every wall in the Equipment Room, spacing should be on 6-ft centers, and located 84-in above the finished floor. Other power requirements (e.g. fluorescent lighting, motors, air conditioning equipment, etc.) should be supplied by a separate feeder, conduit, and branch panel.

(8) Dimensions

a. Determination of "adequate size" for the Equipment Room depends upon what services are to be terminated there. Input from UIT personnel, LAN support groups, Electronics Shop, HVAC and UCard personnel should be considered. Minimum size for an Equipment Room is 10-ft by 15-ft. The actual size of the Equipment Room will be determined during the design phase of the project when more information, pertinent to the size and application of the building, is available.

(9) Space Allocation & Layout:

a. The layout of major communications equipment in the main Equipment Room shall facilitate the effective routing of power and communications cabling. The main Equipment Room shall provide adequate space for:

i. All planned equipment

ii. Access to equipment for maintenance and administration

iii. Future growth

b. In addition to space for communications and security system requirements, an Equipment Room may also include space requirements for environmental control equipment, power distribution/conditioners, and UPS systems.

(10) Determining Size of Equipment Rooms (Based on Area Served)

a. When specific equipment that may be used in an Equipment Room is not yet known, the following criteria may be used to determine the minimum size of the Equipment Room.

i. Divide the amount of useable floor space (building area used by occupants during normal daily activity, including hallways, copier rooms, etc.) by 100 $ft.^2$ (or smaller if average work area size is less) to determine the number of individual work areas; or, count the number of individual work areas (offices, conference rooms, cubicles, etc.).

ii. Multiply the number of work areas to be served by 0.75 $ft.^2$ to determine the minimum Equipment Room size.

b. If there are fewer than 200 work areas, the Equipment Room shall be no less than 150 ft^2. In special use buildings (hospitals, hotels, etc.) Equipment Room sizes may vary. Refer to ANSI/EIA/TIA-569-B.

(11) Fire Protection / Fire Rating / Fire Suppression

a. All ER spaces shall be designed with pre-action fire suppression systems (the space remains water free until both heat and smoke detectors are activated). Fire alarms should be installed in accordance with 3.5 H (5). Portable fire extinguishers should be located in the room as close to the entrance as possible. A minimum of a 2-hour fire rating should be provided with a fire sprinkling system exterior to the room.

(12) Environmental Considerations

a. Environmental considerations should be determined prior to design; however, assume that air conditioning will be a year-round requirement and should be capable of maintaining a maximum temperature of 75 degrees F and a relative humidity of 30% to 50%.

(13) Floor Requirements

a. Equipment Room spaces are generally considered to be computer rooms. Design these rooms with raised floors, 18-inch clearance (minimum), to ensure maximum flexibility of power and communication cabling.

(14) Loading Requirements

a. The floor rating under distributed loading must be greater than 12 Kpa (250 lb/ft.^{2}).

b. The floor loading under concentrated loading must be greater than 4.4 M (1,000 lbs) in areas that will support communications equipment, racks, and cabinets.

(15) Ceiling Requirements

a. The recommended height of the finished ceiling to the finished floor in an Equipment Room is sufficient height to allow 8 ft. 6 in. clear space below light fixtures. Any ceiling protrusions (ventilation, sprinklers, etc.) must be located with a minimum clearance height of 8 ft. 6 in. The ceiling finish must minimize the introduction of dust, and be light colored to enhance room lighting.

(16) Lighting Requirements

a. Equipment Rooms shall be designed with adequate and uniform lighting that provides a minimum equivalence of 540-lux (50 foot-candles) when measured 3 ft. above the finished floor. Locate lighting fixtures a minimum of 8 ft. 6 in. above the finished floor. Locate light switches near the entrance(s) to the Equipment Room. Power for lighting should not come from the same circuits as power for the communications equipment. Provide emergency lighting as required by applicable building codes.

(17) Security Design Considerations

a. Provide adequate clear wall space to accommodate the required number of CCure iStar security control panels as determined by UCard. Provide an adequate quantity of power outlets to serve the iStar panels.

(18) Cable Management

a. Cable management, either overhead or under the floor, must be given careful consideration during design. As a minimum, all communication spaces shall be designed with cable trays installed at a height of 108-in above the finished floor, with minimum dimensions of (4”d x 12”w) and which wraps the entire room. Considerations for additional cable trays and/or raised floor will require consultation with the University Project Manager, the UIT project coordinator, and the tenants of the proposed building or space.

(19) HVAC Requirements

a. Telecommunications equipment requires full time operation of heating, ventilating, and air conditioning in the room to meet the criteria shown below. If the building’s HVAC system cannot provide continuous service to satisfy the ER room’s environmental requirements, consult with the University Project Manager and UIT project coordinator to consider an independent HVAC system. If approved, each ER space would be designed with an independent cooling system capable of operation when other chiller and ventilation systems may be interrupted (*e.g.* fire alarm tests, maintenance, season off-times for cooling or heating, etc.). The system should be designed with a high performance cooling system utilizing positive pressure techniques.

TEMPERATURE RANGE	64 degrees to 75 degrees F
HUMIDITY RANGE	30 percent to 55 percent relative
HEAT DISSIPATION	750 to 5,000 BTUs per hour per cabinet (number of cabinets to be determined through consultation with Facilities Management through the University Project Manager).

(20) Electromagnetic Interference (EMI)

a. Because EMI causes severe problems with electronic equipment, telecommunications rooms shall not be shared with electrical feeders, branch circuits of noisy equipment or transformers.

(21) Un-Interruptible Power Systems (UPS)

a. A building UPS system shall be installed and connected to all communication spaces; and, should be equipped with access to building emergency generator power to protect critical voice and data systems. The sizing of the UPS will depend on the size and use of the building which is to be determined during the design phases with the assistance of UIT and the building occupants' IT staff.

(22) Telecommunications Grounding and Bonding

a. A proper grounding and bonding infrastructure is essential for the reliable operations of today's sensitive telecommunications equipment and systems.

b. The building telecommunications grounding and bonding should follow ANSI-J-STD-607-A. This standard is intended to augment (not replace) the requirements specified in the NEC.

c. The grounding and bonding infrastructure originates at the electrical power service entrance and extends throughout the building. Predrilled copper grounding bus bars are to be installed in all TR's and ER's.

d. Whenever two or more telecommunications bonding backbones (TBB) are used within a multistory building, they are to be bonded together with a grounding equalizer (GE) at the top floor and every third floor in between.

e. The size of wire used in the telecommunications bonding backbone is distance driven. See Drawing Detail COM-2.

TELECOMMUNICATIONS BONDING BACKBONE LENGTH (FT)	TELECOMMUNICATIONS BONDING BACKBONE (AWG)
1 – 13 feet	6 AWG
14 – 20 feet	4 AWG
21 – 26 feet	3 AWG
27 – 33 feet	2 AWG
34 – 41 feet	1 AWG
42 – 52 feet	1/0 AWG
53 – 66 feet	2/0 AWG

E. Telecommunication Rooms ("TR")

(1) Telecommunications Rooms differ from Equipment Rooms and entrance facilities in that they are generally considered to be "floor-serving" (as opposed to "building-serving") spaces that provide a connection point between backbone and horizontal distribution pathways. Requirements for the design of ERs found in this document, specifically power/UPS, HVAC, fire alarm / suppression, security, cable management, and electrical systems also apply to TR design.

(2) Telecommunication Rooms are "floor-serving" spaces for:

a. Voice equipment (e.g. KSU's, etc.)

b. Data equipment (routers, concentrators, etc.)

c. Cable terminations (both horizontal and backbone)

d. Fiber optic terminations (both horizontal and backbone)

e. Cross-connect wiring

(3) Size

a. TRs vary in size depending on their function and the size of the floor area they serve. Typically size requirements are based on distributing telecommunications service to one individual work area per 100 feet ^{2} of occupied work space. While the actual size of Telecommunications Rooms will depend on the application of the building and therefore will require input from various entities during the design phase of the project, minimum Telecommunications Room sizes are shown in the table below:

IF THE SERVING AREA IS....	THEN THE TR MUST BE AT LEAST....
Below 740 meters^2 (8,000 feet^2)	3.0 meters x 3.0 meters (10 feet x 10 feet)
Larger than 740 meters^2 (8,000 feet^2)	3.0 meters x 3.6 meters (10 feet x 12 feet)

(4) Working Clearances

a. NEC Section 110-16 requires three (3) feet of clear working space around equipment with exposed live parts. This applies to Telecommunication Rooms.

(5) Conduit Accessibility

a. It is essential that clear, unobstructed access to cable tray and conduits be provided within the Telecommunication Room. When possible entrance conduit and distribution conduit/cable tray should enter and exit on the same wall, if this is not possible cable tray inside the room should be provided for distribution from wall to wall.

(6) Electrical Systems

a. Power for telecommunications equipment in Telecommunications Room should be supplied by feeders dedicated only to supplying that equipment (NEC Article 215). Quadplex power receptacles with separate 20 amp feeders and isolated grounds, should be mounted on every wall in the Telecommunications Room, spacing should be on six (6) foot centers, located 84-in above the finished floor. Other power requirements (*e.g.* fluorescent lighting, motors, air conditioning equipment) should be supplied by a separate feeder, conduit, and branch panel. Refer to 3.11 D (22) for grounding requirements.

(7) Lighting

a. Telecommunication Rooms should have adequate and uniform lighting. Design room lighting to maintain an intensity of 50 foot-candles (LM/ft^2) at 3 feet above floor level. Coordinate light fixture positions with the equipment layout, especially overhead cable trays, to ensure the light is not obstructed.

(8) HVAC Requirements

a. Telecommunications equipment requires full time operation of heating, ventilating, and air conditioning systems. If the building's HVAC system cannot ensure continuous operation (including weekends, holidays, off-season, maintenance, etc.), coordinate with the University's Project Manager and UIT to consider stand-alone systems with independent controls. Typical room requirements are as follows:

TEMPERATURE RANGE	64 degrees to 75 degrees F
HUMIDITY RANGE	30 percent to 55 percent relative
HEAT DISSIPATION	750 to 5,000 BTUs per hour per cabinet (number of cabinets to be determined through consultation with Facilities Management through the University Project Manager).

(9) Structural Guidelines

a. Telecommunications Room walls should extend from the finished floor to the structural ceiling (*e.g.* the slab).

b. If ceilings shall be installed, they shall be a minimum of 2.6 meters high to provide space over the equipment frames for cables and suspended racks.

(10) Fire Alarm

a. A fire alarm should be installed in all Telecommunications Rooms. A portable fire extinguisher should be made available inside all Telecommunications Rooms. Refer to 3.5 H (5) for fire alarm requirements.

(11) Locating Telecommunication Room

a. It is imperative that TRs be located so as to minimize cable lengths for both horizontal and vertical cable runs.

b. Vertical Distribution

i. When designing TRs for vertical distribution it is preferable to "stack" TRs so that the Telecommunication Room on level one is located directly below the Telecommunications Room on level two, etc. TRs should be connected to one another via four (4), 4-in conduits. Conduits should penetrate the floor in the TR on the far left corner of the TR, and extend no less than 2-in above the finished floor.

c. Horizontal Distribution

i. Telecommunication Rooms shall be located so as to maintain a distance no greater than 90-meters (cable length) from the furthest termination point (communication outlet) being served by that TR. Ensure that conduits and cable trays feeding the Telecommunication Room terminate *completely inside* the TR.

F. Communications Distribution Systems (Pathways & Spaces)

(1) Definition

a. Communications pathways and spaces are facilities used to distribute and support cable and connecting hardware between Equipment Rooms; and, between Equipment Rooms and the work area outlet. These spaces may include conduit, cable tray, open air plenums, cellular floor duct, etc.

(2) Backbone Communication Pathways

a. Backbone communication pathways may consist of shafts, conduits, raceways, and floor penetrations (*i.e.* sleeves or slots) which provide routing space for communication cables.

(3) Sleeves & Slots

a. Vertically aligned TRs with connecting sleeves or slots are the most common type of backbone pathway.

b. Position cable sleeves or slots adjacent to a wall, which can support backbone cables. Sleeves or slots shall not obstruct wall terminating space. All sleeves and slots shall be constructed in accordance with the National Electrical Code (NEC) and local fire codes, and shall have curb, a minimum 2 inches high from the finished floor.

c. Design sleeves with a 4-in diameter, unless a smaller size is required by the structural engineer.

d. The following table provides general guidelines for determining the number of 4-in sleeves required, based on ANSI/EIA/TIA-569.

TOTAL SQUARE FEET	QTY- OF SLEEVES
Up to 50,000	3
50,000 to 100,000	4
100,000 to 300,000	5-8
300,000 to 500,000	9-12

e. The following table provides general guidelines for determining the sizes of slots required, based on ANSI/EIAITIA-569.

TOTAL SQUARE FEET	SIZE OF SLOT
Up to 250,000	6-in x 9-in
250,000 to 500,000	15-in x 46-in
500,000 to 1,000,000	23-in x 51-in
1,000,000 to 2,000,000	38-in x 61-in

(4) Open Shafts

a. Open shafts should only be used where large quantities of cables are required. Backbone cables should never be located in elevator shafts.

(5) Conduit / Enclosed Metallic Raceways

a. Conduit or enclosed raceways may be used to run cables “point to point” where intermediate splicing is not required, or where physical protection or enhanced security is required.

b. The following table indicates the “conduit fill ratio” based on area and the minimum bend radius. Apply these fill percentages to straight runs with nominal offsets equivalent to no more than two 90º bends.

CONDUIT			AREA OF CONDUIT			MINIMUM BEND RADIUS
Trade Size (in.)	Internal Diameter	Area = .79D ^{2} Total 100%	Maximum Occupancy A (1 Cable) 53% Fill	Maximum Occupancy B (2 Cables) 31% Fill	Maximum Occupancy C (3 or more) 40% Fill	10X Conduit Diameter
¾	0.82	0.53	0.28"	0.16"	0.21"	8
1	1.05	0.87	0.46"	0.27"	0.35”	11
1 ¼	1.30	1.51	0.80"	0.47"	0.60"	14
1 ½	1.61	2.05	1.09"	0.64"	0.82"	16
2	2.07	3.39	1.80"	1.05”	1.36"	21
2 ½	2.47	4.82	2.56"	1.49"	1.93'	25
3	3.07	7.45	3.95"	2.31"	2.98"	31
3 ½	3.55	9.96	5.28"	3.09"	3.98"	36
4	4.03	12.83	6.80"	3.98"	5.13"	40
5	5.05	20.15	10.68"	6.25"	8.06"	50
6	6.07	29.11	15.43"	9.02"	11.64"	60

(6) Horizontal Communication Pathways

a. Horizontal distribution systems (or horizontal pathways & spaces) consist of structures that conceal, protect, and support horizontal cables between the communications workstation outlet and the horizontal cross-connect in the serving Telecommunications Room.

b. Horizontal communications pathways are used to distribute and support horizontal cable and connecting hardware between the workstation outlet and the Telecommunications Room. These pathways & spaces are the "container" for the horizontal cabling.

c. It is the responsibility of the designer to review all proposed horizontal distribution systems with the UIT project coordinator to ensure that the systems design:

i. Makes optimum use of the ability of the horizontal cabling system to accommodate change,

ii. Is as unconstrained as possible by vendor-dependence,

iii. Complies with ANSI/NFPA 70 (ref. 7.1), this Design Manual and University of Utah Supplement, Local, State, and Federal Codes, and,

iv. Complies with ANSI/EIA-TIA-569 (Ref. 7.20).

(7) Design Considerations

a. Horizontal distribution systems shall be designed to accommodate diverse user applications including:
    i. Voice Communications
    ii. Data Communications
    iii. Local Area Networks (LANs)
    iv. Wireless Applications
b. The designer shall also consider any other building information systems (*e.g.* CATV, building alarms / security, audio PA systems, etc.), which may require area/space in the horizontal distribution system, and shall allow for these systems accordingly.
c. An effective design of a building's horizontal distribution system should meet the following criteria:
    i. All applicable local, state, and federal, codes.
    ii. All applicable BICSI, ANSI, NFPA, EIA/TIA, UL, NEC, IEEE, ASTM, BOCA, FCC, SBC, ISO, and State adopted codes.Provide flexible cable distribution to workstation locations
    iv. Facilitate ongoing maintenance
    v. Easily accommodate future changes in equipment and services
    vi. Minimize occupant disruption when horizontal pathways and spaces are accessed.
    vii. A minimum of three cable runs per individual workstation.
d. The horizontal distribution system shall be designed to handle all types of communications cabling (i.e., UTP, STP, Coax, and Fiber Optic). When determining the type and size of the cable pathway, consider the quantity and size of the cables that the pathway is intended to house, and allow for growth of the area served over the planning cycle.
e. When designing the horizontal distribution system, it is important to consider adds, moves, and changes, and minimal disruption to immediate occupants.

(8) Number of Cable Runs per Work Area
    a. The pathway design should allow for a minimum of three cable runs per individual work area.

(9) Electromagnetic Interference (EMI)
    a. Because EMI causes severe problems with electronic equipment, telecommunications, and data communications, avoidance of all potential sources or electromagnetic interference shall be a primary consideration when designing a horizontal distribution system. To avoid electromagnetic interference, all distribution pathways should provide clearances of at least:
        i. Four ft. (4' or 1.2 m) from large motors and/or transformers
        ii. One ft. (1' or 0.3 m) from conduit and cables used for electrical power distribution
        iii. Five in. (5-in or 12 cm) from fluorescent lighting
    b. Horizontal distribution pathways should cross perpendicular to fluorescent lighting and electrical power cables or conduits.
    c. For additional clearance requirements, see ANSI/EIA-TIA-569 and ANSI/NFPA 70.

(10) Grounding & Bonding

a. Horizontal pathways shall be grounded and bonded in accordance with the requirements specified in ANSI J-STD-607-A, except where other codes or local authorities impose more stringent requirements.

(11) Fire-Stopping

a. Install removable fire pillows.

b. All horizontal pathways that penetrate fire-rated barriers must be sealed in accordance with applicable codes. Provide smoke rated protection as required for smoke rated wall and floor penetrations.

(12) Administration of Horizontal Distribution Systems

a. Utilize standard methods and procedures for labeling and managing horizontal pathways. Locate markings so that they are clearly visible after installation, and easily distinguishable from any markings that appear on individual components. For details on guidelines and requirements for the administration of horizontal pathways and spaces, see BICSI TDM Manual Chapter 4 and ANSI/TIA/EIA-606.

(13) Types of Horizontal Distribution Systems

a. Many types of horizontal distribution systems are acceptable for installation at the University of Utah. Many buildings may require two or more of the following systems to meet all distribution needs. Acceptable types of horizontal pathways are:

i. Unlimited access (raised floors).

ii. Ceiling zones and grids

iii. Cellular floors.

iv. Conduit

v. Underfloor ducts (one-level or two-level)

vi. Cable tray

(14) Sizing of Horizontal Pathways

a. The size requirements for horizontal distribution pathways depend on the following:

i. Usable floor space served by the pathway.

ii. Maximum occupant density (*i.e.*, floor space required per individual work area).

iii. Cable type and diameter.

iv. Pathway capacity (requires that the fill factor be taken into account).

TRADE SIZE	CABLE OUTSIDE DIAMETER (INCHES)									
Inches	0.13	0.18	0.22	0.24	0.29	0.31	0.37	0.53	0.62	0.70
½	1	1	0	0	0	0	0	0	0	0
¾	6	5	4	3	2	2	1	0	0	0
1	8	8	7	6	3	3	2	1	0	0
1 ¼	16	14	12	10	6	4	3	1	1	1
1 ½	20	18	16	15	7	6	4	2	1	1
2	30	26	22	20	14	12	7	4	3	2
2 ½	45	40	36	30	17	14	12	6	3	3
3	70	60	50	40	20	20	17	7	6	6

TRADE SIZE	CABLE OUTSIDE DIAMETER (INCHES)									
Inches	0.13	0.18	0.22	0.24	0.29	0.31	0.37	0.53	0.62	0.70
3 ½	-	-	-	-	-	-	22	12	7	6
4	-	-	-	-	-	-	30	14	12	7

b. The usable floor space (also referred to as "office space") is generally considered to be the building area used by the occupants for their normal daily work functions. For design purposes, this space should include hallways. All other common areas in the building should be disregarded.

c. The occupant density or floor space allocation per office or individual work area for the University is 100 ft^2 of usable floor space.

d. Cable Density. Design for pathway capacity to accommodate a minimum of three horizontal cable runs per workstation location.

e. Cable Diameter: For planning purposes use the following table to determine the minimum amount of Horizontal Pathway Distribution capacity.

HORIZONTAL CABLE TYPE	TYPICAL OUTSIDE DIAMETER
Four-Pair Category 5, 100-ohm UTP	0.25 to 0.28 inches
Two-Pair Shielded Twisted Pair, 150-ohm STP	0.31 to 0.43 inches
Duplex 62.5/125pm Optical Fiber Cable	0.11 to 0.18 inches

f. Conduit Capacity: Adequate planning should allow for a minimum of 1 inch conduits to each workstation location. Maximum conduit fill capacities shall not be exceeded in accordance with ANSI/NFPA 70, Chapter 9.

(15) General Conduit Distribution

a. A horizontal conduit system consists of conduits radiating from the Telecommunications Room to the work station outlets in the floor, walls, ceilings, and columns of a building.

(16) Suitable Conduit

a. The following types of conduit are deemed suitable for building installation at the University:

i. Flexible Metal Tubing - (limitations apply, obtain specifications and direction from the UIT project coordinator)

ii. Rigid metal conduit (typical two (2), 3/4 inch conduits to each workstation location for horizontal distribution).

(17) Conduit Runs

a. Conduit runs should be designed for the most direct route, parallel to building lines, with no more than two (2), 90 degrees bends between pull points or pull boxes. Design each run with a maximum horizontal cable run of ninety (90) meters (295 ft.). Continuous sections shall not be longer than thirty (30) meters without pull points or pull boxes installed.

b. It is recommended that conduit runs be kept to no more than 45 meters (150 ft.) in total length including sections through pull boxes.

(18) Conduit Quantity and Size
   a. A minimum of two (2), 3/4-inch metal conduits shall be installed from the Telecommunications Room and terminated to each four square workstation outlet.
   b. Include in the design, the installation of one ¾" metal conduit from the Telecommunications Room to termination at each wireless access point.

(19) Conduit Bend Radii
   a. The radius of a conduit bend shall be at least 6 to 10 times the diameter of the conduit. Conduits designated for Futureflex tubing shall be installed with a minimum bend radius of 12 times the diameter of the conduit.

(20) Conduit Entering Telecommunications Rooms
   a. Horizontal distribution conduits entering a Telecommunications Room should terminate near the corners and allow for proper cable racking. If conduits are entering through the floor, they must terminate four inches (4") above the finished floor. If conduits are entering through a wall, the conduits must be reamed and bushed, and terminated as close as possible to the terminating rack or wall.

(21) Completing Conduit Installation
   a. Upon completion of Horizontal Distribution Conduit, the conduits will be:
      i. Left clean, dry and unobstructed
      ii. Capped for protection
      iii. Labeled for easy identification
   b. All conduits will be equipped with a contiguous length of plastic or nylon pull string with a minimum rating of 200 lbs. (90 Kg) or a 12 AWG wire.

(22) General Cable Tray Systems
   a. Cable tray systems are used primarily as main corridor distribution apparatus. Cable tray systems should be designed as equipped to support only telecommunications and data communications cable. Shared systems with power are not acceptable under the guidelines listed in avoiding EMI.

(23) Suitable Cable Tray Systems
   a. The following cable tray systems are acceptable for installation at the University:
      i. Channel
      ii. Ladder
      iii. Solid Bottom
      iv. Trough
      v. Wire Mesh (basket), dual hung with no center support

(24) Cable Tray Runs
   a. Cable tray systems should be installed with a minimum number of bends installed, if more than three 15 degree turns are installed in a contiguous length, then de-rate the effective capacity of the cable tray by twenty-five (25) percent. Delineations in a level cable tray installation are often unavoidable, however these delineations should be kept at a minimum with each delineation not exceeding 30 degrees and 24 inches offset. The total delineation for the tray span should not exceed 180 degrees.

(25) Cable Tray Size and Capacity

a. Cable tray size and capacity will be determined by the amount and type of cable installed, the static load capacity of the tray, and the length of the support span. Cable tray systems should be designed to accommodate 100 percent future growth.

(26) Cable Tray Installation Clearance

a. Cable tray systems are to be installed with as much clearance as possible from other building facilities, and installed in the lowest position below all other building facilities but above the ceiling grid, in accordance with ANSI/NFPA standards and meeting the following criteria:
   i. 8 in. clearance from obstructions on both sides.
   ii. 8 in. clearance from obstructions to the top.
b. Installation of cable tray pulley systems installed in a solid ceiling environment should provide access points at 20 ft. on-center, and at any directional deviation greater than 15 degrees and/or 90 degree turns.

(27) Cable Tray Entering Telecommunications Rooms

a. Cable tray entering a Telecommunications Room should wrap around the room and allow for proper cable racking.

(28) Completing Cable Tray Installation

a. Upon completion of horizontal cable trays, the trays shall be inspected by the designer to verify that the trays are:
   i. Free and clear of all obstructions and debris
   ii. Free of burrs, sharp edges, and projections
   iii. Labeled for easy identification
   iv. Identified as "Telecommunications Cable Tray Only"

(29) Other Types of Horizontal Distributions Systems

a. The university has identified other types of acceptable horizontal distribution systems that may be installed. These include, but are not limited to:
   i. Unlimited access (raised floors).
   ii. Ceiling Zones and Grids
   iii. Cellular Floors.
   iv. Conduit
   v. Underfloor ducts (one-level or two-level)
b. Due to the individuality, complexity, and the broad scope of requirements for these systems. UIT will review each of these specified systems on a ‘case-by–case’ basis.

(30) Outlet Boxes, General

a. Telecommunications outlet boxes installed in dry-wall, plaster, or concrete block wall shall be single gang plaster (mud) rings. Wall phones and wireless connections shall use single gang plaster (mud) rings.

(31) Mounting Outlet Boxes, Office Environment

a. Outlet boxes installed in an office environment must be specified to meet the following criteria:
b. At least 4 in^2 by 2-1/8 in. deep
c. Mounted at least 18 inches above the finished floor or even with adjacent electrical duplex services
d. Outlet boxes shall not be placed back to back

(32) Mounting Outlet Boxes, Above Counters
   a. Outlet boxes installed above a counter will meet the following criteria:
      i. Counter with Backsplash: At least 6 inches above the top of the counter to the center of the outlet.
      ii. Counter without a Backsplash: At least 12 inches above the top of the counter to the center of the outlet.

(33) Mounting Outlet Boxes, Wireless
   a. At least 4 in^2 by 2-1/8 in. deep
   b. Mounted at 10 inches below the finished ceiling
   c. Outlet boxes shall not be placed back to back
   d. Distance between units determined by the project designer

(34) Elevator Phone
   a. Elevator phones on campus are installed and maintained by UIT.

(35) Communication Connection
   a. Include in specifications that the Contractor will be responsible for the installation of the traveling cable from the elevator panel to the Car Operating Panel ("COP"). A minimum of four (4) 18 gauge wires will be provided in the traveling cable for the purpose of communication services transport. The communication wires will extend from the COP to the access panel opening that is provided for the communication device.

(36) Conduit
   a. The Contractor shall provide a home run 3/4-inch conduit extending from the top of the elevator panel and extending to the nearest Telecommunication Room (TR or ER). UIT will provide the necessary cable to connect the emergency line to the elevator panel.

(37) Communication Device
   a. The elevator communication device (phone panel) will be a standard design and configuration per drawing Detail COM-1. The 'back-box' is required per the drawing. The University UIT Department will furnish and install the device. The approved device for elevator installation is Ramtel Corporation Model RR833. The unit is a stainless steel, brushed finish panel which meets ADA requirements. The minimum required opening that shall be provided for the approved device is 9 1/4" H x 6-5/8" W with a minimum 4-inch clearance for the back of the device.
   b. The elevator car is to be factory prepared for this device; or, the Contractor shall prepare the car to receive the device per Detail COM-1. Note that the device shall be mounted at a height which positions the activation button no higher than 48-3/4" above the finished floor.

(38) Emergency Service Line
   a. The telephone line that is used in the elevators is a standard Centrex line that automatically rings to Public Safety.
   b. It is the responsibility of the University Project Manager to order the line for the elevator and to notify Public Safety that a new elevator phone is being added to their system.

G. Security Systems

(1) Access Control and Intrusion Detection
   a. System
      i. The Access Control and Intrusion Detection system is the Software House CCure system which includes a microprocessor based and managed access control system, with options for intrusion detection, and personal protection (duress) security and specifies sensors, detection devices, signal equipment, system controls, and displays. Each system installed will utilize either the iSTAR Pro or iSTAR Edge Controllers, or designated dialer.
      ii. The system shall tie into the existing CCure access control system currently installed on the University Campus.
      iii. The system shall have access controlled doors as well as perimeter doors and hatches monitored with door position switches.
      iv. The system shall interface with the fire alarm system and in the event of an alarm, shall unlock all controlled doors designated for emergency egress.
      v. Any card access component of this system shall be an extension of the existing campus-wide CCure access control system utilized by the University of Utah for all their facilities, with all existing functions available and be completely compatible with the then current version of the CCure system installed.
      vi. Duress alarm: Performed by indicated hard wired stationary duress alarm button locations and remote wireless receivers that are triggered by portable transmitters.
      vii. Alarm Annunciation: In addition to the audible signal sounds and visual text indication on the system keypad, video images from associated cameras in the area may, at the election of Facilities Central Services, be called up immediately and automatically to an assigned workstation for viewing. No additional operations for video call up by the control officers shall be necessary. Provide all licensing as required for CCure system and video system to perform automatic video camera call up via event programming in CCure.
      viii. Battery backup for all components in security system shall be capable of operating for a minimum of 8 hours in the event of a power failure.
      ix. Security contractor shall interface ADA openers where security access control is installed to allow for proper ADA access/egress as per building code.

(2) Testing
   a. The campus Facilities Central Services Office will perform final system testing. Contractor shall provide notification to Project Manager that system is complete and ready. Project Manager will schedule the final testing with the University Facilities Central Services.

(3) Warranty
   a. Specify two-year warranty to repair or replace components of access control and intrusion detection devices and equipment that fails in materials or workmanship. Warranty should be started upon completion of final walk through and sign off with University Facilities Central Services.

(4) Equipment
   a. Equipment specified for the CCure system will be required to use the approved University Parts list. The Parts list can be found in 6.0.

b. Surge Protection: Comply with minimum requirements of UL Standard 1449, "Transient Voltage Surge Suppressors," for each component using solid-state devices and having a line voltage power source connection or an exterior underground signal connection.
c. Controllers: Provide at the locations identified, a complete and CCure System including but not limited to the following equipment:
    i. iSTAR Pro or iSTAR Edge controller: iSTAR Pro controllers can be purchased and installed as either an 8 door package or a 16 door package. The Altronix Power Supply AL300ULX can be used for powering 2 iSTAR Pro controllers when they are installed in the same room.
    ii. For a list of approved parts for the 16 and 8 Reader Front End Package Equipment refer to the University Parts list. The Parts list can be found in 6.0.
    iii. I-class Card Readers
    iv. Relay Output Contact
    v. Motion Detectors
    vi. Request to Exit Devices
    vii. Door Contacts
    viii. Power Supplies and Transformers
d. Magnetic Door Locks
    i. Magnetic door locks shall not be used within alarm and access systems at the University
e. Power Supplies
    i. Provide power supplies as per manufacturers written recommendations with total number of powered devices for each power supply restricted to only consuming 75 percent of the power supplies rated amperage. Provide separate power supplies for system controllers (As per manufacturer), card readers (12VDC, 5A), and locks (24VDC, 7A).
    ii. 120V 60Hz from locked disconnect device. System components are supplied with power through separate power supplies. Provide all required power supplies and associated transformers as specified by the manufacturer and required for the installation.
    iii. Power Source Transfer: When normal power is interrupted, system is automatically switched to backup supply without degradation of critical system function or loss of signals or status data. Whenever possible, the system should be tied to the building's emergency power.
    iv. To ensure adequate power, installer shall calculate the total power requirements of the iSTAR Pro controller and related hardware. If the maximum power consumption exceeds the output of the iSTAR Pro power supply, an additional power supply shall be connected to the system.
f. Card Access System Hardware
    i. The access control panel (iSTAR Pro and/or iSTAR Edge controller) shall be provided and wired with back-up battery power for a minimum of 8-hours operation upon loss of AC power.
    ii. The access control panel shall have provisions for relay suppressor kits for each relay used, to protect the access control panel from collapsing electrical fields.

iii. Card readers shall be HID Prox-Pro and HID Mini-Prox readers matching the readers currently installed on campus for door control. The access control panel shall support card readers using Wiegand, Proximity and Biometrics technologies.

g. Door and Window Switches
   i. Balanced-magnetic switch, complying with UL 634, installed on frame with integral overcurrent device to limit current to 80 percent of switch capacity. Bias magnet and minimum of [two] [three] encapsulated reed switches shall resist compromise from introduction of foreign magnetic fields.
   ii. Position switches on doors shall be magnetic reed switch type and shall be per manufacturers recommendations for the type of door installed on. Provide concealed door frame types.
   iii. Flush-Mounted Switches: Unobtrusive and flush with surface of door and window frame.
   iv. Overhead Door Switch: Balanced-magnetic type, listed for outdoor locations, and having door-mounting magnet and floor-mounting switch unit.
   v. Remote Test: Simulate movement of actuating magnet from central station control unit.

h. Exit Request Devices
   i. Passive Infrared (PIR) Devices: Detect request to exit by monitoring infrared energy emitted within the door exit zone. Units are sensitive to the infrared wavelengths emitted by the human body and are insensitive to general area thermal variations.
   ii. On door types (see drawing schedules) that do not show motion detectors being used, the request to exit function will be handled by the switched exit hardware devices. It shall be the responsibility of the security contractor to coordinate with the hardware contractor in wiring of power transfer hinges and switched exit devices. The only doors that do not require any exit request are doors with a reader on both sides.

i. Acoustic Type, Glass-Break Sensors
   i. Sensor Element: Microprocessor-based, digital device to detect breakage of plate, laminate, tempered, and wired glass while rejecting common causes of false alarms. Detection pattern shall be at least a 20-foot (6-m) range.
   ii. Hookup Cable: Factory installed, not less than 72 inches (1830 mm).
   iii. Activation Indicator: LED that lights on sensor housing when responding to vibrations, remaining on until manually reset at sensor controller or at central-station control unit.
   iv. Controller: Integral with sensor housing or in a separate assembly, locally adjustable by control under housing cover.
   v. Glass-Break Simulator: A device to induce frequencies into protected glass pane that simulate breaking glass without causing damage to glass.

j. Photoelectric Sensors
   i. Sensitivity: Detect standard-intruder movement within sensor's detection patterns at any speed of less than 7.5 fps (2.3 m/s) though the beam. Allow

installation of multiple sensors within same protected zone that will not interfere with each other.

ii. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

iii. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard intruder movement within sensor's detection patterns, causing an alarm.

k. Microwave Pir Dual Technology Motion Sensors

i. Single unit combining a sensor that detects changes in microwave signals and a PIR sensor that detects changes in ambient level of infrared emissions caused by standard-intruder movement within detection pattern.

ii. An alarm is transmitted when either sensor detects a standard intruder within a period of three to eight seconds from when the other sensor detects a standard intruder.

iii. Minimum Detection Pattern: A room 30 by 30 feet.

iv. PIR Sensor Sensitivity: Adjustable pattern coverage to detect a change in temperature of 2 deg F (1 deg C) or less, and standard intruder movement within sensor's detection patterns at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s) across 2 adjacent segments of detector's field of view.

v. Microwave Sensor Sensitivity: Adjustable, able to detect standard intruder movement within sensor's detection pattern at any speed between 0.3 to 7.5 fps (0.09 to 2.3 m/s). Sensor sensitivity adjustments shall be accessible only when sensor housing is removed, and sensors shall comply with 47 CFR 15.

vi. Activation Indicator: LED indicator shall not be visible during normal operation. Indicator shall light when sensor detects a standard intruder. Locate test enabling switch under sensor housing cover.

vii. Remote Test: When initiated by central-station control unit, start a test sequence for each detector element that simulates standard intruder movement within sensor's detection patterns, causing an alarm.

l. Wire and Cable

i. Provide both TPS (Twisted pair Shielded) and TP (Twisted Pair), with the appropriate number of pairs. Provide Cat 5e UTP for emergency telephone signal wiring.

ii. Cable for Low-Voltage Control and Signal Circuits: shall be shielded twisted-pair cable with drain.

iii. HID Card Reader-Weigand-Composite cable part number CSC #702790.

(a) 1-22/6 conductor overall shield (Reader)

(b) 1-18/4 conductor (Lock Power)

(c) 1-22/2 conductor (Door Contact)

(d) 1-22/4 conductor (Request to Exit)

iv. RM Style Card Reader-RS485-CSC #112102

(a) 1-18/2 pair individually shielded

v. Inside Card Reader on IN/OUT Door-Weigand-CSC #110253

(a) 1-22/6 conductor overall shield

vi. Alarm Door Contact-CSC #110105

(a) 1-22/2 conductor

vii. Duress/Panic Button-CSC #110105

(a) 1-22/2 conductor

viii. RM input/output Modules-RS485-CSC #112102

(a) 1-18/2 pair individually shielded

(5) Installation Requirements for Wiring

a. Install all wiring in raceways
b. ¾ inch minimum conduit is required
c. Multiple home runs may be contained in a single conduit of appropriate size.
d. Conceal raceways except in unfinished indoor spaces.
e. Conduit fill shall not exceed 40%.
f. Wiring shall be neat and workmanlike.
g. Cables shall be individually labeled.
h. Cable Central Services using spools, guides, supports and other devices.
i. Cable shielding and grounding SHALL be utilized in panels and enclosures.
j. Shield grounding SHALL be at the panel and NOT at the device (to avoid ground loops)
k. Cable routing within the enclosure or panel shall be neat and workmanlike.
l. Number of terminated conductors shall be in accordance with manufacturers' recommendations and/or requirements.
m. Un-terminated conductors shall be electrically isolated and secured within the enclosure or panel.
n. Appropriate splices, taps or terminations shall be in an approved junction box.
o. External device power supplies shall be installed in Facilities Central Services approved locations.

(6) Naming and Programming

a. Convention:

i. Use the official University campus building numbers, and the University designated room numbers.

ii. Descriptive abbreviations should be used as most CCure program display boxes are limited in size.

b. iSTARs:

i. Building Number: iSTAR Number L# Door#
Room Description Ex: 0003:03 L1 0166
Northwest Comm Rm
0079:02 L2 2000D L2 Data Closet 0525:19 L4
East Comm Rm by Elevator.

ii. A more complete description of the iSTAR's location, access requirements (card access, key number, how to find the room where the iSTAR is located, etc.) should be entered in the description section of the configuration identification screen.

Ex.; Located on level one, room 1001, (or across from elevator) using key RT2674 or access card.

iii. Programming:
   (a) Leave time zone box blank.
   (b) Tamper, AC power fail and Low Battery inputs should all be defined and properly working.
   (c) An event should be defined for controller communication failure.

c. iSTAR Clusters:
   i. Naming: Building Number: iSTAR L#
   Ex: 0003:03 L1 Cluster
   0079:02 L2 Cluster
   0525:19 L4 Cluster

d. Reader, Input & Output Device:
   i. Naming; Building Number: iSTAR number, (IZ, PH, EX, etc) – if included in intrusion zone, pharmacy, exterior door, etc. : (input/output type) (DC, REX, DL, ML, GB, DUR, MOT) Room number, L#, which board it is controlled by (ACM, I8 or RM) and which port or relay it is wired to on the board to which it is attached.
      (a) Ex: 0851:01 1125 Lab Reception 1-R6
      (reader 6 on ACM 1 of iSTAR 1)0043:01
      (IZ):MOT Safe Rm 1-I7 (motion sensor within intrusion zone) 0086:04 DC L1 DSL/TACC RM-4-I1 (door switch monitor on RM board number 4)
      0512:01 DC L1 E101 Conf Rm I8:1-I4 (door switch monitor on I8 board number1)
   ii. Programming:
      (a) Input and output state changes should not be sent to the Monitoring Station and should only be sent to the Journal if it is part of an intrusion zone, panic button or other life safety or high level security feature; i.e. freezers.
      (b) Readers should have the continuously active box checked.
      (c) Reverse sense of input should only be used in exceptional situations and then only temporarily.
      (d) No unused inputs, outputs, readers, doors or any other element should be defined in the system.
      (e) After complete installation, no input supervision errors, open loops, or line faults should be reporting in the Monitoring Station.
   iii. Door
      (a) Naming: Building Number: iSTAR number (Door type) – IZ (intrusion zone), EX (exterior door), PH (pharmacy) University assigned room number (if known) Floor (if applicable): Description
      Ex: 0019:03 0490 Atmos Comp/Vis 0575:01 (EX) L1 North Entry :13 3C354 Vascular Surgery Back Dr
      (b) A more complete description of the door can be entered in the description section of the configuration identification screen.
   iv. Camera:

(a) Naming: Building Number View Description (IP Address) Camera Model Number
Ex: 0086 Loading Dock (10.0.86.5) Axi P3346

(7) Facilities Central Services is generally responsible for programming the following:
a. Event:
i. Naming: Building Number: iSTAR number, (type) – (intrusion zone, duress, etc) : Event Description
(a) Ex: 0026:01 (DU) Rm 106 Duress Evt 0032:01 Unlock Usher Rm Evt 0179:01 (IZ): Arm Event Group Evt
ii. A more detailed description should be entered if the cause of the event or required action to the event needs to be displayed on the General Activity Monitor screen.
b. Clearance:
i. Naming: Building Number – Partition name if other than default, Description, (type) – (IZ-intrusion zone, PH-pharmacy, etc.), time range (D-D 0000-0000)
(a) Ex: 0093 Natatorium Men's Pool Entry Clr 0179 Ext Ent M-F 0800-1700 Clr
ii. The type and/or location of the doors in the clearance should be clear.
c. Schedule:
i. Naming: Building Number: iSTAR number (if applicable for event activation) – Description, time range (D-D 0000-0000)
(a) Ex: 0053:01 Disability Center Unlock M-F 0800-1700 Scd 0722:02 Shop Area Force Arm M-S 2200 Scd 0086 Custodial Day M-F 0600-1500 Scd
(b) Since there is no place for a detailed description, the time specification name should supply as much information in as an abbreviated form as possible.
ii. Programming:
(a) The time zone box shall be left blank when defining a time specification.
d. Groups:
i. Naming: Building Number: Floor (if applicable): Description
(a) Ex: 0512 Ext Door Grp for door group
0556 Patient ElevGrp for elevator group
0865 EvtGrp for event group
0064 InputGrp for input group
0035 OutputGrp for output group
(b) There is a description box that can be used to clarify particular group information if necessary

(8) Grounding
a. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and system pre-testing, testing, adjustment, and programming.
b. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
c. Pre-testing: Align and adjust the system and perform pre-testing of all components, wiring, and functions to verify conformance with specified requirements. Correct

deficiencies by replacing malfunctioning or damaged items with new items. Retest until satisfactory performance and conditions are achieved.

d. Testing: Provide at least 10 days' notice of acceptance test performance schedule.

e. Operational Tests: Perform operational system tests to verify conformance with specifications. Test all modes of system operation and intrusion detection. Methodically test for false alarms in each zone of space intrusion devices by simulating activities outside indicated detection patterns.

f. Installer Start-up Responsibility: The Installer shall initiate system operation. The Installer shall provide competent start-up personnel until the system is fully functional. Upon reoccurring technical problems, the Installer shall supply factory direct Manufacturer's support in the form of factory technical representation and/or diagnostic equipment until the resolution of those defined problems.

g. Final testing shall be observed by a representative of the campus Facilities Central Services Office. Complete security system shall be approved and accepted by Facilities Central Services.

H. Video Surveillance Systems

(1) General

a. The contractor or sub-contractor installing the video system must be qualified and trained to OnSSI standards and Axis certified.

b. Video Central Services systems shall integrate with the Software House CCURE 9000 software. The IP video surveillance control and Central Services system shall handle an unlimited number of cameras and alerts through a desktop-based or mobile video client.

c. The contractor or sub-contractor installing the video system shall be qualified and trained to OnSSI standards and Axis certified.

(2) Warranty

a. Manufacturers standard form in which manufacturer and Installer agree to repair or replace components of video surveillance devices and equipment that fails in materials or workmanship within specified warranty period which is two years from date of final walkthrough and sign-off by Facilities Central Services.

(3) Equipment

a. Video Surveillance Wire/Cable

i. The primary cabling is Ethernet cabling, either Cat 5 or Cat 6. Cat 6 cable shall be used for any new or replacement cable installations. Additional cable may be required for the environmental controls of outdoor housings or additional power requirements for PTZ (Pan-Tilt-Zoom) cameras. However, as cameras have continued to evolve, the additional power required for these (Power-Over-Ethernet) standard. Any deviation shall require approval from Facilities Central Services prior to installation of substitute cabling. Ethernet extenders may be used in rare circumstances to provide reliable connectivity. Use of extenders shall be approved by Facilities Central Services during the design process.

b. Video Surveillance Equipment

i. The University has standardized on the Axis product line for video surveillance. Common Axis camera models used by the university are listed. Other camera models may be required for specific surveillance purposes, but shall contain the

remote focus feature. However, any substitution or deviation from Axis camera products, or these specific Axis models, shall be approved by Facilities Central Services prior to installation.

(a) Legacy analog camera conversion: existing camera installations can be converted to the Ocularis OnSSI system with the addition of conversion hardware. While replacement of analog cameras with newer high-definition models is preferred, the following hardware shall be used in situations where analog camera images are determined to be sufficient.

c. OnSSI Video Software and Hardware

i. Facilities Central Services maintains the centrally managed servers the Ocularis Surveillance system as well as the appropriate server(s) for the cameras at various locations throughout the campus. Installations/conversions of fewer than 8 cameras will record to existing Ocularis servers. Installations/conversions of 9 or more cameras will require an additional recording server which will be supplied and maintained by Facilities Central Services. Cost of these servers is covered within monthly camera fees already billed to the departments.

ii. Video Monitoring Workstations require a minimum of:

(a) CPU: Intel core i7 (similar or better)

(b) RAM: 8GB

(c) Operating System: Microsoft Windows 7 Professional 64- bit.

(d) Graphics Adapter: PCI-Express, 1GB RAM w/dual DVI outputs 35 simultaneous Video Channels – 1GB

(e) Software: Microsoft .NET 3.5 Framework and DirectX 9.0 or newer.

iii. Switches: All IP camera installations shall be connected to a campus standard PoE rated switch.

d. Raceways, Electrical Boxes, and Fittings shall be per 3.5 Electrical.

(4) Installation

a. Install video surveillance systems and components where indicated, in accordance to NFPA 70, with equipment manufacturer's written instructions, in compliance with National Electrical Code, and with recognized industry practices, to ensure that video surveillance system complies with requirements and serves intended purposes.

b. Wiring Method: Install all wiring only in raceways, 3/4” minimum, or cable trays. Multiple home runs may be contained in a single conduit of appropriate size. Conceal raceways except in unfinished indoor spaces. Conduit fill shall not exceed 40%.

c. Wiring within enclosures: Label, bundle, wrap, and train the conductors to terminal points with 6-inches of slack minimum, 12-inches of slack maximum. Provide and use cable Central Services hardware and distribution spools. Wire shielding, where used, should remain un-cut as much as possible.

d. Number of Conductors: As recommended by system manufacturer for functions indicated.

e. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull and outlet boxes, terminal cabinets, and equipment enclosures.

f. Tighten connections to comply with tightening torques specified in UL Standard 486A.

g. Identification of Conductors and Cables: Color-code conductors and apply wire and cable marking tape to designate wires and cables so media are identified and coordinated with system wiring diagrams.

h. Install power supplies and other auxiliary components for camera devices at the locations pre-approved by Facilities Central Services.

(5) Grounding

a. Ensure that any power supplies are properly connected to an earth ground near the AC input wiring.

b. For devices appropriate for cable shield grounding, ensure that any shield wires are grounded at the power supply end of the cable to the ground referenced above.

c. Do NOT connect the shield to ground at the far end cabled device. (This will avoid the potential for “ground loops”.)

d. When disconnecting wiring, disconnect ground wires last (to provide maximum protection to the equipment and personnel.)

4.0 LANDSCAPE AND IRRIGATION STANDARDS

The DFCM Landscape and Irrigation Standards shall be followed on all University projects, along with the additional University requirements detailed below.

4.1 General

A. Applicability

(1) All landscape designs prepared for the University shall include the general and specific requirements described in this supplement, and include applicable graphics located in the section containing the detail drawings.

(2) The purpose of this supplement, including the detail drawings, is to acquaint the design consultant (Landscape Architect, herein referred to as "A/E") with these University specific landscape and irrigation requirements, as established by the University Department of Landscape Maintenance.

B. Site

(1) The University is situated on a 1,500-acre site, encompassing 600 developable acres. The site supports over 300 buildings. Since moving to its current location in 1900, the University campus has evolved into a 'look' and 'feel' identifiable as "The U of U." A mission objective of the University Department of Landscape Maintenance is to insure that the University's identity and setting is applied consistently in the design of campus green space.

C. Purpose

(1) Over years of campus evolvement, the Landscape Maintenance Department has evaluated, and continues to evaluate products, materials, and methods of irrigation and plantings in support of a cost effective, low maintenance landscape infrastructure which maintains the traditional University identity. Products, materials, plants, and system assemblies described herein and in the detail drawings have been selected to standardize campus landscape and irrigation systems; minimize the stocking of parts from multiple manufacturers; and, efficiently conserve University energy, water, and maintenance resources.

D. Definitions

(1) University Landscape Reference Standards

a. Use plant names in the specifications obtained from "Standard Plant Names" or "Bailey's Encyclopedia of Horticulture." When a name is not found in either reference, consult local resources from the nursery trade for a name which will not confuse local landscape contractors. Refer to the University Plant List, 4.3 A (4).

(2) Tree and Planting Specifications

a. Tree and planting guidelines are to be specified in accordance with ISA (International Society of Arboriculture), Utah State University Extension Service (Extension Forester), and the U.S. Department of Agriculture, except where the requirements herein are more restrictive.

(3) Plant Tagging Requirements

a. Require all plants to be tagged by the supplier nursery with the identification labels consistent with the specified plant names and project drawing identifiers if drawing symbol identifiers are used.

E. Designer(s)

(1) No additional University design requirements.

F. Contractor Qualifications and Experience

(1) Require at least one registered Certified Irrigation Contractor (CIC), with a current certification from the Irrigation Association to be included in the Contractor's work crew as a direct employee of the Contractor. The CIC will be required to meet weekly with the Irrigation Foreman of the University Landscape Maintenance Department to walk the work site and review the progress of the Work.

G. Submittals

(1) Joint A/E and Facilities Management Site Meeting

a. When the building footprint is known, and prior to submission of the design development drawings, coordinate with the University Project Manager to arrange a site meeting with the University Project Manager and the University Landscape Maintenance Department.

b. Existing site conditions and A/E's proposed improvements will be evaluated at the meeting.

c. Trees and other site vegetation, both within the intended construction site limits and adjacent to the construction site, will be evaluated. Roots from adjacent trees and vegetation which could be damaged by construction activities (*i.e.*, vehicular traffic, lack of water, excavation, etc.) will be addressed.

d. Analyze access routes for equipment, staging locations, and temporary storage areas likely to affect the site.

e. Inventory the trees within the contract limit lines. Record the location, size, and health of each tree to be saved. Identify trees which will require pruning to allow for future structure.

f. Photograph each tree to establish a base line health status and condition of the tree before construction.

g. Estimate the size of the protection zone for each tree and determine the feasibility of fencing the affected trees at the protection zone line. Show the protected zone areas on the project drawings.

h. Information gathered at the site meeting will be used to establish the following:

i. The environmental value of special vegetation and trees in and around the project site will be considered.

ii. The Department of Landscape Maintenance will provide the specific terms to be included in the project documents regarding tree replacement (both for intended replacement and for unintended loss). See 4.3 B (2).

iii. The Department of Landscape Maintenance will identify the current dollar value for each tree remaining on site. The A/E shall insert tree value(s) in the drawings and specifications. See 4.3 B (1).

iv. The Landscape Maintenance Department will provide special care instructions for existing vegetation to remain. These shall be included in the project documents. See paragraph e) herein. Examples of tree protections methods are provided in 4.3 B (4).

i. The A/E shall prepare minutes of the meeting to record specifics for each tree. The A/E shall distribute the minutes to the University Project Manager and Landscape Maintenance Department.

H. Construction Inspection and Post-Construction Monitoring

(1) Instruct the Contractor that landscaping work shall be suspended at any time when it may be subject to damage by climatic conditions. However, no substantial work suspension may be made without permission of the A/E and University Project Manager.

(2) Any plant not alive, in poor health, or in poor condition at the end of the guarantee period will be replaced immediately. All replaced plants shall be guaranteed and maintained according to the specifications for another four (4) consecutive growing months (growing months to be defined as April, May, June, July, August and September).

4.2 Water Allowance

A. No additional University design requirements.

4.3 Landscape Design Standards

A. Landscape Plan

(1) Plant Selection

a. For University projects, the A/E is to specify drought resistant plants per the 4.3 A (4), and as directed by the Landscape Maintenance Department.

b. The A/E is to meet with the Landscape Maintenance Department to review all plants intended for the site prior to bid. As part of the review, any proposed plant which is not on the University Plant List shall be specifically presented to the Supervisor of the Landscape Maintenance Department. If approved, a written notice of approval shall be forwarded to the University Project Manager (and DFCM Representative if applicable) prior to bid.

c. Specified plants shall be sound, healthy, vigorous, and free from pests and diseases. They shall be well branched, be in full leaf, and have a healthy root system. All plants specified shall be nursery grown. Require the Contractor to obtain plants which conform to specie and size specified.

(2) Maintenance of Plant Materials

a. The specifications will require the Contractor to be responsible to maintain all planted materials in a healthy and growing condition for a period of any four (4) consecutive growing months (growing months to be defined as April, May, June, July, August and September).

b. Specify this maintenance to include weeding, cultivating, fertilizing, monitoring water schedules, controlling insects and diseases, re-guying and staking, and all other operations of care necessary for the promotion of root growth and plant life so that all plants are in a condition satisfactory to the University at the end of the guarantee period.

c. The specifications shall state that the Contractor shall be held responsible for failure to monitor watering operations and shall replace any and all plant material that is lost due to the improper application of water.

(3) Plant Material

a. For University of Utah projects, the name and address of the source(s) or supplier(s) for all plant materials shall be furnished to the University Project Manager and A/E prior to the delivery of any plant materials.

b. All plant materials are to be inspected by the A/E at the time of delivery on site. This inspection does not constitute final acceptance of any plant material. All plant material will be inspected again at time of final inspection and once again at the end

of the warranty period. Include in project specifications that any plant found to be unacceptable at any of these inspections shall be immediately removed and replaced.

c. The A/E shall monitor the project and confirm that no unauthorized substitutions are present. If such are found, the A/E is to reject the material and require immediate replacement. If proof is submitted that specific plants or plant sizes are unobtainable, consider written substitution requests for the nearest equivalent plant or size. All substitution requests shall be made in writing and preferably before the bid due date. Review any substitution request with the Landscape Maintenance Department before taking action.

(4) University Plant List

BOTANICAL NAME	COMMON NAME
DECIDUOUS TREES	
Acer sp	
Acer ginnala	Amur Maple
Acer grandidentatum	Bigtooth Maple
Acer griseum	Paperbark maple
Acer palmatum	Japanese Maple
Acer palmatum dissectum	Lace leaf Maple
Acer platanoides	Norway Maple
Acer rubrum	Red Maple: Brandywine. Red sunset
Acer saccharinum	Sugar Maple
Acer tatarica	Tatarian Maple
Acer truncatum	Shantung Maple or Purpleblow
Aesculus X carnea	Red Horsechestnut
Albizia julibrissin	Misosa, Silk Tree, Albizia
Amelanchier alnifolia	Saskatoon, Western Serviceberry
Amelanchier arborea	Downy Serviceberry
Amelanchier grandiflora	Autumn Brilliance
Amelanchier laevis	Princess Diane Serviceberry, Cole's Select Serviceberry, Laevis Serviceberry
Amerlancier utahensis	Utah Serviceberry
Betula nigra	River Birch
Betula papyrifera	Paper Birch
Betula occidentalis	Betula fontinalis
Carpinus betulus 'fastigata'	European Hornbeam

BOTANICAL NAME	COMMON NAME
DECIDUOUS TREES	
Catalpa Sp.	Northern Catalpa
Cercidiphyllum japonicum	Katsuratree
Cercis canadensis	Eastern Redbud or Judas Tree
Cercis occidentalis	Western Redbud
Cercocarpus intricatus	Littleleaf mountain mahogany
Cerocarpus ledifolius	Curlleaf Mountain Mahogany
Chilopsis linearis	Desert Willow
Cladrastis lutea kentuckea	Yellowwood
Cornus florida	Flowering Dogwood
Cornus kousa	Kousa Dogwood
Cornus sericea & alba	Red-osier or Red-Stemmed Dogwood
Corylus colurna	Turkish Filber, Turkish Hazel
Cotinus coggygria & obouatus	Smoketree
Crataegus sp.	Hawthorn; Paul Scarlet
Eucommia ulmoides	Hardy rubber tree
Fagus sylvatica cultivers	European Beech
Fraxinus	Ash
Ginkgo biloba	Ginkgo, Maidenhair Tree
Gleditsia triacanthos var. inermis	Thornless Honey Locust
Koelreuteria paniculata	Goldenraintree
Laburnum X watereri	Goldenchain tree, Waterer Laburnum
Larix decidua	European Larch
Liriodendron tulipifera	Yellow-Poplar, Tuliptree, Tulip Poplar
Maackia amurensis	Amur Maackia
Magnolia x loebneri	Magnolia
Magnolia x soulangiana	Saucer Magnolia
Magnolia sprengeri	Sprenger Magnolia
Magnolia stellata	Star Magnolia
Malus,	Flowering Crab, Prairiefire(pink) - Flowering Persistant Only, springsnow(white)
Porsha mexicana	Clifforse, Quininebush
Prunus sp	

BOTANICAL NAME	COMMON NAME
DECIDUOUS TREES	
Prunus maackii	Amur Chokecherrry
Prunus virginiana	Common Chokecherry
Pyrus Calleryana	Flowering Pear - red spine
Quercus sp	
Quercus gambelii	Gambel Oak/Scrub Oak
Quercus macroparpa	Bur Oak
Quercus robur 'fastigiata'	English Oak
Quercus shumardii	Shumard Red Oak
Quercus virginiana	Live oak
Robinia neomexicana	New Mexico Locust
Sorbus sp.	Mountain Ash
Tilia americana	American Linden or Basswood
Ulmus ‘Frontier’	Frontier Elm
Ulmus glabra ‘camper downii’	Camper Down
Ulmus parvifolia	Lacebark or Chinese Elm
Yucca brevifolia	Joshua Tree
Zelkova serrate ‘Schmidtlow’	Wireless Zelkova

BOTANICAL NAME	COMMON NAME
EVERGREEN TREES	
Abies concolor	White Fir
Calocedrus decurrens	Incense Cedar
Cedrus atlantica 'glanca'	Atlas Cedar
Cedrus deodara	Deodar Cedar
Cedrus libani	Cedar of Lebanon
Chamaecyparis obtusa	Hinoki falsecypress
Cupressus sempervirens	Italian Cypress
Curpessus arizonica	Arizona Cypress
Juniperus osteosperma	Utah Juniper
Juniperus chinensis	Chinese Juniper
Juniperus scopulorum	Rocky Mountain Juniper
Juniperus virginiana	Eastern Red Cedar

BOTANICAL NAME	COMMON NAME
EVERGREEN TREES	
Larix kaempferi	Japanese Larch
Metasequoia glyptostroboides	Dawn Redwood
Picea abies	Norway Spruce
Picea engelmannii	Engelmann spruce
Picea pungens glauca	White or Blackhills Spruce
Picea omorika	Serbian Spruce
Picea pungens	Blue Spruce
Pinus aristata	Bristlecone Pine - Rocky Mtn.
Pinus bungeana	Lacebark Pine
Pinus contorta var. latifolia	Lodge Pole Pine
Pinus edulis	Pinyon Pine
Pinus flexilis	Limber Pine
Pinus flexilis glauca	Vanderwolf Pine
Pinus leucodermis	Bosnian/Dwarf Pine
Pinus jeffreyi	Jeffrey Pine
Pinus monophylla	Singleleaf Pinyon Pine
Pinus monticola	Western White Pine
Pinus mugo	Mugo Pine
Pinus nigra	Austrian Pine
Pinus parviflora	Japanese White Pine
Pinus ponderosa	Ponderosa Pine
Pinus thunbergiana	Japanese Black Pine
Pinus wallichiana	Himalayan White Pine
Pseudotsuga menzeisii	Douglas Fir
Pseudotsuga menzeisii 'Glauca'	Rocky Mountain Fir
Sequoiadendron giganteum	Giant Sequoia
Taxodium distichum	Baldcypress
Thuja occidentalis	Arborvite

BOTANICAL NAME	COMMON NAME
SHRUBS	
Abies balsamea 'Nana'	Dwarf Balsam Fir

BOTANICAL NAME	COMMON NAME
SHRUBS	
Amelanchier alnifolia	Saskatoon Serviceberry
Amelanchier utahensis	Utah Serviceberry
Amorpha canescens	Lead Plant
Amorpha fruticosa	Flase Indigo
Arctostaphylos patula	Greenleaf manzanita
Artemisia cana	Silver Sagebrush
Artemisia filifolia	Sand Sagebrush
Artemisia frigida	Fringed Sagebrush
Artemisia ludoviciana	Prairie Sagebrush
Artemisia nova	Black Sagebrush
Artemisia tridentata	Big Sage, Sagebrush
Atriplex canescens	Four winged Salt Bush
Atriplex conferifolia	Shade Scale
Atriplex gardneri	Gardner Salt Bush
Berbesis sp	William Penn
Berberis fremonti	Desert Holly
Buddleia davidii	Butterfly bush; black beauty
Caragana arborescens	Siberian Peashrub
Ceratoides lanata	Winterfat
Cercocarpus ledifolius	Curl-leaf Mountain Mahogany
Chaenomeles japonica	Flowering quince
Chamaebatiaria milliefolium	Fernbush
Chilopsis linearis	Desert Willow
Chrysothamnus nauseosus	Rubber Rabbitbrush
Continus coggygria	Smoke Tree or Smokebush
Cornus sp.	Red Twig Dogwood, Yellow Twig Dogwood, Tartarian Dogwood
Cornus sericea 'Kelseyi'	Dwarf Kelsey Dogwood
Cowania mexicana	Cliff Rose
Cytisus scoparius	Broom: moonlight, Burkwood, Hollandia, Lena, Lilac Time
Daphne burkwoodii	Daphne

BOTANICAL NAME	COMMON NAME
SHRUBS	
Ephedra viridis	Mormon Tea or Brigham Tea
Euonymus alatus compacta	Dwarf Winged Euonymus
Fallugia paradoxa	Apache Plume
Forestiera neomexicana	New Mexico Privet or Desert Olive
Forysthia sp	Dwarf Forsythia
Forsythia courtasol	Dwarf Gold tide
Grayia Spinosa	Snakebrush/Hop Sage
Hesperaloe paruiflora	Red Yucca, Duct Red Yucca
Hibiscus syriacus	Rose of Sharon
Hippophae rhamnoides	Sea buckthorn
Ilex sp.	Holly
Iiex meservea	Holly Blue boy
Ilex verticillata	Winterberry holly
Juniperus chinesis	Phitzer Juniper, Blue Point Juniper and other upright varieties
Juniperus horizontalis	Creeping Juniper
Juniperus Sabina	Juniper
Kerria japonica	Japanese Kerra
Kolkwitzia amabilis	Beauty Bush
Ligustrum vulgare	Common Privet (several varieties of screening)
Lonicera japonica	Honeysuckle; Hilliana
Mahonia aquifolium	Oregon Grape
Mahonia repens	Dwarf oregon grape
Peraphyllum ramosissimum	Squaw Apple
Peraphyluum caespitosum	Rock Spirea, Tufted Rock Mat
Perovskia	Russian sage
Philadelphus sp.	Mockorange, Sweet Mockorange (dwarf varieties also available)
Philadephus microphyllus	Littleleaf Mockorange
Physocarpus malvaceus	Mountain Ninebark
Physocarpus opulifolius	Ninebark; Darts gold, Diabolo, Dwarf

BOTANICAL NAME	COMMON NAME
SHRUBS	
Pinus mugo cultivars	Dwarf Mugo Pine
Potentilla fruticosa	Shrubby Cinquefoil, 'Fronsty' or 'Hinrob', Marion Red Robin
Prunus besseyi	Western Sand Cherry
Prunus x cistena	Purple Sand Cherry
Purshia mexicana var. stansburiana	Cliff Rose
Purshia tridentata	Antelope Bitterbrush
Pyracantha angustifolia	Dwarf Pyracantha
Rhamnus asplenifolia	Fernleaf Buckthorn
Rhamnus columnaris	Upright Buckthorn
Rhamnus smithii	Smith's buckthorn
Rhus aromatica 'Grow Low'	Fragrant sumac
Rhus glabra	Smooth Sumac
Rhus glabra cismontanta	Dwarf Mountain Sumac
Rhus glabra laciniata	Cutleaf Smooth Sumac
Rhus trilobata	Oak.three leaf
Rhus typhina laciniata	tiger eye gold leaved
Ribes sp.	Alpine Currant, Golden Currant
Rosa meidiland	Meidiland Rose
Salix purpurea nana	Dwarf Blue Arctic Willow
Salvia dorrii	Dorr's Sage
Sambucus sp	Elderberry, black beauty,
Shepherdia argentea	Silver Buffaloberry
Spiraea x bumalda	Spriea; Anthony waterer
Spiraea x vanhouttei	Bridal Wreath Spiraea
Symphoricarpos sp	Coralberry/Snowberry
Symphoricarpos orbiculatus	Coralberry/Snowberry Indian current
Symphoricarpos oreophilus	Mountain Snowberry
Syringa meyeri 'Palibin'	Dwarf Korean Lilac
Syringa patula 'Miss Kim'	Miss Kim Lilac
Taxus cuspidata	Japanese Yew

BOTANICAL NAME	COMMON NAME
SHRUBS	
Taxus sp. (low spreading)	Spreading English Yew, Upright Yew, Browns, Yew and Others
Thuja occidentalis	Eastern White Cedar
Viburnum burkwoodii	Burkwood Viburnum
Weigela florida	Weigela
Yucca filamentosa	Yucca; garland gold, ivory tower, color guard

BOTANICAL NAME	COMMON NAME
GROUND COVER	
Ajuga	Bugleweed
Arabis caucasica	Rock Cress
Cerastium tomentosum	Snow In Summer
Delosperma cooperi	Delosperma, Ice Plant
Delosperma nubigenum	Yellow Ice Plant
Euonymus fortunei	Winter Creeper
Fargesia	Pink Panda' and 2 others
Genista pilosa	Vancouver Gold'
Hedera helix	English Ivy
Helianthemum nummularium	Sunrose, Rockrose
Hypericum calycinum	Aaron's Beard, St. John's Wort
Lamium maculatum	Spotted deadnettle
Pachistima canbyi	Dwart Mountian Lover
Sedum sp.	Stonecrop
Thymus cultivars	Thyme; wooly
Veronica	Creeping Veronica
Vinca major and minor	Periwinkle

BOTANICAL NAME	COMMON NAME
VINES	
Campsis radicans	Trumpet Vine
Clematis 'Hybrids'	Clematis
Clematis ligusticifolia	White Virgin's Bower

BOTANICAL NAME	COMMON NAME
VINES	
Hedera helix	English Ivy
Hydrangea anomala subsp. petiolaris	Climbing Hydrangea
Polygonum aubertii	Silverlace Vine

BOTANICAL NAME	COMMON NAME
ORNAMENTAL GRASSES (USE AS ACCENT OR IN MASSES)	
Achnatherum calamagrostis	Spear Grass
Aristata purpurea	
Bouteloa gracilis	Blue Grama
Calmagrostis acutiflora 'Karl Foerster'	Feather Reed Grass
Calmagrostis brachytricha	Korean Feather Reed Grass
Carex sp	
Cespitosa 'Goldschleier'	Gold Vieled Tufted Hair Grass
Chasmanthium latifolium	Indian Woodoats
Cortaderia selloana	Pampas Grass
Deschampsia sp.	Tufted Hair Grass
Festuca sp.	Coyota
Hakonechloa macra	Japanese forest grass
Helictotrichon sempervirens	Blue Oat Grass
Miscanthus "Adagio"	Idaho fescue
Miscanthus "Purpurascens"	Flame grass
Miscanthus Sinesis	"Little Gem"
Miscanthus s. 'Gracillimus'	Maiden grass
Miscanthus s. 'Graziella'	Silver Grass
Miscanthus s. 'Morning Light'	Morning Light Japanese silver grass
Miscanthus s. 'Puenktchen'	Little Dot'
Miscanthus s. 'Variegatus"	Variegated Japanese Silver (Eulalia) Grass
Miscanthus s. 'Zebrinus'	Zebra Grass
Panicum virgatum	"Shenandoah"
Pennisetum oriental	Fountain Grass
Pennisetum ruppelii	Oriental Fountain Grass
Phalaris arundicacea	Feesey's Form

BOTANICAL NAME	COMMON NAME
ORNAMENTAL GRASSES (USE AS ACCENT OR IN MASSES)	
Saccharum ravennae	Ribbon Grass
Schizachyrium scoparium	Formerly: Erianthus ravennae ; Ravenna Grass
Sesleria autumnalis	Little blue stem
Sorghastrum nutans	Autumn Moor Grass
Sporobolus airoides	"Cheyenne"
Stipa gigantea	Giant Feather Grass

BOTANICAL NAME	COMMON NAME
HERBACEOUS PERENNIALS	
Agastache ssp.	Hyssop, Hummingbird Mint
Alcea rosea	Hollyhock
Alcemilla	Ladys Mantle
Alyssum saxatalis compactum	Basket of Gold
Anacyclus depressus	Mount Atlas Daisy
Anemone hupehensis	Japanese Anemone
Anemone hybrids	Anemone
Anemone pulsatilla	Pasque Flower
Antennaria dioica	Pussy Toes
Aquilegia sp.	Columbine
Arabis caucasica	Rock Cress
Arenaria ssp.	Sandwort
Armeria maritima	Common Thrift or Sea Pink
Artemisia frigida	Fringed Sage
Artemisia ludoviciana	Prairie Sagebrush
Artemisia schmidtiana	Silver Mound
Artemisia versicolor 'Seafoam'	Curlicue Sage
Asclepias tuberosa	Butterfly Milkweed
Astilbe sp.	Astilbe
Aubretia	Rock Cress
Baptisia	False Indigo
Brunnera sp.	Brunnera

BOTANICAL NAME	COMMON NAME
HERBACEOUS PERENNIALS	
Bulbs	Spring Flowering Bulbs
Callirhoe involucrata	Poppy Mallow
Calylophus spp.	Sundrops
Campanula sp.	Bellflower
Catananche sp.	Cupid's Dart
Chrysanthemum x superbum	Shasta Daisy
Coreopsis verticillata	Tickseed,moombean
Dephinium nattalianum	Perennial Larkspur
Dianthus sp	Dianthus Pinks
Diascia integerrima 'Coral Canyon'	Twinspur
Dicentra eximia	Fringed Bleeding Heart
Dicentra formosa	Pacific Bleeding Heart
Dicentra spectablilis	Bleeding Heart
Digitalis obscura	Dusty Foxglove, Willow Leaf Foxglove
Digitalis thapsi 'Spanish Peaks'	Spanish Peaks Foxglove
Echinacea purpurea	Purple Coneflower
Echinops sp.	Thistle
Epilobium angustifolium	Fireweed
Eriogonum umbellatum	Sulphur Flower
Eriophyllum lanatum	Woolyleaf, Oregon Shunshine
Eryngium alpinum	Blue Sea Holly
Eryngium sp.	Sea Holly
Gaillardia sp	Blanketflower
Gaura coccinea	Scarlot Guara
Geranium sp.	Cranebill
Gilia aggregata	Scarlet Gilia
Guara lindheimeri	"Siskyou Pink' Gaura
Gutierrezia sarothrae	Snakeweed
Hemerocallis hybrid	Daylily
Helianthella uniflora	Little Sunflower
Helianthemum nummularium	Sun Rose
Helleborus foetidus	bear's-paw hellebore

BOTANICAL NAME	COMMON NAME
HERBACEOUS PERENNIALS	
Heuchera sp.	Coral Bells
Hibiscus coccineus	Scarlet Hibiscus
Hosta sp.	Hosta
Houttuynia cordata	Chameleon plant
Hypericum calycinum	St. Johnswort
Iberis sempervirens	Candytuft
Iliamna rivularis	Mountain Hollyhock
Iris Hybrids	Iris
Kniphofia uvaria	Red Hot Poker
Lavandula angustifolia	Lavender
Limonium latiflolium	Statice, Sea Lavender
Linum sp.	Golden Flax, Perennial Flax, Native Blue Flax
Lychnis coronaria	Rose campion
Mirabilis multiflora	Showy Four-O-Clock
Monarda didyma	Bee Balm - Cultivars supposedly mildue resistant: 'Jacob Cline', 'Dark Ponticum', Marshalls Delight'. 'Raspberry Wine'. 'Colrain Red'.
Narcissus species	Daffodil
Nepeta x Faassenii	Catmint
Oenothera sp.	Evening Primrose
Oenothera caespitosa	Evening Primrose
Papaver orientale	Oriental Poppy
Papaver sp.	Poppy, Oriental Poppy
Penstemon sp.	Firecracker Penstemon, Palmer Penstemon, Shrublet Penstemon, Wasatch Penstemon
Penstemon palmeri	Balloon Flower
Penstemon pinifolius	Pine leaf Penstemon
Perovskia atriplicifolia	Russian Sage
Phlox hoodii	Carpet Phlox
Phlox longifolia	Long leaved Phlox
Phlox subutata	Creeping Phlox
Physostegia sp.	Obedient plant

BOTANICAL NAME	COMMON NAME
HERBACEOUS PERENNIALS	
Polemonium	Jacob's ladder
Pulmonaria langifolia	
Ratibida columnaris	Prairie Coneflower, Mexican Hat
Rudbeckia sp.	Black Eyed Susan, Dwarf Rustic Coneflower
Salvia sp.	Salvia
Santolina sp.	Lavender Cotton
Saponaria ocymoides	Rock Soap Wort
Sedum sp.	
Solidago sp.	
Stanleya sp.	
Tradescantia sp.	
Tulipa hybrids	Tulip
Verbena sp.	
Zauschneria california	Orange Carpet; catalina
Zauschneria latifolia	Orange Carpet; Garrettii
Zinnia grandiflora	Rocky Mtn. Zinnia

BOTANICAL NAME	COMMON NAME
CACTI	
Coryphantha vivapara	Nuttal's Pincushion
Echinocereus engelmanii	Hedge Hog Cactus
Echinocereus triglochidiatus	Claret Cup
Opuntia ssp.	Common Pricklypear
Pediocactus simpsonii	Simpson's Footcactus

BOTANICAL NAME	COMMON NAME
TURF GRASS	
Xerilawn	
Bella Blue	
BioMeadow	
RTF – *preferred in areas that will have minimum foot traffic – substitute for bluegrass*	
Blue Grass – *high traffic areas*	

Note: Do not plant turf in areas between hard surfaces less than 8-ft wide. Decorative rocks and boulders are preferred in landscaping where feasible.

(5) Topsoil Guidelines
   a. Topsoil for General Applications
      i. Provide a minimum of 12-in of topsoil in all planting beds and a minimum of 6-in of topsoil in all lawn areas.
      ii. Subsoil will not be accepted as topsoil.
      iii. Soils with less than 4-percent organic matter shall be amended.
   b. Soil Preparation and Amendments
      i. When contract operations have been completed to a point where the areas will not be disturbed, the Contractor shall clean the subgrade so as to be free of waste material of all kinds.
      ii. Direct the Contractor to scarify and pulverize the subgrade to a depth of 6 inches, then mix layered soils as follows:
         (a) First distribute a 2 to 3-in layer of the new soil.
         (b) Mix the new soil thoroughly with the existing soil.
         (c) Distribute the remainder of the new soil on top.
      iii. Scarification shall be completed in all areas that are to receive plant materials.
      iv. Animal fertilizer is not to be used on Campus.
      v. Specify chemical fertilizer to be 16-16-8 with guaranteed analysis marked on the container.

(6) Compost
   a. Compost materials include: composted weed residues, peat, leaf, and mushroom mulch. Require the Contractor to coordinate with the University Project Manager and A/E prior to using compost at the site to determine the appropriate compost for the intended area.

(7) Mulch
   a. Specify this material to be medium coarseness. All planting beds shall receive a 4-in mulch layer.

(8) Sod
   a. The University will not allow hydro-seeding nor any manual seeding. Seeding will not be used in place of sod.
   b. Sod Specifications
      i. All sod shall be 18 month old Kentucky Blue Grass that has been cut fresh the morning of installation. Only specify sod that has been grown on a commercial sod farm. Do not allow sod from any other source.
      ii. Apply fertilizer prior to laying any sod.
      iii. Specify that all sod that has not been laid within 24 hours shall be deemed unacceptable and will be removed from the site.
      iv. Direct the Contractor to lay sod with seams tightly closed with no gaps between each piece of sod.
      v. Instruct the Contractor to apply water directly after laying sod. Rainfall is not acceptable.

vi. Require the Contractor to rope off and secure new grass areas until the sod is established or grown sufficiently to the first mowing.

c. Fertilizer for Sod Applications
   i. Commercial fertilizer shall be specified as a mixed commercial fertilizer, O-F-241C, type 1, grade 16-16-8, level B with guaranteed chemical analysis of contents marked on the containers.

d. Topsoil Specifications for Sod
   i. Specified topsoil shall consist of natural sandy loam and be of uniform quality, free from subsoil, hard clods, stiff clay, hard-pan, sod, partially disintegrated debris, or any other undesirable material. Soil shall be free of plants, roots, or seeds that would be toxic or harmful to growth. Topsoil shall be obtained from naturally drained areas and shall contain at least 4-percent organic material as determined by loss upon ignition of a moisture free sample that has been dried in accordance with current methods of the Association of Official Agricultural Chemists. pH range shall be 5.5 to 8.2 inclusive.
   ii. Require the Contractor to furnish a certified report of an analytical chemist approved by the A/E showing the analysis of the topsoil proposed for use. Further require the Contractor to furnish a sample of the proposed topsoil to the A/E prior to delivery of topsoil on site.

e. Top Soil Installation for Sod
   i. When contract operations have been completed to a point where the areas will not be disturbed, the Contractor is to clean the subgrade so as to be free of waste material of all kinds. Direct the Contractor to scarify and pulverize the subgrade to a depth of not less than 4 inches. Scarification shall be completed in all areas that are to receive plant materials whether it is to be sod, trees, ground cover, or shrubs.
   ii. Specify the distribution of topsoil to a depth of 6-in in all planting areas shown in the Contract Documents. Do not allow the placement of topsoil over subgrade that is frozen or damp.
   iii. The surface on which the sod is to be laid is to be specified firm and free from footprints, depressions, or undulations of any kind. Specify the surface to be free of all materials larger than 1/2-in in diameter.
   iv. The finish grade of the topsoil adjacent to all sidewalks, mow strips, etc., prior to the laying of the sod, shall be set such that the crown of the grass shall be at the same level as the adjacent concrete or hard surface.

f. Sod Installation
   i. Include the following in specifications:
      (a) Prior to laying of sod, the entire surface to receive sod shall be uniformly covered with the specified fertilizer at the rate of 4-lbs per 1,000 square feet. Notify the University Landscape Maintenance Department 24-hours prior to intended fertilizer application. The A/E, University Project Manager and University Landscape Maintenance may inspect the site and fertilizer prior to application, and witness the application procedure.
      (b) Upon completion of the laying operation, an inspection of the area shall be made. All voids and large cracks between individual pieces of sod shall be filled with topsoil, prior to watering.

(c) Watering of the sod shall be the complete responsibility of the Contractor by whatever means necessary to establish the sod in an acceptable manner prior to acceptance by the University. If an irrigation system is in place on the site, but for whatever reason, water is not available in the system, it is the full responsibility of the Contractor to water the sod by whatever means, until the sod is accepted by the A/E and University Landscape Maintenance Department.

(d) Upon completion of filling all voids in the newly laid sod areas, the sod is to be completely saturated with water.

(e) Protection of the newly laid sod shall be the complete responsibility of the Contractor. Instruct the Contractor to provide acceptable visual barriers, to include barricades set at appropriate distances with strings or tapes between the barriers, as an indication of new work. Specify that the Contractor is to restore any damaged areas caused by others (including vehicular traffic), erosion, etc., until such time as the lawn is accepted by the University.

g. Sod Guarantee

i. Specify that the Contractor shall be responsible for the protection, watering, and replacement of any damaged sod until acceptance by the University. This guarantee shall include filling any voids between sod pieces, repairing of any eroded areas, and maintaining the sod by watering, mowing, and controlling of insects, as well as advising the University of any maintenance or watering procedures necessary to care for and promote plant life. All sod shall be in satisfactory condition at the time of the substantial completion inspection.

B. University Campus Tree Standards

(1) Value of Campus Trees

a. The University of Utah campus is Utah's State Arboretum. Each tree on campus has a significant value to the University, each is cataloged, and the condition of each tree is monitored.

b. The current monetary value for each tree will be established by the Landscape Maintenance Department for each project where trees may be affected by construction.

i. A/E drawings and specifications shall include the dollar value of each tree which is intended to remain on, and/or adjacent to the project site.

ii. The cost shown for each tree will establish the basis for the Contractor's liability if any tree is damaged due to construction activities or the Contractor's lack of care.

(2) Tree Replacement on Campus

a. Include the following statement in the Construction Documents:

i. "Written permission by the Landscape Maintenance Department (through the A/E and University Project Manager) is required prior to the removal of any tree on campus."

b. When a project includes the planned removal of trees, or when trees are removed by the Contractor for any reason, either the project or the party responsible for the removal shall replace each lost tree with at least two new trees.

i. The Landscape Maintenance Department reserves the right to require replacement by more than two-for-one, or by a larger caliper specimen size, when tree removal will cause significant loss of value to the University (i.e., prominent landmark, tree function / value to the site, historical value, pairing loss to other trees, significant loss to the State Arboretum, etc.).

ii. The Landscape Maintenance Department will consider A/E suggestions for the species proposed for the replacement; however, the Landscape Maintenance Department is the jurisdiction having authority and will make the final determination of the selection of the tree species, and determine exact location(s) for replacement tree plantings.

iii. When trees are planned to be removed for new construction, the A/E's drawings / specifications shall identify the species and location of replacement trees as directed by the Landscape Maintenance Department.

(3) Tree Damage During Construction

a. The A/E shall observe the status of the trees during regular inspection site visits. Tree damage at the project site, including overstressed, dying or dead trees, shall be reported to the Contractor and University Project Manager as soon as it is observed. Photograph the damage. The University Project Manager will coordinate with the Landscape Maintenance Department to determine the cause of the damage, assess the value of loss based on the tree's cost shown in the project documents, and direct any remedial action required to restore the tree.

b. The A/E shall include damage penalties in the specifications if trees are to be saved on site. Base the penalties on the value of each tree as determined by the University Landscape Maintenance Department.

c. For trees which are damaged beyond recovery due to Construction or lack of care, the Contractor shall be responsible for replacement in accordance with 4.3 B (2).

(4) Tree Protection at University Construction Sites

a. In the drawings and specifications, the A/E shall establish the Contractor's responsibility to care for and protect each tree which will remain on site, or face penalties for damage, or replace each lost tree in accordance with the terms established by the Landscape Maintenance Department.

b. General Requirements for Tree Protection

i. Trees can be damaged or killed by a wide variety of construction activities. Above ground injuries such as broken branches or torn bark are open wounds which can deplete a tree's energy resources and provide entry points for insects or diseases.

ii. Root damage can be a significant danger to a tree. Critical roots generally exist in the top one to three feet of soil extending out to the drip line of the tree canopy, and beyond to a distance of two times the height of the tree.

c. Protected Root Zone (TPZ – Tree Protection Zone)

i. Determine the area needed for the tree protection zone ("TPZ") for each tree, including trees which could be affected adjacent to the construction site. The TPZ is the approximate distance from the tree trunk in which a critical amount of the tree's roots may be found. This is the area which should be isolated from construction activity, and is determined as follows:

(a) Estimate the height of the tree.

(b) Multiply the tree height by 0.40.

(c) Measure and mark this distance from the tree trunk. If this distance is less than the extent of the tree's canopy drip line, extend the mark to the outside drip line.

ii. Specify that nothing inside the TPZ is to be raked, cut, stored, or otherwise disturbed.

iii. Specify regular watering during construction.

d. TPZ Fence

i. Direct the Contractor to install protective fencing around each tree at the marked TPZ perimeter. Specified fencing shall be sturdy and highly visible to discourage entrance and disturbance of the area within the TPZ.

ii. Specify either chain-link, or sturdy wire mesh, or wood fencing. Require the Contractor to solidly anchor the fencing into the ground.

iii. Require the Contractor to attach weather protected warning signs every 50 linear feet along the fence (for a smaller TPZ, require a minimum of two signs at appropriate locations on the perimeter fence). Each sign shall be at least two feet wide, with red lettering on white background, with the following message prominently displayed:

TREE PROTECTION AREA
DO NOT ENTER
ZONA DE PROTECSION
PARA ARBOLES – NO ENTRE

iv. Specify fencing height of 4 to 6 feet or higher depending on the needs of the site and anticipated construction activities.

v. If the A/E's design cannot guarantee that construction traffic will remain outside of a tree's TPZ for the entire duration of construction, require trunk protection as described herein, and additionally specify one or more of the root protection measures described below.

e. Trunk Protection

i. Instruct the Contractor to install a closed cell foam pad around the trunk and buttress roots, overlaid with 2-inch thick wood planks (2-in x 4-in or 2-in x 6-in as appropriate) arranged vertically and approximately 1-in apart.

ii. Specify straps or wire to bind the planks in place.

iii. Do not allow the Contractor to drive fasteners into the tree.

iv. As determined by the length of the construction schedule, require the Contractor to adjust the strap or wire binding during periods of trunk diameter growth.

f. Root Protection Measures

i. Options available to the A/E for root protection measures within the TPZ are:

(a) 6 to 12-in of wood chip mulch evenly distributed within the protection zone.

(b) A 3/4-in plywood deck, or a matt of 4 x 4 wood beams laid over 4+ inches of wood chip mulch evenly distributed within the protection zone.

(c) 4 to 6-in of gravel laid evenly over a taut, staked geotextile fabric.

(d) Commercial logging or road mats assembled over support rails, laid over a 4-in to 6-in mulch layer.

ii. Root protection measures specified by the A/E shall be inspected daily by the Contractor and refreshed as conditions warrant (i.e., weather, time, traffic wear, etc.).

iii. Trunk and vehicle load protective methods described above shall be removed from the TPZ when the threat of damage has ended, or at Substantial Completion, whichever occurs first.

iv. The TPZ perimeter fence shall remain in place until immediately before the required construction activity within the TPZ.

v. The TPZ perimeter fence shall be replaced as soon as possible when the required construction activity in the TPZ is done.

(5) Tree Planting Procedure

a. The tree planting hole should be the same depth as the root ball, and three times the diameter of the root ball.

b. Trees shall be placed on undisturbed soil at the bottom of the planting hole.

c. The tree hole depth shall be determined so that the tree may be set slightly high of finish grade, 1-in to 2-in above the base of the trunk flare, using the top of the root ball as a guide.

d. Except in rare cases trees should not be staked.

e. Set tree on soil and remove ALL burlap, wire baskets, twine, wrappings, etc. before beginning any backfilling operations.

f. All tree holes shall be backfilled in 12 inch lifts and settled with water to minimize any settling of the tree.

g. Upon completion of backfilling operation, thoroughly water the tree to completely settle the soil and fill any voids that may have occurred. Use a watering hose, not the area irrigation system. If additional prepared topsoil mixture needs to be added, it should be a coarser mix as required to establish finish grade.

h. The amount of pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches. All cuts, scars and bruises shall be properly treated according to the direction of the A/E. Proper pruning techniques shall be used. Do not leave stubs and do not cut the leader branch. Improper pruning shall be cause for rejection of the plant material.

i. Prepare a watering circle of 2' diameter around the trunk. For conifers, extend the watering well to the drip line of the tree canopy. Place 4-in of mulch around the planted trees.

j. Tree wrap is not used on campus.

k. Upon completion of all planting operations, The Contractor is to remove all undesirable material from the surface of the planting beds, including all rocks over the size of 1/2-inch diameter; re-establish all watering basins and install the specified mulch.

(6) Tree Grates

a. Tree grates should be specified for trees located in paved walkways so the inner rings can be cut as the tree grows. They should be removable grates for maintenance

purposes equal to D & L Supply Co. #R-8740 180-degree square with cast iron angle frame.

C. Roof Top Gardens
   (1) Irrigation system is required to be a two wire system controller with WiFi Module.
   (2) Soil moisture sensor is required for each planter bed.
   (3) Designer should structure zones based on light, reflection, plant type, and plant layout.
   (4) In line drip emitters need to be installed at 12-in spacing in a grid pattern using 0.6-in gph emitters.
   (5) Hydrometers should include infrared registers.
   (6) Where rooftop access is not protected by a guard as prescribed in the IBC; and maintenance or work of any kind is performed within 10 feet of roof edges or open sides of walking surfaces, guards or approved safety harness systems shall be installed.
   (7) All valves shall be freely accessible for maintenance from the roof, and be protected from the elements.
   (8) A hose bib shall be included at every manifold off of the mainline, an isolation valve shall be included in line preceding the hose bib.
   (9) Mainline isolation needs to be included inside of the building with easy access for the landscape maintenance department. It shall not be placed in areas that require safety certification and protection in order to access. Keys should be provided to the landscape department for any areas required to be locked.
   (10) Where rooftop access is not required by the IBC or IFC, and rooftop gardens are installed, access to the rooftop garden shall be provided by means of permanent ladders or stair systems.
   (11) A ¼-inch test cock is to be included for a pressure gauge test for irrigation to be on the same floor as the rooftop landscape. The test cock is to be installed near the point of change from Copper to PVC. Pressure should be designed to be 90 PSI at the test port.

D. Site Furniture
   (1) Anchors for Site Furniture
      a. Specify all site furniture with appropriate anchors to the concrete slab on which they are mounted, per manufacturer's instructions.
   (2) Exterior Benches and Tables
      a. Specify benches (backed or backless) and tables with coated metal grid assemblies with secure ground attachments.
      b. Colors are to be selected and approved by Facilities Management.



c. Approved manufacturer is Landscape Forms, Inc. “Plexus” benches, “Carousel” tables.

(3) Bike Racks

a. Campus Planning will determine whether the proposed bicycle parking is located in an area of campus with higher or lower density parking demands.

b. The "inverted "U" bicycle rack with the galvanized finish is the campus standard for areas of campus with lower density bicycle parking demand.

i. For bike racks specified as an inverted “U” rack with no cross bar. The inverted “U” rack shall be fabricated from 2-in Schedule 40 galvanized tubing. The overall vertical dimension shall be 40-in. The overall width of the rack measured leg to leg shall be 22-in, measured from outside vertical tube to outside vertical tube.

ii. The installed rack shall have a vertical dimension of 34-in from top of concrete to top of the inverted “U”. Each leg’s remaining 6-in shall be cored into concrete with a 3-in diameter core, and filled after the rack is set with expansive anchoring cement, non-shrink grout.

iii. The completed installation shall be true and plumb, square to building lines. Each core drilled hole shall be no closer than 3-in to any concrete edge or expansion joint or line. When installing a series of racks, consideration shall be taken not to place them too close to each other, a minimum of 30-in shall be maintained between racks.

iv. If a series of inverted “U” bike racks is specified, require the Contractor set the racks such that the clear space between individual racks is a minimum of 30-in.

c. The stainless steel inverted “U" rack is recommended for high profile areas of campus with lower density demand, i.e. campus portals.

d. For high density bicycle parking demand areas, a rack meeting the following specifications is required:

i. the rack contains the front wheel, preventing bicycles from falling over;

ii. the rack itself is located on one side of the parking area, leaving more area clear when the racks are not in use than the "inverted U" rack;

iii. allows two point locking for security;

iv. the racks can be placed closely together and angled, allowing higher density layouts,

v. the finish is either galvanized or stainless steel.

e. If desired, a brightly colored "artsy" bicycle rack, approved by Campus Planning, may be placed in a highly visible position to draw attention to the high density rack bicycle parking area.

(4) Waste Receptacles

a. Waste receptacles shall be located at each main entry to the building (next to the entry door but out of the way for snow removal) and on each patio. Design a concrete pad extension to the entry or patio specifically for trash receptacles and urns to avoid snow plows. Direct the Contractor to bolt waste receptacles and urns to the concrete pad. The waste receptacles shall be cast concrete units manufactured by WAUSAU TILE CO., Number TF 1040. Round receptacles will not be approved. Color shall be Sand. Waste receptacles shall also be equipped with a No. TF 2094 Snuffer Attachment.

b. Where exterior site furniture weight is a limiting criterion, and design approval is received for Plexus / Landscape Forms benches, specify waste receptacles (side opening with sand pan) from the same manufacturer, with coated metal grid assemblies

(5) Urns

a. Wall mount urns shall be cast concrete matching the trash receptacles in item 3 above. Specify WAUSAU TILE COMPANY Number UR 10201NS or UR11201NSPL, sand color. Selection of the specific unit style will be made by the University Project Manager and Landscape Maintenance Department. Provide a special concrete pad to avoid snow plows.

E. Grounds Storage Closet

(1) Each new building and each remodel, where applicable, is to include a storage closet for University Landscape Maintenance Department equipment and supplies, accessible from the exterior. Coordinate with the University Project Manager who will contact the Landscape Maintenance Department for specific design criteria. Generally, each storage closet should be at least 6’ x 6’ and 7’ high (unobstructed), with general lighting, electrical outlets, and sufficient heat to prevent freezing.

F. Chain Link Fences and Gates

(1) Indicate acceptable materials and products which may be used in construction of this project. Determine manufacturers and consult with Facilities Management through the University Project Manager.

(2) No fencing shall be attached to any building or gate anchor to any building without approval of Facilities Management.

(3) Fencing Product/Materials

a. Fabric:

i. PVC coated steel chain link fabric with zinc coating applied to core wire. Material to be helically wound and interwoven in such a manner as to provide a continuous mesh without knots or ties except in the form of knuckling at both ends of the wires to form the selvage of the fabric.

ii. Fabric mesh size shall be 2-in x 2-in except in areas where children climbing on fences is to be discouraged. In such areas, the mesh size shall be 1-in x 1-in.

iii. Fabric breaking strength shall be 800-lbs per square foot.

iv. Fabric height to be as noted on drawings.

v. Weight of zinc coating on fabric shall be 0.30 oz. per square foot.
vi. Fabric selvage to be knuckled at both ends.
vii. Thickness of PVC coating on fabric shall be 0.015 inches min.
viii. Fabric color to be black.

b. Pipe shall be zinc coated with a chromate conversion applied. Polyester resin color coating thermally fused to the zinc coated pipe.
i. End structural post shall be 2-1/2" O.D. diameter pipe with a wall thickness of 0.130 inches.
ii. Line posts shall be 2" O.D. diameter pipe with a wall thickness of 0.120 inches.
iii. Zinc coating shall be a min. of 0.06 OZ. per square foot.
iv. Color coating shall be 0.004 inches thick and over cured.
v. Color to be coordinated with Facilities Management through the University Project Manager.

c. Fittings. All fittings (bands, caps, eye tops, rail ends, sleeves, truss rods, bars, hinges, ells, clamps, scrolls, and clips) shall have an electrostatically applied polyester color resin that has been oven cured and thickness of 0.004 inches.

d. Ties and Tension Wires. These items shall be of extruded PVC over zinc coated steel wire. Color to be coordinated with Facilities Management through the University Project Manager.

e. Concrete footings and concrete mow strip shall be as per drawings and specifications for cast-in-place concrete.

f. All gate material shall be consistent with the fencing material.

g. Provide sufficient information to ensure quality workmanship. Indicate that experience is required and specify the qualifications of workmen and tolerances expected.

4.4 Irrigation Design Standards

A. Irrigation Plan

(1) General

a. The landscape irrigation system will be specified and graphically represented on drawings using sprinklers, valves, piping, fittings, controllers, wiring, etc., of quality and capacity described herein.

b. Once approved by the University, locations of sprinkler heads, valves, piping, wiring, etc., will be changed only with the permission of the Landscape Maintenance Department.

c. The University expects an irrigation design which will result in a complete water distribution system efficient in operation, fully automated, low maintenance, and fully compatible with current industry standards, the University's maintenance plan, and the existing irrigation system structure.

(2) Piping

a. Specify piping (except flex swing pipe) to be Schedule 40 pressure rated PVC with the ratings printed on the pipe, for sizes 1-in through 3-in. Specify piping to be Class 200 for sizes 4-in through 10-in, pipe ratings shall be clearly printed on the pipe. The pipe shall be new, free from cracks, holes, foreign material, blisters, inside bubbles,

wrinkles, dents, and weathering from storage outside more than three months. No pipe will be less than 1-in diameter.

b. Main Line Piping
   i. Main lines are to be sized appropriately to handle the gallons per minute (gpm) required to serve the three largest lateral systems.
   ii. Main lines are to be specified with solvent welded joints (gasketed pipe will be considered on a case-by-case basis, and allowed only with permission of the University Landscape Maintenance Department). Specify primer and cement (glue) for the appropriate pipe type, applied per manufacturer's specifications. Products are to be applied per manufacturer's specifications. All connections on main lines shall be allowed to set for twenty-four hours prior to pressurization.
   iii. Main line pipe shall be tested for a minimum of 2 hours, at a pressure of 150-psi. System shall be closed during test. Increase in pressure for testing shall be achieved by a powered pressure pump used for this specific purpose. Loss during testing shall not exceed 5%.
   iv. Thrust Block
      (a) The drawings and specifications shall require main lines to have a thrust block of poured concrete installed at each change of direction. The thrust block shall be of sufficient size for the pipe involved and rest on undisturbed ground. Thrust blocks shall be installed per Details LS-1, LS-2, and LS-3, Direct Bearing Thrust Blocks. No temporary thrust blocking shall be allowed.

c. Lateral Line Piping
   i. Lateral lines shall be specified as solvent weld with threaded connections at swing joints. Solvent welded lateral lines shall have the same specifications described for main lines. Threaded connections shall be sealed with Teflon type tape, and/or thread sealant, Rector Seal Number Five, or approved equal. Minimum pipe size shall be 1-in, no ¾-in pipe shall be allowed. Lateral pipes shall be 1-in, 1-/4-in, 1-1/2-in, 2-in, to a maximum of 2-1/2-in. Control valves and other components shall be designed to accommodate the lateral size.

d. Flex Swing Pipe
   i. Flex swing pipe shall be specified to be thick-walled polyethylene pipe, kink resistant, rated to at least 80 psi, and with a minimum of a two-year warranty. Approved manufacturers and models include: Rain Bird: SPX FLEX, Toro 'Super Funny Pipe', Irritrol 'Super Blue Flex'. This pipe is to be used only between heads and lateral lines and will not exceed lengths of 2-feet. Specify for use only on heads with 3/4-in or smaller inlets, and sprinkler output of 6-gpm and less. Not for use with sprinklers having output over 6-gpm. For heads with 1-in or larger inlets specify a prefabricated swing joint of appropriate size.

e. Pre-Bury Pipe Inspection Form
      (a) All pipe shall be inspected by the University Irrigation Shop before it can be buried. When pipe has passed inspection, the University's representative will give the Contractor a pipe inspection form indicating which areas of pipe have passed. If pipe has not passed inspection, the University reserves the right to have the pipe dug up to insure it meets the standards noted herein.

(3) Sleeves

a. Specify all sleeves to be PVC Class 200 minimum, two sizes larger than the total outside diameter of the piping contained in the sleeve. Sleeves shall be a minimum of 2-in. Specify the depth of installation for lateral and main lines. Coordinate the installation of sleeves with the location and installation of all hard surfaces. Require the Contractor to mark the location of all sleeves by attaching a locating magnet in both ends of the sleeve, and mark their location on record drawing. Where sleeves are buried under hardscape, instruct the Contractor to mark the location of each sleeve by installing a magnetized masonry nail, flush with the hardscape, indicating the location of each end of the sleeve. Insure that adequate amounts of sleeves are specified for both water lines and electrical control wires. Wires shall be in a sleeve separate from pipe, and wire sleeves shall be gray PVC Schedule 40 electrical conduit.

(4) Fittings

a. Fittings for pipe sizes 3-in and over will be specified ductile iron gasketed fittings. If gasketed pipe fittings (elbows and tees) are used, these shall be thrust blocked against undisturbed soil. Refer to Details LS-1, LS-2, and LS-3, Thrust Blocking - Gasketed Piping / Sizing Procedure.

b. Fittings on main and lateral lines 2-in and larger will be specified Schedule 80 pressure rated PVC.

c. Fittings on lateral lines smaller than 2-in diameter shall be specified Schedule 40 pressure rated PVC.

d. Flex Swing Fittings

i. Approved manufacturers and models for fittings on flex swing pipe shall be Rain Bird SB Series spiral barb fittings, Lasco Blue Twister, Toro Super Funny Pipe fittings, or approved equal.

e. Do not allow galvanized fittings of any kind on any PVC lines or fittings.

(5) Non-Electric Valves

a. Ball Valves

i. Specify ball valves to be domestic solid brass, meeting Federal Specification WW-V- 54, CLASS A TYPE 1. Valve sizes are to be the same size as the line on which installed. Specify ball valves as isolation valves on the upstream side of automatic valve clusters and place these valves in a standard valve box.

b. Stop and Waste Valves

i. Specify stop and waste valves to be solid brass meeting Federal Specification WW-V-54, CLASS A, TYPE 1. Valve sizes are to be the same as the line size on which installed. This valve shall be installed below the frost line. Specify access to each valve by an appropriately sized PVC standpipe, and specify an 8-in round box to cover each valve. The round box shall be stabilized on brick, and with a 12-inch gravel sump beneath the valve.

c. Hose Bib

i. Specify one hose bib per group of valves. The hose bib is to be installed on a manufacturer assembled Schedule 80, swing joint. See Detail LS-5 for additional information.

d. Quick Coupler Valve

i. Specify one quick coupler valve to be installed downstream of, and close to, the backflow preventer. The quick coupler valve is to be installed downstream of the master valve/flow sensing device.

ii. The quick coupler valve shall be a, two-piece, one inch, brass valve. Approved manufacturers and models shall be Rain Bird 44NP, Buckner QBRB5NP10, or Hunter Industries HQ-44LRC-NP.

(6) Electric Remote Control Valves

a. Installation

i. Specify each valve to be installed using Schedule 80 piping on both the upstream and downstream sides, to extend beyond the valve box. Refer to Detail LS-4, Ball Valve Assembly and LS-7, Valve Manifold.

b. Specification Requirements

i. Specify electric remote control valves using the following requirements:

ii. One inch valves shall be plastic, approved manufacturers and models Rain Bird 100-PEB, Hunter Industries ICV-101G, or Toro 220-P:

(a) Glass-filled nylon reinforced bodies

(b) Fabric-reinforced diaphragms

(c) Brass flow control stem

(d) Manual external bleed

(e) Capability to operate low flows of .25 gpm or less

(f) Optional pressure regulating device available

(g) 1-in valves shall be designed with a minimum of 5-gpm and a maximum of 24-gpm for load.

iii. Valves larger than 1-inch shall be brass. Approved manufacturers and models shall be Toro 220 Series valves, Rain Bird GB, Hunter IBV.

(a) Corrosion resistant brass body and bonnet.

(b) Fabric-reinforced diaphragms.

(c) Manual external bleed.

(d) Optional pressure regulating device available. The pressure regulating device shall be serviceable while the main line is under pressure. The device shall not be installed under the solenoid.

(e) 1-1/2-in valves shall be designed with a minimum of 25 GPM and a maximum of 34 GPM for load. 2-in valves shall be designed with a minimum of 35 GPM and a maximum of 75 GPM for load.

(f) Zone size shall not exceed 75 GPM

iv. Specify that all valves will be tagged with University Landscape Maintenance Department approved tag indicating the appropriate controller and station number.

(7) Electric Control Wire

a. Wire Specifications

i. Electric control wire shall be specified polyethylene (PE) UF/UL DIRECT BURIAL type. Wire which is routed from the electric remote control valve to the controller shall be #14 AWG. PVC coated UF/UL type wire shall not be used.

ii. Specify all wiring to be direct run with no splices except as noted in below. Include a statement in the construction documents that wire outside of valve manifold cannot be spliced without the approval of the University Project Manager and Landscape Maintenance.

iii. The specifications shall require an extra or "spare" control wire provided to each valve group. This spare wire shall not be a single wire looped throughout the site. Five valve groups require five spare wires.

b. Wire Color

i. Wire coloring shall follow the following coding:

(a) Ground wire shall be green.

(b) Common wire to a valve shall be white.

(c) Controller electrical power wire shall be black.

(d) Master valve wire, other than the common wire, shall be orange.

(e) Flow sensing wire, other than the common wire, shall be Purple.

(f) Each control wire extending to a valve shall have a different color wire for each valve, excluding those colors designated for other purposes i.e. green, white, black, purple and orange.

c. Splices

i. Splices in electric control wire at the electric remote control valve shall be twisted together, then soldered and fitted with a direct bury UL listed wire connector. All splices shall be contained in a valve box.

(8) Electric Controller

a. Rain Bird ESP

i. All clocks shall be equal to a Rain Bird ESP-SAT-LS or LW series controller or approved equal, installed according to manufacturer's instructions. Models within the series shall be -SITE-SAT, -SAT-LINK or –SAT-TW. Controller station counts shall be 24 or 40 only, no other count configurations allowed. Controllers shall be provided with a Rain Bird RB-SE-MET Ethernet device server. Refer to Detail LS-11, Pedestal Mounted Controller.

ii. The exact location of the clock shall be approved by the Landscape Maintenance Department.

iii. The controller shall be located such that it can communicate clearly to the University's central computer. A radio site survey is required to verify transmission clarity.

iv. All controllers shall be compatible with the University's existing central control system. Alternate manufacturers must be prior approved before bidding. Before prior approval will be considered, proposed products will be required to undergo on-site compatibility testing under direction of the University.

v. Central control equipment including but not limited to CCU's and controllers shall be commissioned, tested and approved by a Factory Authorized Service Technician from a local Rain Bird Authorized Distributor, before substantial completion will be granted. This task shall be at the Contractor's expense.

vi. Cluster Control units shall be model CCU-28, with a Rain Bird RB-DS-MPX Multiplexer and a RB-SE-MET Ethernet device server.

b. Grounding

i. Require the Contractor to ground all clocks according to manufacturer's recommendations, using either a three rod grounding grid or a grounding plate with a rod combination. See grounding details. If a three rod grounding triangle cannot be installed, contact the University Project Manager and the Landscape Maintenance Department.

ii. The grounding plate shall be manufactured for the express purpose of grounding. The plate shall measure a minimum of 4 inches by 96 inches, and no thinner than six one-hundredths of an inch.

iii. Grounding rods shall be 8-ft long, 5/8-in minimum diameter solid copper. Rods shall be placed a minimum of 8-ft apart.

iv. Connect rods and/or plate using #6 AWG or larger bare, solid copper wire to interconnect all rods.

v. Wire shall be run as straight as possible, with a bend of no tighter than ninety degrees and a radius no smaller than eight inches going into the controller. The ground wire entering the controller shall be of the shortest possible length and contain no bends kinks or coils in the wire.

vi. All grounding shall be tested to 10-ohms or less.

c. Central Control Radio Signal

i. The controller shall include radio signal access to the University's central controller. This shall be done by installing a 900 MHz spread spectrum radio card into the controller which is compatible with the controller. The radio card will be attached to a 900 MHz, 3db gain, antenna mounted on the controller. If the need for an antenna with a larger DB gain is determined, then the antenna of appropriate size shall be attached to the radio card and controller.

d. Controller hand-held Radio Remote Card

i. The controller will include a radio remote card compatible with the University's radio remote system. This card shall be connected to a compatible radio antenna, permanently installed, and transmitting at 27-MHz, Preferred antenna shall be TRC Irrigation Remotes model 35-001-006 low profile 'hockey puck' antenna, or approved equal.

e. Antenna Location

i. Antennas shall be installed at least forty feet away from electric motors, large power transformers, power lines, variable-frequency drives and other devices with a high level of electrical noise which could affect communication from the controller to the CCU. All antennas shall be permanently mounted on the exterior of the controller cabinet, nearby building or fixture. Antennas shall be positioned such that they are three feet away from all vertical surfaces and out from underneath roof awnings.

(9) Master Valve / Flow Sensor

a. The master valve and flow sensing device shall be a single, combined, unit with the capability of adding pressure regulation where needed, Netafim Reed Switch, Normally Closed models, LHMXXTG1-MEL or LHMXFG1-MEL, or approved equal. Photo Diode and normally open models shall not be specified. The valve shall be designed for high pressure, remote control applications via 14 AWG PE wire. The unit shall be double-chambered, and made of polyester coated cast iron, with a reinforced natural rubber valve diaphragm. No straight length of pipe will be

required upstream or downstream of the device. Only globe configured valves will be used.

b. Add Brass Ball Valves
    i. When ports are available on the valve, two brass ball valves will be added to the valve, attached by two brass nipples, to allow for drainage and winterization of the valve.

(10) Backflow Prevention
a. Reduced Pressure Assembly Valves
    i. Specify backflow preventers to be approved reduced pressure assembly valves with accessory construction, modular design, and replaceable seats. Specify this valve assembly to meet the following standards: ASSE No. 103; AWWA C506-78; CSA b65.4; and, FCCCCHR of USC. This valve shall be serviceable "in line" and have ball valve test cocks and valves on both sides for testing.
b. Installation
    i. Installation will be on the main line in an accessible location.
c. Site Location
    i. The exact location for the reduced pressure assembly is to be approved on site by the Landscape Maintenance Department. Specify the reduced pressure assembly to be installed above ground in a lockable metal enclosure approved by the Landscape Maintenance Department. See Detail drawing LS-17.
d. Drains
    i. Specify the installation of drains upstream and downstream of the reduced pressure assembly. These shall be ’American made’ brass stop and waste valves. Specify each drain to be provided with a gravel sump 12-in x 12-in x 12-in filled with 1-in minus washed gravel. Each drain is to be accessible by an appropriately sized PVC standpipe and covered with an 8-in round box. The round box shall be stabilized on brick, and installed with a 12-inch-deep gravel sump beneath the valve.

(11) Heads
a. Spray Heads
    i. Spray heads shall be Rain Bird RD-XX-S-P30 or Hunter PROS-XX-PRS30-CV series spray heads, or approved equal, of appropriate height for the plant material it services.
    ii. At no time use the side inlet.
    iii. Heads shall have the following characteristics:
        (a) UV resistant plastic.
        (b) Stainless steel spring.
        (c) Retractable stem that flushes while retracting.
        (d) Ratcheting riser.
        (e) Five-year warranty.
b. Small Rotors
    i. Small rotors shall be approved manufacturers and models: Rain Bird 5000-PL-XC-SAM-R series, Hunter I-20-XX-CV.
    ii. Small Rotors shall have the following characteristics:

(a) A radius of 25 to 50 feet.
(b) Durable, commercial grade body, cap and riser top.
(c) A flow shut off mechanism in the rotor such that water can be cut off to the head while the lateral irrigation system is still in operation.
(d) All rotor adjustments like arc, head shut-off, radius, nozzle set screw, riser access, shall be readily accessible from the top of the head.
(e) A twelve inch, four inch, and stainless steel riser options.
(f) A ratcheting or slip clutch riser.
(g) Low angle and matched precipitation rate nozzles shall be available.
(h) An optional built in check valve that can hold back at least seven feet of water due to an elevation change of the pipe.
(i) Five-year trade warranty.
(j) A matched precipitation rate nozzle package for 25, 30 and 35-foot radius of coverage.

c. Large Rotors
   i. Large rotors shall be approved manufacturers and models, Rain Bird 8005 series rotor, Hunter I-25 series rotor.
   ii. Large rotors shall have the following characteristics:
      (a) A radius of 39 to 60 feet.
      (b) Durable, commercial grade body, cap and riser top.
      (c) Brass reinforced nozzle to riser connection.
      (d) Vandal resistant arc adjustment that will return to a user defined arc.
      (e) In-head option to change from part-circle to a continuous 360°, true full circle, head.
      (f) All rotor adjustments like arc, head shut-off, radius, nozzle set screw, riser access, shall be readily accessible from the top of the head.
      (g) A stainless steel riser option.
      (h) Built-in check valve that can hold back ten feet of water due to an elevation change of the pipe.
      (i) Five-year trade warranty.

(12) Nozzles
   a. No variable arc nozzles for spray heads will be allowed.
   b. Multi-Stream Rotary Nozzles
      i. Multi-stream rotary nozzles for spray heads are allowed, approved manufacturers and models: Hunter Industries MP Rotator nozzles, Rain Bird RVAN nozzles. The radius of arc shall be adjustable from the top of the nozzle. Multi-stream nozzles shall be installed on spray heads with pressure regulated stems.

(13) Head Location
   a. Drawing Requirements
      i. Show all irrigation head locations on drawings diagrammatically. Although the Contractor will be required to exactly determine the location of each head for proper coverage, the A/E shall exercise all due diligence in establishing head

spacing, head specifications for best coverage, and piping design for minimum pressure loss to provide peak head performance.

ii. After due diligence in the design, the A/E shall include a note on the drawings indicating:

(a) "It shall be the Contractor's responsibility to determine the exact location of each irrigation head to accommodate the conditions found on the site in order to provide COMPLETE coverage of all areas. If a deficiency is found during the installation process, contact the University Project Manager and the landscape consultant at that time."

b. Manufacturer's Recommended Spacing

i. The A/E's design shall locate sprinklers at 90% OR LESS, of the manufacturer's published coverage radius. The A/E shall also use the manufacturer's published optimum pressure recommendation for the respective sprinkler head. (i.e. using a pressure rating higher than the published recommendation in order to justify increased spacing is not acceptable) Site conditions such as wind or slope may require tighter spacing than the 90%. At no time shall the A/E match or exceed the manufacturer's published coverage for spacing.

c. Layout Adjustments

i. Do not allow the Contractor to make adjustments in the designed layout unless prior approved to clear existing fixed obstructions.

ii. Direct the Contractor to note all deviations from the drawings on the as built drawings.

d. Perpendicular & Flush to Finished Grade

i. Specify all irrigation heads to be set perpendicular and flush to the finished grade unless otherwise designated on the drawings and specifications.

e. No Mixed Head Types

i. The design shall not mix head types in a zone. All heads shall be matched precipitation rates within a sprinkler zone.

f. The design shall not have head to head coverage extending through fencing or other barriers, or over walks or pavement. Mow curbs, paths, walks shall be border watered with part circle heads on both sides.

(14) Valve Boxes

a. Installation Requirements

i. Specify each valve box to be placed on a bed of 1-in minus washed gravel 6-in deep below the valve box. Use the same manufacturer's valve boxes throughout the construction site, Carson & Brooks, tee top lids. Additionally, direct the Contractor to set the box on a foundation of pressure treated wood frame or brick, which is placed on well compacted, undisturbed soil. Note that there shall be 2-in clearance between the base of the valve and the gravel bed. Also note that there shall be 2-in clearance between the top of the valve and the valve box lid. Valve boxes shall be green in color only. Specify that all valve box lids shall be 'lipped' or 'T' cover configuration, not 'flush' cover configuration. Specify that all valve box lids shall have labels branded into lid, using a device same as or similar to Nova Tool Co. model BI-CC-XX 2-in bronze letters. Box branding shall be as follows:

BOX LID BRANDING LABEL	ITEM OR EQUIPMENT IN THE BOX
XXX – YY	Controller #XXX – Station #YY
ISO	Isolation or Line Valve
WS	Wire Splice
S/W	Stop & Waste Valve
QC	Quick Coupler
HYD	Hydrometer
GND	Grounding Equipment

b. Site Location
   i. The Contractor shall be directed to install all valve boxes no closer than three feet from sidewalks, curbs, and all hard surfaced areas. Where three feet clearance from hardscape is not possible, locate the valve box as far as practical from areas of vehicle traffic. Do not allow the Contractor to install valve boxes at the low point of the landscaping.

c. Valves in Box
   i. Limit the number valves per valve box. The maximum number allowed in each box is shown in the chart below:

VALVE BOX SIZE	ELECTRIC VALVE SIZE AND QUANTITY
Standard Valve Box	One Valve per Box
Jumbo Valve Box	One 2-in Valve, or Two 1-1/2-in Valves, or Two 1-in Valves
Little Giant	Two 2-in Valves, or Three 1-1/2-in Valves, or Three 1-in Valves
Giant	Three 2-in Valves, or Four 1-1/2-in Valves, or Four 1-in Valves

(15) Trenches

a. Lateral Lines
   i. Specify trenches for lateral lines to be dug such that a minimum of 8-in and a maximum of 18-in of cover on top of the pipe, and as wide as necessary to properly install piping.

b. Main Lines
   i. Specify trenches for main lines to be dug a minimum of 18-in deep (from grade to top of pipe) and as wide as necessary to properly install piping.

ii. Direct the Contractor to route all electrical wiring in the main line trench as shown on Detail LS-12, Trench Detail. Require the Contractor to attach the electrical wires every 15-ft with tape to the underside of the main line.

c. Multiple Pipes
   i. Require trenches with more than one pipe installed to have a pipe separation distance of 4-in between each pipe. No exceptions will be considered for this requirement.

d. Buried Wire
   i. Wire not in a main line trench shall have a minimum of 12-in of cover to finish grade. Wire will be buried below and to the side of pipe with a separation from the pipe of no fewer than 3 inches.

e. Location
   i. Specify that trenches shall be at least 12-in away from curbs, buildings, and sidewalks; and, three feet from all roads. No exceptions will be considered for this requirement.

f. Backfilling of Trenches
   i. Instruct the Contractor to backfill around and over the pipes in accordance with Detail LS-12, Trench Detail. All material that is to come in contact with the pipes shall be less than 1/4-in in diameter and shall be imported for this specific use. The existing material on site can only be used as backfill material above the piping upon the approval of the A/E; then, it may be used in accordance with Detail LS-12. Compaction requirements shall generally be 95% under walks and roadways and 85% in lawn and shrub areas, unless information shown on Detail LS-12 or elsewhere on the drawings is more restrictive.

(16) Drip and Sub-Surface Irrigation Systems

a. Manufacturer's Recommendations
   i. Direct the Contractor to follow manufacturers' recommendations for installing drip irrigation systems.

b. No Point Source Systems
   i. No point-source systems shall be permitted on University projects.

c. Use End Feed / Grid Design
   i. Design drip systems using an end feed, grid design.

d. End Feed Piping
   i. End feed pipes at each end of the grid (also known as footers, headers, or exhaust pipes) shall be 1-in Schedule 40 PVC.

e. Manifolds
   i. Manifolds shall include the following devices, in this order:
      (a) Brass isolation ball valve.
      (b) Use an automatic valve. Do not exceed 14-gpm per zone.
      (c) Manifold union.
      (d) Disc filter with 140 mesh disc filter rings, of appropriate size.
      (e) In-line pressure regulator valve of appropriate size and flow.
   ii. All of the devices in the manifold shall be spaced such that all of the devices are fully operational and accessible for maintenance purposes.

f. Drip Tube Requirements
   i. Use inline drip tubing, approved manufacturers and models Netafim Techline CV or Rain Bird XFCV.
   ii. Drip tubing shall be pressure compensating, have a continuously self-flushing drip emitter design, and have a 2-psi check valve in each emitter.
   iii. Direct the Contractor to bury the tubing 2 to 5-inches. Do not place tubing under weed barrier fabric.
   iv. Require anchoring the drip tubing with stainless steel soil staples every 4 feet. Use two soil staples at each tee, elbow or cross.
   v. Place manual line flushing valves at each dead end, and low point in the system. Line flush valves shall be placed in a 10 inch round box, stabilized on brick, and with a 12-inch gravel sump beneath the valve.
   vi. Tubing shall be 0.40, 0.60 or 0.90 GPH set at 18-in emitter spacing in tubing. Tubing row spacing shall be uniform at 18-in on center.

(17) Flushing and Preliminary Testing
   a. Direct the Contractor to flush and test each zone after installation of new piping, swing pipe, and prefabricated swing joints, but before installation of irrigation heads and before trenches have been completely backfilled. The control valve shall be opened fully and a full head of water used to flush out the system. Each automatic valve shall then be disassembled, inspected for rocks, cleaned, and reassembled. Install irrigation heads and test each zone for complete coverage.
   b. Specify that testing will be performed after completion of each circuit, and again after completion of the entire system. At this time any necessary repair work will be done at the Contractor's expense and the entire system will be in good working condition prior to the Substantial Completion Inspection.

(18) Winterization
   a. All irrigation systems at the University are winterized starting October 15th. If the Substantial Completion Certificate has not been issued before winterization, it will be the responsibility of the Contractor to coordinate with the Landscape Maintenance Department Irrigation Shop regarding winterization, and the Contractor shall be responsible to winterize the system and prevent all components from freezing. Require the Contractor to then be responsible to activate the system in the Spring, with the assistance of the Landscape Maintenance Irrigation Shop to insure there are no problems.

(19) Irrigation System Guarantee
   a. All work shall be guaranteed for compliance with the drawings and specifications for a period of one year after the date of Substantial Completion. The Contractor shall correct any deficiencies when notified during the warrantee period, and additionally correct, to the satisfaction of the University, any damage to buildings or grounds caused by the deficient work, without cost to the University. All guarantees shall be in writing and approved by the A/E before submitting to the University. The written guarantee is due to the A/E for review and approval on or before the date of Substantial Completion.

B. Submittals prior to Construction
   (1) No additional University requirements.

C. Submittals prior to Substantial Completion

(1) Prior to the Substantial Completion inspection, require the Contractor to coordinate with the University's Irrigation Department to subcontract with a Certified Landscape Irrigation Auditor (CLIA), at the Contractor's expense. At a pre-approved time and date, the Contractor's CLIA auditor will be directed to a location or locations specified by the University to conduct the audit. The Substantial Completion Inspection will not be authorized until the CLIA report is acceptable to the University.

(2) During the Substantial Completion Inspection, the entire system, both electric and hydraulic, will be tested in the presence of the A/E, the Landscape Maintenance Department, and the University Project Manager to insure complete coverage of all areas to be watered. This test shall be performed by using the irrigation controller. Any deficiencies identified at this time will require revisions by the Contractor at the Contractor's expense.

5.0 HIGH PERFORMANCE BUILDING SYSTEMS

The DFCM HPBS shall be followed on all University projects, along with the additional University requirements detailed below.

5.1 LEED Requirements

A. All University of Utah projects exceeding $10 million of construction costs and which constructs a new building or an addition to an existing building shall meet the following additional minimum standards, unless the Chief Design and Construction Officer (CDCO) of the University of Utah approves an exception. The CDCO may not approve an exception for a new building without first consulting with the University President.

B. The project shall achieve a minimum of Silver Certification under the current LEED standard if the project is of a type for which LEED Certification is applicable.

C. The project shall specifically achieve the LEED credits as outlined in Table 5.1

(1) Table 5.1 is not inclusive of all credits allowed under LEED but shows the required credits in the University's Design Requirements as listed under *University LEED Standards* column.

(2) The *DFCM HPBS Requirements* column shows the DFCM High Performance Building Standard items that shall be followed in addition to the University's requirements.

(3) HPBS requirements not listed are either not as strict as University's Design Requirements or not as strict as LEED requirements. LEED credits that are not listed but would be required to achieve LEED Silver can be pursued at the design firms' discretion as long as the outcome is a minimum of LEED Silver certification.

(4) Table 5.1 is a quick reference guide of how LEED Silver, the University's Design Requirements and DFCM HPBS relate to each other in order for projects to meet LEED and HPBS design requirements. Design teams are responsible to verify requirements in HPBS and LEED and report any discrepancies to the Project Manager for clarification.

TABLE 5.1: QUICK REFERENCE GUIDE FOR THE UNIVERSITY'S LEED STANDARDS AND THE DFCM HIGH PERFORMANCE BUILDING STANDARDS

LEED CATEGORY OR PREREQUISITE	LEED CREDIT NAME	UNIVERSITY LEED STANDARDS	DFCM HPBS REQUIREMENTS
Prerequisite	Integrated Project Planning and Design	Prerequisite for "Healthcare". Highly recommended for all other projects.	Projects shall follow HPBS 5.15 (Owner's Project Requirements)
Credit	Integrative Process	Required	Project must follow HPBS 5.1 (Integrated Design Process)
LOCATION AND TRANSPORTATION			
LT	Sensitive Land Protection	Highly Recommended	
LT	Surrounding Density and Diverse Uses	Highly Recommended	
LT	Access to Quality Transit	Highly Recommended	
LT	Bicycle Facilities	Required	

LT	Reduced Parking Footprint	Lack of building specific parking on campus make this credit challenging. May require “Campus” or “Group Approach” to comply	
LT	Green Vehicles	Lack of building specific parking on campus make this credit challenging. May require “Campus” or “Group Approach” to comply	Project shall follow HPBS 5.3 E (Transportation Management--parking stalls)
SUSTAINABLE SITES			
SS	Construction Activity Pollution Protection - prerequisite	Required: Coordinate with Occupational and Environmental Health and Safety for potential additional campus requirements	
SS	Environmental Site Assessment – prerequisite	Required for Healthcare	
SS	Site Assessment	Highly Recommended	
SS	Rainwater Management	Required; following campus design standards will meet the credit requirements of Path 2	
SS	Heat Island Reduction		Project shall follow HPBS 5.4 D (Heat-Island Effect)
SS	Light Pollution Reduction	May require “Campus Approach” to comply	Project shall follow HPBS 5.4 E (Light Pollution Reduction)
WATER EFFICIENCY			
WE	Outdoor Water Use Reduction	Required; project shall earn a minimum of 1 point	
WE	Indoor Water Use Reduction	Required; project shall earn a minimum of 2 points (1 point minimum for Healthcare projects)	
WE	Water Metering	Highly Recommended	
ENERGY AND ATMOSPHERE			
	General	HPBS requirements are mandatory	Project shall follow HPBS 5.14 (Incentives and Rebates) Please also see Materials and Resources HPBS 5.5 B requirement (Appliances and Equipment)

EA	Fundamental Commissioning and Verification Prerequisite		Project shall follow HPBS 5.12 (Commissioning) and HPBS 5.13 (Envelope Commissioning)
EA	Building-Level Energy Metering Prerequisite	Following the DFCM HPBS will meet LEED requirements	AND project shall follow HPBS 5.10 (Metering)
EA	Enhanced Commissioning	Required; project shall earn 6 points (Option 1: Path 2 and Option 2).	Project shall follow HPBS 5.12 (Commissioning) and HPBS 5.13 (Envelope Commissioning)
EA	Optimize Energy Performance	Required; project must earn a minimum of 13 points exclusive of consideration of cogeneration at the U. Cogeneration may be used in the LEED submittal, however.	Project may not go below threshold set in HPBS 5.5A(1) without DFCM review and approval
EA	Advanced Energy Metering	Required. This credit is well aligned with the metering requirements of DFCM HPBS	Project must follow HPBS 5.10 (Metering)
EA	Demand Response	Projects considering this credit should work closely with UU Energy Management office.	
EA	Renewable Energy Production	Highly Recommended. Coordinate with Energy Management and Sustainability Office for potential additional funding opportunities.	
MATERIALS AND RESOURCES			
MR	General	HPBS requirements are mandatory.	Project shall follow HPBS 5.5 B (Appliances and Equipment) Project shall follow HPBS 5.7 B (Water bottle filling stations) Project shall follow HPBS 5.7 D (Sustainable Material Sourcing)
MR	Storage and Collection of Recyclables - Prerequisite	Coordinate design approach with Facility Operations Recycling and Sustainability Managers.	
MR	Construction and Demolition Waste Management Planning – Prerequisite	Provide final plan and documentation to UU Sustainability Office	

	PBT Source Reduction – Mercury (Prerequisite for Healthcare)	Required for Healthcare	
MR	Building Product Disclosure and Optimization--Environmental Product Declarations	If this credit is achieved along with Building Product Disclosure and Optimization--Sourcing of Raw Materials, then the project does not need to follow DFCM HPBS 5.7 D (1), 5.7 D (2), and 5.7 D (3).	
MR	Building Product Disclosure and Optimization--Sourcing of Raw Materials	Please see above note regarding Building Product Disclosure and Optimization--Environmental Product Declarations.	
MR	Construction and Demolition Waste Management	Required; project shall earn a minimum of 1 point. Provide final Waste Report documentation to UU Sustainability Office	
INDOOR ENVIRONMENTAL QUALITY			
IEQ	Low-Emitting Materials		If the LEED credit is not pursued, projects shall follow HPBS 5.8 (Indoor Environmental Quality) Sections C, D and E
IEQ	Construction Indoor Air Quality Management Plan	Required	
IEQ	Indoor Air Quality Assessment	Required	
IEQ	Interior Lighting	Option 2 of this credit is required; individual spaces that require specialty finishes based on functionality may be exempted from this requirement as identified in programming documents	If LEED Credit Option 1 is not pursued, then the project shall follow HPBS 5.8 H (Task and overhead lighting)
IEQ	Daylight		If the LEED credit is not pursued, project shall follow HPBS 5.8 I (Access to daylights and views)
IEQ	Quality Views		If the LEED credit is not pursued, project shall follow HPBS 5.8 I (Access to daylights and views)

INNOVATION			
	Innovation	Required; project shall earn 1 innovation point that meets or exceeds the requirements in DFCM HPBS 5.9 (Education and Outreach Program)	

5.2 University's Measurement and Verification Plan

A. Introduction

(1) In order to encourage better project design, enable better building operation and account for increased energy savings and reduced emissions, the University developed this Measurement and Verification (M&V) Plan. The purpose of this M&V Plan is to establish a consistent method for quantifying the performance of energy conservation measures by comparing actual energy consumed by a building, its systems and subsystems to the predicted energy consumption developed during project design. All projects shall comply with the University's Measurement and Verification Plan.

(2) The basis of this M&V Plan is the Efficiency Valuation Organization's International Performance Measurement and Verification Protocol (IPMVP). *IPMVP Volume 1: Concepts and Options for Determining Energy and Water Savings* (available at www.evo-world.org) outlines four options (Options A through D) for measuring and reporting a project's savings. Option B: Retrofit Isolation: All Parameter Measurement is the only option allowed under this M&V Plan.

(3) Compliance with this M&V Plan will support projects registered under LEED to earn EA Credit: Enhanced Commissioning, Option 1 Path 2 and for projects registered under LEED to earn the Advanced Energy Metering credit. Additionally, compliance with this Plan will assist the University as it works to meet its commitments to sustainability and energy efficiency including the American College and University President's Climate Commitment (climate neutrality by 2050) the Better Buildings Challenge (20% reduction in energy intensity by 2020).

B. Project Specific Measurement and Verification Plan Requirements

(1) A project specific Measurement and Verification Plan shall be developed by the design team along with the development and design of energy conservation measures. All design strategies and devices needed to fulfil the M&V Plan shall be budgeted in the project and included in project documents. Details of the Plan shall be coordinated with Facility Operations/Energy Management. The following outline represents the minimum requirement for a project-specific M&V Plan in addition to the requirements of LEED EA Credit Enhanced Commissioning Option 1, Path 2.

a. Table or listing of project's energy end uses and which are monitored

b. Indication of the location of all monitoring devices

c. Specific information regarding the baseline conditions established for the project

d. Specific information regarding the method/frequency for analysis against the documented baseline conditions

C. Metering Requirements

(1) Energy and water meters are fundamental to meeting the requirements of this M&V Plan. Utility grade meters shall be installed at the building level for each utility feeding each

building or major subunit of a complex. Sub-metering shall be installed on each subsystem as required by the project specific M&V Plan. Sub-metering shall also be installed to isolate any functional and/or billable subdivision within a building. In addition to metering devices, data acquisition devices shall be installed in each building to enable communication between each metering device and the University's Energy Information System (EIS) and/or Building Automation System (BAS). Details of the required metering and meter communications shall be coordinated with Facility Operations/Campus Utility Services and Energy Management.

(2) Following is an outline of basic metering and data requirements. This is a general list; exact metering shall be based on specific building requirements as outlined in the project specific M&V Plan. (See DFCM HPBS 5.10 for specific meter requirements.)

(3) Primary metering (utility grade meters)
   a. Building level. This also applies to separate programmatic spaces (spaces requiring individual energy accounting or billing)
      i. Electricity
      ii. Gas
      iii. Chilled Water
      iv. High Temperature / Hot Water
      v. Water

(4) Sub-metering (utility grade meters not required if alternative means are available)
   a. Electricity
      i. Lighting
         (a) Interior Lighting
         (b) Exterior Lighting (walkways, parking lots, etc.)
         (c) Special use lighting (athletic fields, etc.)
      ii. Plug loads
      iii. High Intensity/Process Loads (data centers, specific equipment)
      iv. HVAC System Equipment (fans, pumps, etc.)
   b. Thermal Energy
      i. Primary Heating (boilers (gas), heat exchangers (btu))
      ii. Domestic Hot Water (water heaters (gas), heat exchangers (btu))
      iii. Primary Cooling (chillers (electrical), heat exchangers (btu))
      iv. Pressure/temperature ports on hydronic equipment, such as cooling and heat coils.
   c. Water
      i. Irrigation
      ii. Domestic
      iii. Mechanical water usage (makeup/feed water)

(5) Data Requirements
   a. Meters to provide instantaneous data to BAS for operational monitoring of HVAC system
   b. Meters to provide 15-minute interval data to EIS for trending and analysis
   c. Electrical meters to report volts, amps, power (kW), energy (kWh), etc.

d. Gas meters to report pressure and temperature compensated volume in hundred cubic feet (CCF) or thousand cubic feet (MCF)
e. Chilled and High Temp/Hot Water meters to report flow in gallons per minute (gpm), supply and return temperature, energy (kBtu or MMBtu)
f. Water meters to report volume in cubic feet (CF) or gallons

D. Responsibility and Accountability

(1) It is the responsibility of the design team to develop the project specific M&V Plan. The design team shall ensure all required metering devices are budgeted and included in the design documents. It is the responsibility of the project team (design team, contractors, commissioning agent) to verify that all metering devices are reporting, recording, and communicating prior to project substantial completion.

(2) It is the responsibility of the University (Facilities Management/Facility Operations) to provide coordination and information to the design team in support of developing the project specific M&V Plan. Upon substantial completion, the University will take ownership of Measurement and Verification Plan and the process of collecting and reporting data.

6.0 SUMMARY OF PRODUCTS AND VENDORS

6.1 General

A. The intent of this section is to provide a central repository for the manufacturers, vendors and products that are found in the University Design Requirements, and are therefore specifically needed by the University. This section lists items with approved products, manufacturers, vendors, etc., (one product or a small group of products) which represent the required quality standard for each item. Some of these items are "sole source" and will be specified without the opportunity for substitution.

B. During the bidding process and prior to the bid due date, the A/E will assist the University in the evaluation of substitution requests (prior approval requests) submitted by vendors / suppliers. Refer to 1.5 for University Approved Equal requirements.

(1) These requests for prior approval will generally be submitted by the A/E no later than a deadline established by Facilities Business Services and placed in the bidding documents.

(2) Each substitution request will be evaluated by the A/E who will forward a summary of its recommendations to the University in a proposed addendum format for University review. The A/E will submit the proposed addendum to both the University Project Manager and to Facilities Business Services/Contracts. The University Project Manager will distribute the proposed substitutions to Facilities Management for review.

(3) Upon approval of the A/E's recommendation by Facilities Management, Facilities Business Services will post the A/E's addendum in the University's web based bid system.

(4) The A/E shall not distribute addenda to bidding contractors / vendors.

C. Product changes or special design circumstances may suggest a deviation from these standards. For all University projects, any anticipated change to, or variance from any portion of the supplement will require a review by the Design Standards Committee. Refer to 1.2 B. Each request for change or variance shall be submitted through the University Project Manager to the committee on the appropriate form found in Design Process, University of Utah Supplement or on the Facilities web site.

6.2 List of University Approved Products

A. Civil Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.2 A (2)	ADA Curb Ramps	Armorcast Products Company	For Other Products / Manufacturers, Prior Approval is Required

B. Architectural Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.3 B (3) a.	Roof Boards (High Traffic)	Georgia-Pacific "DensDeck"	For Other Products / Manufacturers, Prior Approval is Required

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.3 B (3) b.	Roof Under Overburden	Hydrotech "Garden Roof"	For Other Products / Manufacturers, Prior Approval is Required
3.3 B (4) a.	Roof Membrane Termination Sealant	Dow 795 / 790	For Other Products / Manufacturers, Prior Approval is Required
3.3 B (6) a.	Roof Drain Domes	Josam, Smith, Wade, Zurn	For Other Products / Manufacturers, Prior Approval is Required
3.3 B (7) b.	Roof Penetration Sealant	Dow 890	For Other Products / Manufacturers, Prior Approval is Required
3.3 B (8) a.	Roof Conduit and Pipe Supports	PipePier Support Systems	Similar To (No Prior Approval Required)
3.3 B (10) c.	Roof Curb	Unistrut	Similar To (No Prior Approval Required)
3.3 D (1)	Waterproofing, Fluid Applied	American Hydrotech, Inc. Monolithic Membrane #6125 Grace Construction Products Procor 20, and/or 75 Barrett Company Ram-Tough 250 DM	For Other Products / Manufacturers, Prior Approval is Required
3.3 D (2)	Joint Sealants	Dow Corning #780 Thiokol Base Federal Specification TT-S-00227 Hornflex	Similar / Equal To (No Prior Approval Required)
3.3 K (2)	Face Brick	Interstate Brick Company (SLC): Baja Brown, Matte Interpace Industries, Inc.: Desert Brown, Wirecut Robinson Brick Company: Colorado Rose	No Other Products / Manufacturers Allowed
3.3 N (7) c.	Electronic Locks	CCure	Sole Source, No Other Products Approved *(Standardized Security Requirements)*
3.3 N (7) c.	Electronic Locks, Interior, for Buildings without CCure	Essex	Sole Source, No Other Products Approved *(Standardized Security Requirements)*

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.3 N (7) c.	Electronic Locks, Interior, for Doors without Power	Locknetics	Sole Source, No Other Products Approved *(Standardized Security Requirements)*
3.3 N (7) d.	Cylinder Locks	Schlage "Standard 6 Pin Format" / L Series / ND Series	For Other Products / Manufacturers, Prior Approval is Required
3.3 N (7) d.	Panic Bars	Von Duprin 99 Series or 33 Series	For Other Products / Manufacturers, Prior Approval is Required
3.3 N (7) i.	Door Closers	LCN #4041 Series (domestic mfg.)	Sole Source, No Other Products Approved *(Standardized Maintenance Requirements*)
3.3 N (8)	Door Openers, Automatic	LCN #4611 or #4622	For Other Products, Prior Approval is Required
3.3 O (6) h.	Rubber Base	Johnsonite , Burke, Roppe, VPI	Similar / Equal To (No Prior Approval Required)
3.3 O (7)	Paints, Interior	Pratt and Lambert ProHide or Cellu-tone or Vitralite Sherwin Williams ProMar 200 Dupont 76 Kwal-Howells Accu-Pro Satin 1910	No Other Products Allowed
3.3 O (7)	Paints, Exterior	Pratt and Lambert, Ameritone , Glidden, Sherwin Williams, Kwal-Howells	No Other Manufacturers Allowed
3.3 O (8)	Wall Coverings	Vicretex , Essex	Similar / Equal To (No Prior Approval Required)
3.3 P (1)	Chalkboards and Markerboards	ADP Lemco	Similar / Equal To (No Prior Approval Required)
3.3 P (4) a.	Towel Dispenser (Owner Furnished, Contractor Installed)	Steiner SST	Sole Source, No Other Products Approved *(Standardized Maintenance Requirements)*
3.3 P (4) a.	Soap Dispenser (Owner Furnished, Contractor Installed)	Ulitmatic L-3	Sole Source, No Other Products Approved *(Standardized Maintenance Requirements)*

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.3 P (4) a.	Toilet Paper Dispenser (Owner Furnished, Contractor Installed)	Ulitmatic S-44C	Sole Source, No Other Products Approved *(Standardized Maintenance Requirements)*
3.3 P (4) b.	Toilet Accessories	American Specialties, Inc. Bobrick Washroom Equipment, Inc. Bradley Corporation	No Other Manufacturers Allowed
3.3 Q (3) c.	Laboratory Tops	Prime Industries, Laboratory Tops, Inc., Durcon, Epoxyn Products	No Other Manufacturers Allowed
3.3 Q (3) f.	Laboratory Waste and Drain Piping, Substitute for Pyrex	Durcon, Duriron	No Other Manufacturers Allowed
3.3 Q (3) h.	Paper Towel Dispenser, Laboratory Casework	Scott 995	For Other Products / Manufacturers, Prior Approval is Required
3.3 R (1)	Laboratory Casework	Sheldon, Hamilton, Kewaunee, Granite Mill Graniteline	For Other Products / Manufacturers, Prior Approval is Required
3.3 R (2)	Louver Blinds, Horizontal	Bali Classic Blind Series 3000	For Other Products / Manufacturers, Prior Approval is Required
3.3 S (2)	Floor, Waterproof, Washable	Crossfield Products Dex-O-Tex	Similar / Equal To (No Prior Approval Required)

C. Electrical Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.5 A (3) c.	Fuses for Pole Lights	CooperPower Systems Bussmann KTK-6 with HEB-JJ In-Line Fuse Holder	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 A (3) d.	Pole Light Base Concrete Forms	Sonoco Sonotube	Similar To (No Prior Approval Required)
3.5 A (3) e.	Light Poles, 10’ & 20’	Sterner Lighting by Hubbell Lighting, Inc. LSI Industries, Inc.	No Other Manufacturers Allowed *(Standardized Maintenance Requirements)*

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.5 A (3) f.	Walkway Lighting, 10' Pole Light Fixtures	LSI Industries, Inc., Enterprise Round Area Light, Model # SPL – ENS – PT – H – 2 – 100MH – F – MT – BLK – TE – 0450SFTR	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 A (3) f.	Walkway Lighting, 10' Pole Light Fixtures	Beta Lighting, Inc. by Ruud/Cree, Edge Model # ARE–EDR–3M–R5–08–D–UL–BK–350–43K	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 A (3) g.	Parking Lot Lighting, 20' Pole Light Fixtures	Lithonia Lighting, Round Area Light, Model # KVR2 – 250S – SYMFL – 277 – PT4.5 – DBL – LPI	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 E (2) a 3.5 E (4) d.	Cable Mounting in Manhole	Unistrut	Similar To (No Prior Approval Required)
3.5 E (2) a.	Cable Mounting Clamps	ZSI, Inc. Cush-A-Grip	For Other Products / Manufacturers, Prior Approval is Required
3.5 E (2) a.	Cable	Okonite, Kerite Company, General Cable Corporation, Superior Essex	No Other Product / Manufacturers Allowed
3.5 E (2) a.	Splices	Raychem TE, 3M	No Other Manufacturers Allowed
3.5 E (2) a.	Terminations	Thomas & Betts Corporation Elastimold, Cooper Power Systems, 3M, Richards Manufacturing	No Other Product / Manufacturers Allowed
3.5 E (1) c.	Padlock for Switch / Transformer Enclosure Gate	ASSA, Inc. #65190B	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 E (2) b.	Medium Voltage Solid Dielectric Switches	Thomas & Betts Corporation Elastimold G&W Electric Company Eaton VisoVac Fault Interrupter	No Other Manufacturers Allowed
3.5 E (2) c.	Padlock for Switch Cabinet Door	ASSA, Inc. #65190B	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.5 E (4) d.	Grade Ring Sealing System	Sika Corporation "Sikadur Combiflex"	For Other Products / Manufacturers, Prior Approval is Required
3.5 F (1)	Motor Control Centers	Schneider Electric Square D GE Energy Eaton Corporation Cutler-Hammer Siemens AG	No Other Manufacturers Allowed
3.5 F (2)	Variable Frequency Drives	Danfoss GE Energy Mitsubishi Electric Automation Rockwell Automation Allen Bradley Yaskawa Electric America	No Other Manufacturers Allowed
3.5 F (4)	Combination Starters	Eaton Corporation Cutler-Hammer GE Energy Siemens AG	No Other Manufacturers Allowed
3.5 F (5)	Electronic Solid State Starters	Schneider Electric Square D GE Energy Eaton Corporation Cutler-Hammer Siemens AG	No Other Manufacturers Allowed
3.5 G (3)	Padlock for Transformer Cabinets	ASSA, Inc. #65190B	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.5 G (3)	Distribution Transformers	Cooper Power Systems GE Energy Eaton Corporation Cutler-Hammer Schneider Electric Square D MGM Transformer Company	No Other Manufacturers Allowed
3.5 G (3) b.	Step Down Transformers	Eaton Corporation Cutler-Hammer GE Energy Schneider Electric Square D Siemens AG Synergy Energy, Inc	No Other Manufacturers Allowed

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.5 G (4)	Digital Power Meters	Electro Industries/Gauge Tech (EIG) "Shark" GE Energy Schneider Electric Square D "Power Logic"	No Other Manufacturers Allowed
3.5 G (5)	Switchboards / Distribution Boards	Schneider Electric Square D GE Energy Eaton Corporation Cutler Hammer Siemens AG	No Other Manufacturers Allowed
3.5 G (6)	Panel Boards	Schneider Electric Square D GE Energy Eaton Corporation Cutler Hammer Siemens AG	No Other Manufacturers Allowed
3.5 G (9)	Engine Generator Sets	Caterpillar Generac Power Systems Kohler Power Systems Cummins Onan Detroit Diesel	No Other Manufacturers Allowed
3.5 G (9)	Large UPS Systems	Emerson Network Power Liebert MGE UPS Systems, Inc. Mitsubishi Electric Automation, Inc. Toshiba Corporation	No Other Manufacturers Allowed
3.5 H (3) a.	Clock System	SimplexGrinnell Primex Wireless Sapling, Inc.	For Other Products / Manufacturers, Prior Approval is Required
3.5 H (5)	Fire Alarm Systems	FCI (Honeywell Gamewell Fire Control Instruments)	Sole Source, No Other Manufacturer or Vendor will be Approved *(Standardized Maintenance / Fire Security Requirement)*
3.5 H (5)	Electronic Notifying Pressure Switch (Fire Extinguishers)	MIJA, Inc. "en.Gauge"	Sole Source, No Other Manufacturer or Vendor will be Approved *(Standardized Maintenance / Fire Security Requirement)*
3.5 H (5) d.	Portable Fire Extinguishers, Electronically Monitored	Mija, Inc.	For Other Products, Prior Approval is Required

D. Plumbing Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENTS
3.7 B (4)	Water Softening or Conditioning Equipment	GE Osmonics, Pacific Water Inc, Water Specialties, Fluid Treatment Systems	For Other Products / Manufacturers, Prior Approval is Required
3.7 E	Emergency Eye Wash / Emergency Showers	Haws, Bradley, Guardian	For Other Products / Manufacturers, Prior Approval is Required

E. Mechanical Products (General and HVAC)

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENTS
3.8	Control Valves	Johnson Controls, Inc. Metasys Trane US, Inc. Trane Wasatch Controls Honeywell	No Other Products / Manufacturers Allowed *(These Contractors were selected by advertised procurement)*
3.8	BTU Meters	Fluxus ADM 7407	For Other Products / Manufacturers, Prior Approval is Required
3.8	Air Compressors	Quincy Compressor FS-Curtis Air Compressors Ingersoll-Rand Company	For Other Products / Manufacturers, Prior Approval is Required
3.8	Vacuum Pumps	Quincy Compressor FS-Curtis Air Compressors Ingersoll-Rand Company	For Other Products / Manufacturers, Prior Approval is Required
3.8	Reciprocating Chillers	Carrier Trane York	For Other Products / Manufacturers, Prior Approval is Required
3.8	Centrifugal Chillers	Carrier Trane York	For Other Products / Manufacturers, Prior Approval is Required
3.8	Pumps, 1-hp or higher	Bell and Gossett Taco Paco Armstrong	For Other Products / Manufacturers, Prior Approval is Required

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENTS
3.8	Automatic Temperature Control Systems	Johnson Controls, Inc. MSEA Trane US, Inc. Trane Wasatch Controls Honeywell	No Other Products / Manufacturers Allowed *(These Contractors were selected by advertised procurement)*
3.8 F	Building Automation Systems	Johnson Controls, Inc. Metasys Trane US, Inc. Trane Wasatch Controls Honeywell	No Other Products / Manufacturers Allowed *(These Contractors were selected by advertised procurement)*
3.8 F	Controllers	Johnson Controls, Inc. Metasys Trane US, Inc. Trane Wasatch Controls Honeywell	No Other Products / Manufacturers Allowed *(These Contractors were selected by advertised procurement)*

F. High Temperature Water Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.8 D	Pre-insulated HTW Pipe, Below Grade	Thermacor Process, L.P. Duo Therm “505”	For Other Products / Manufacturers, Prior Approval is Required
3.8 D	Control Valves, HTW Heat Exchangers & Steam Generators	Fisher	For Other Products / Manufacturers, Prior Approval is Required
3.8 D	Controls, HTW Heat Exchanger	Powers 535 Controller	For Other Products / Manufacturers, Prior Approval is Required
3.8 D	Feedwater Controls	McDonnell Miller 150S, Mercoid, Magnetrol	No Other Product / Manufacturers Allowed
3.8 D	Low Water Cut-Out Alarm / High Water Level Cut-Out Alarm	McDonnell Miller 150, Mercoid, Magnetrol	No Other Product / Manufacturers Allowed

G. Laboratory Ventilation Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.8 N	Hood Manufacturers	Thermo Scientific Hamilton, Kewaunee Scientific Corporation, Labconco Corporation, ALC-Collegegdale, Mott Manufacturing, Ltd.	For Other Products / Manufacturers, Prior Approval is Required
3.8 N	Flow Measuring Device	Phoenix Controls, TSI Incorporated	For Other Products / Manufacturers, Prior Approval is Required
3.8 N	Coatings, Exhaust Fan	Eisenheiss, Heresite	For Other Products / Manufacturers, Prior Approval is Required

H. Communications and Security Wiring Products

LOCATION	PRODUCT DESCRIPTION	UNIVERSITY APPROVED VENDOR / MGFR	PROCUREMENT REQUIREMENT
3.11 B (1)	Cable Seals at Manholes	Virginia KMP Presstite Permagum	Sole Source, No Other Manufacturers Approved *(Standardized Maintenance Requirements)*
3.11 C (5)	Conduit Entrances	Emerson O.Z. Gedney Bell End Entrances Type TNS	Equal To (No Prior Approval Required)
3.11 F (37)	Communication Device, Elevator Phone Panel	Ramtel Corporation RR833	Sole Source, No Other Products Approved *(Standardized Maintenance Requirements)*

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