

University of Utah Building 303 Seismic Upgrade Phase 5

U o U Project # 22508

Salt Lake City, Utah 84123



Specifications

Permit Set

March 5, 2024

FFKR ARCHITECTS

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The University of Utah
U FACILITIES

GENERAL CONDITIONS

September 1, 2020

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**The University of Utah
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GENERAL CONDITIONS

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 (14th) 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.

The University of Utah
FACILITIES MANAGEMENT

**SUPPLEMENTAL
GENERAL CONDITIONS
FOR UNIVERSITY OF UTAH PROJECTS**

September 30, 2011

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Revision Note: This document replaces the *Supplemental General Conditions for University of Utah Projects* dated May 2, 2011. The only change is a new paragraph 5.1 added to Article 5 “Request for Utility Shutdown.”

Article 1 Basic Definitions

Except as otherwise described herein, definitions provided in the General Conditions apply to this document. The following definition is added to the General Conditions:

UNIVERSITY PROJECT MANAGER. “University Project Manager” means the University of Utah Facilities Management person directly assigned to coordinate the University’s interests and involvement in the Work. If the contractor’s agreement is issued by the University of Utah, the “University Project Manager” is the “University’s Representative” as defined in the General Conditions.

Article 2 Affirmative Action

The Contractor is encouraged to utilize the services of Small Business Enterprises, Disabled Veteran-Owned Business Enterprises, Minority-Owned Business Enterprises, Woman-Owned Business Enterprises, and Small Disadvantage Business Enterprises as subcontractors and/or suppliers for University projects. The Contractor may be required to survey and provide information on contracts and utilization of these services.

Article 3 Access to Communication Manholes

The University of Utah requires communications manholes on campus to be fitted with a secure access system. Authorization will be required before the Contractor may enter any communication manhole, whether secured or not. Authorization will be requested through the University Project Manager and permission will be given by University Information Technology - Network and Communication Services.

- 3.1 The Contractor must not proceed with any work in the manhole without first fully understanding the systems and equipment currently in place. Assistance in identifying communications systems and their functions in the manhole may be obtained from University Information Technology - Network and Communication Services at 801-581-8999.
- 3.2 Note that campus communication systems provide support to several critical functions at the University, including, but not limited to major research activities. An unintended shutdown may adversely affect several critical functions, including highly expensive research. Unintended shutdown of any communication service caused by the Contractor which results in any damage(s) will be assessed to and paid by the Contractor.

Article 4 Digging Permits

A Digging Permit shall be required for all underground digging on campus. The University and other non-University entities support an extensive network of underground utilities.

- 4.1 Contractors shall request digging permits through the University Project Manager.
- 4.2 Requests for a Digging Permit are available on-line or from the University Project Manager. Requests must be submitted at least five full University working days prior to the commencement of digging. The request should include a description of the intended work, and drawing(s) showing the intended work area and the contract limit lines.

- 4.3 This permit process does not automatically request Blue Stakes assistance. The Contractor must also contact Blue Stakes and other utility companies as applicable for assistance in locating non-University underground utilities.
- 4.4 The issued Digging Permit will identify University utilities known to exist within the affected area. After issuance of the permit, Facilities Management (“FM”) will mark the location of existing University utilities at the site. Note that there is a risk that some underground utilities may not be documented in University records. All excavation should proceed with caution.
- 4.5 During excavation, the equipment operator shall have copies of the Digging Permit and Blue Stakes documentation in his/her immediate possession to guide the operator in utility avoidance and to document the University’s approval of the work.
- 4.6 Additional assistance in locating existing University utilities is available from the University Surveyor at 801-585-5070.
- 4.7 Contractor shall provide the University Project Manager notice of not less than two working days prior to backfilling over utilities or other underground improvements. While the intent of this requirement is to allow the University to collect survey data, this does not relieve the Contractor of its obligation to maintain As-Built documentation required by Article 4.8 of the General Conditions.

Article 5 Request for Utility Shutdown

A Request for Utility Shutdown shall be submitted to the University Project Manager for each anticipated interruption of any existing utility service on campus. This includes, but is not limited to, any interruption to electric systems, communications; control systems, security, gas (natural, laboratory gasses, etc.), water (potable, non-potable, purified, etc.), steam systems, high-temperature water systems; sanitary sewer, storm sewer, etc. The Contractor is to discuss anticipated shut-down requirements with University Project Manager well in advance of the proposed shut-down.

- 5.1 Prior to beginning any work on a Utility Shutdown, the Contractor must meet with the University Project Manager and Plant Operations staff to define a hazard control plan that can include Lock Out Tag Out, Confined Space Entry, and NFPA 70 compliance. Refer to Article 24 in these Supplemental General Conditions for additional information. The Contractor must verify that all sources of hazardous energy for the affected system have been identified, properly controlled and/or isolated, and locked out prior to beginning any work. The Contractor and its subcontractors shall place their own locks on the shut down system as an added measure of protection for their employees.
- 5.2 Utility Shutdown Request forms are available on-line or they can be obtained from the University Project Manager.
- 5.3 Submit the request to the University Project Manager at least three (3) full University working days prior to the day of shut-down.

- 5.4 A longer lead time is required for interruptions affecting several campus departments, scientific experiment disruption, and similar complications. Shutdowns of this nature must be identified early and reviewed with the University Project Manager in order to determine notice requirements.
- 5.5 Each utility shut-down request is subject to approval by Campus Design & Construction, Plant Operations, and University departments which will be affected by the proposed loss of service.
- 5.6 If immediate shutdown is required to prevent damage to personnel or property, contact Plant Operations Dispatch at 801-581-7221.

Article 6 Drug Free Workplace

It is the policy of the University of Utah that "...the unlawful manufacture, distribution, dispensation, possession, or use of a controlled substance on University property is prohibited." All contractors, subcontractors, and their employees, while under contract with the University must abide by the terms of the above policy. Violation may result in termination of the contract. The University will prosecute violators of this policy to the fullest extent possible.

Article 7 Hazardous Chemicals

The University of Utah shall inform contractors of hazardous chemicals their employees may be exposed to while working on University projects. Conversely, the Contractor shall inform the University of Utah of all hazardous chemicals the Contractor will bring on campus that University of Utah employees may be exposed to. This exchange of information shall occur through the University Project Manager.

Article 8 Interim Life Safety Measures

The Contractor must observe the following interim life safety measures during construction of the project. The University must approve any variance or exception in writing.

- 8.1 All exits will provide free and unobstructed egress.
- 8.2 Free and unobstructed access to emergency departments and for emergency forces will be maintained.
- 8.3 Fire alarm, detection, and suppression systems will not be impaired. In the event of disruption, alternative systems shall be provided which are satisfactory to the authority having jurisdiction.
- 8.4 Temporary construction partitions will be smoke tight and built of non-combustible or limited combustible materials that will not contribute to the development or spread of a fire.
- 8.5 The Contractor will provide appropriate additional fire fighting equipment (such as charged, current fire extinguishers) on the construction site.
- 8.6 Smoking is prohibited in or adjacent to construction areas.

- 8.7 The Contractor will develop and enforce storage, housekeeping, and egress removal practices that reduce the flammable and combustible fire load of the building to the lowest level necessary for daily operation.
- 8.8 When structural or compartmentation features of fire safety are compromised, the Contractor will notify the A/E and University Project Manager so that the University can develop alternate fire safety procedures.

Article 9 Keys

Should the Contractor require key(s), (as determined by the University Project Manager) for access to the Project Site, the University Project Manager shall arrange to obtain such key(s) for the Contractor.

- 9.1 At the completion of the Project and before final payment is approved, the Contractor shall return University key(s) to the University Project Manager. Should he/she be unable to do so because of loss, theft, or for any reason, the cost of replacement key(s) and/or re-keying of any locks deemed necessary shall be deducted from the Contractor's final payment. Loss or theft of keys is to be reported to the University Project Manager immediately.

Article 10 No Smoking Area

In order to comply with the Utah State Clean Air Act which prohibits smoking in public buildings, a strict no smoking policy shall be enforced at any job site located within the confines of any University of Utah building or within 25 feet of any building opening or entrance. This policy will apply to all contractors, their employees and subcontractors.

Article 11 Operating and Maintenance Manuals / Warranties and Guarantees

- 11.1 All information is to be organized by discipline (architectural, mechanical, electrical, etc.).
- 11.2 Security Systems O&M Manuals and Warranties/Guarantees
 - a. The Security Contractor shall submit security systems O&M and warranty/guaranty documents separately.
 - b. These documents must be delivered directly to the UCard main office by the installing Security Contractor. No other entity will receive a copy of security system documentation.
- 11.3 Warranties and Guarantees
 - a. Submit two sets of paper originals bound in a binder for the University (plus sets required by DFCM for their projects)
 - b. Submit two CDs of the same information prepared electronically in a self executable searchable PDF format for the University (plus sets required by DFCM for their projects).

- c. Hard copies and electronic submittals are to be clearly identified on the front cover and label with the title “Warranties and Guarantees”, University building number, the project name, University project number, and the Contractor’s business name.

11.4 Operating and Maintenance Manuals

- a. Submit O&M manuals as a separate bound document in the same formats described above for warranties and guarantees (2 paper sets and 2 electronic copies of a self executable searchable PDF).
- b. The following information shall appear on the front cover (both CD and hard copy):

<p><u>"Operation and Maintenance Manual"</u></p> <p>Building Number: Project Name: Volume Number: University Project Number:</p> <p>A/E Firm: A/E Subconsultant(s): Commissioning Agent:</p> <p>Contractor: Major Subcontractor(s):</p>

- c. Special equipment must include a material list, and special architectural items must include paint color identification (source and catalog number).
- d. Include complete set(s) of building control diagrams, drawn as installed at the site with all sequences of operations included for all equipment. Equipment, devices and wiring shall be clearly identified with model, size, etc. These drawings are to be included in O&Ms as well as being framed behind glass and hung in the mechanical room along with a valve matrix showing valve type, service and location.
- e. For each item of equipment, include approved submittals and provide data and instruction sheets marked to indicate the equipment/device serial number, the plan symbol found on the construction drawings, the model number, and all options ordered.
- f. Additionally, the following information is to be included:
 - (1) A table of contents.
 - (2) A complete parts list(s) and source of supply for each piece of equipment, including contact information (addresses and phone numbers).

- (3) The balance report, where applicable.
- (4) Performance curves and capacity data.
- (5) Wiring diagrams.

Article 12 Parking Permits

Every vehicle will require a permit to park on the University of Utah campus. The Contractor is responsible for all costs of required parking permits. Contractor permits are available at 1901 E. South Campus Drive, Room #101 (the north-west corner of the Annex Building just east of the Jon M. Huntsman Center). The sale of parking permits to Contractors is subject to any limitations or other constraints identified in the bidding documents and by University of Utah Commuter Services.

Article 13 Parking on University Sidewalks

Parking or driving on campus sidewalks is not allowed unless prior authorization is received and a hang-tag permit is clearly visible in the vehicle. Authorization must be obtained through the University Project Manager. The hang-tag shall be placed on the vehicle's dashboard or interior mirror, fully visible through the windshield at all times. Not all sidewalks are vehicle accessible. For more information see <http://www.facilities.utah.edu/sidewalkpermits/>.

Article 14 Sexual Harassment

Sexual harassment of any kind is taken very seriously at the University. Contractors will be held responsible for the actions of their employees and subcontractors while working on University projects. Any contractor, subcontractor, or employee thereof participating in verbal or other sexual intimidation of any kind toward any other individual or group (e.g., making "catcalls") shall be held in violation of Federal Law, Title VII, Section 703 (sexual harassment) and will be prosecuted to the fullest extent possible. University sanctions of convicted violators may include, but not be limited to, termination of Contract.

Article 15 Site Lighting


New and existing site lighting along walkways and around the perimeter of the construction site shall be operational for all hours of darkness during extent of construction. Upon notification of lighting failure, the Contractor shall respond and initiate repair of the failed system within four hours of notification. If the response time exceeds four hours, the University reserves the right to repair the system and the Contractor will then be responsible for the repair costs.

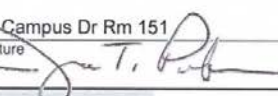
Article 16 Tax Exemption

Do not include Utah State Sales and Use Tax on materials purchased for the Work, and do not include this tax on materials for proposed changes or invoices. The University of Utah is exempt from Federal Excise Taxes and Utah Sales and Use Taxes. The Contractor is responsible for complying with all Utah State Sales and Use Tax exemption requirements. The Contractor is responsible for payment of all Utah State Sales and Use Tax obligations that arise from the Contractor's failure to comply with exemption requirements.

*The Utah State Tax Commission Exemption Certificate (Number N21318)
is provided on the following page.*

TAX EXEMPTION CERTIFICATE

	Utah State Tax Commission Exemption Certificate (Sales, Use, Tourism and Motor Vehicle Rental Tax)	TC-721 Rev. 1/09
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Name of business or institution claiming exemption (purchaser) University of Utah		Telephone Number 801-581-7241	
Street Address 1901 E South Campus Dr Rm 151	City Salt Lake City	State UT	ZIP Code 84112
Authorized Signature 	Name (please print) James T. Parker	Title Director of Procurement & Supply Mgt.	
Name of Seller or Supplier:		Date	

The person signing this certificate **MUST** check the applicable box showing the basis for which the exemption is being claimed. Questions should be directed (preferably in writing) to Taxpayer Services, Utah State Tax Commission, 210 N 1950 W, Salt Lake City, UT 84134. Telephone (801) 297-2200, or toll free 1-800-662-4335.

DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION
 Keep it with your records in case of an audit.

CONSTRUCTION MATERIALS PURCHASED FOR RELIGIOUS AND CHARITABLE ORGANIZATIONS

I certify the construction materials purchased are on behalf of a religious or charitable organization. I further certify the purchased construction materials will be installed or converted into real property owned by the religious or charitable organization.

Name of religious or charitable organization:

 UNIVERSITY OF UTAH

Sales Tax Exemption No. _____ N21318

Name of project: _____

To be valid this certificate must be filled in completely, including a check mark in the proper box.

A sales tax license number is required only where indicated.

Please sign, date and, if applicable, include your license or exemption number.

NOTE TO SELLER: Keep this certificate on file since it must be available for audit review.

NOTE TO PURCHASER: Keep a copy of this certificate for your records. You must notify the seller of cancellation, modification, or limitation of the exemption you have claimed.

If you need an accommodation under the Americans with Disabilities Act, contact the Tax Commission at (801) 297-3811 or TDD (801) 297-2020. Please allow three working days for a response.

DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION
 Keep it with your records in case of an audit.

Article 17 Water Use on Campus

Fire hydrants on campus may only be used with permission. If water trucks or tanks must be filled outside the construction area, the water station between Buildings 306 and 309 may be used.

Article 18 Storm Water Pollution Prevention (SWPPP)

In addition to complying with the SWPPP requirements provided for in the Instruction to Bidders, the Contractor shall comply with the following. The University must approve any variance or exception in writing.

- 18.1 The Contractor must employ the following storm water pollution prevention measures during construction of the project.
 - a. Perimeter control, a system of sediments control best management practices (BMPs) that act as barriers to retain sediment on the construction site.
 - b. Construction entrance/exit stabilization for all entrances/exits used by the project, no matter how short the duration. Sediment tracking onto University roads, parking lots, sidewalks, and other paved surfaces is prohibited. If tracking occurs, the Contractor must clean the affected area before the end of the workday.
 - c. Temporary earth stabilization until final stabilization has been achieved.
 - d. Protect all storm drain inlets/catch basins that could receive storm water from the project until final stabilization of the site has been achieved.
 - e. If concrete work is part of the project, a concrete washout area must be provided. The area must be lined or a sealed container may be used.
- 18.2 The Contractor's SWPPP must be reviewed and approved by the University's Department of Environmental Health and Safety (EHS) prior to submitting the application (NOI) online, and the Contractor must have the permit before beginning construction. The University Project Manager will assist in submitting the Contractor's SWPPP to EHS.
- 18.3 The Contractor shall assume full responsibility for any SWPPP drafted by others and adopted by the Contractor for use at the construction site. The Contractor shall finalize and file the SWPPP grading, sediment and erosion control plan and pay permit fees. The Contractor shall make any needed modifications to the SWPPP to fit the existing site conditions prior to beginning construction.
- 18.4 In addition to other requirements, the Contractor shall:
 - a. Inspect the construction site to verify the SWPPP plan every two weeks and after significant rainfall, and keep a record of each inspection at the construction site,
 - b. Remedy deficient management practices, controls and control structures; and,

- c. Modify the SWPPP as site conditions change (i.e., as demolition and construction phases progress).

Article 19 Vehicle Idling Policy

In an effort to reduce vehicle emissions and fuel use at the University of Utah, the Contractor shall adhere to this idling policy for all vehicles and equipment operating on campus.

- 19.1 For the purposes of this policy, idling means an engine is running while the vehicle it serves is stationary, or the equipment it operates is not performing work.
- 19.2 Contractor vehicles and equipment are prohibited from idling for periods longer than 60 seconds except under the following conditions:
 - a. Where idling is necessary to power auxiliary equipment such as lifts, hoists, computers or safety lighting (auxiliary equipment does not include the vehicle's air conditioner, heater or defrost for wintertime vehicle warm up),
 - b. Where idling is necessary for testing, maintenance, repair or diagnostic purposes,
 - c. Where idling is necessary to maintain factory installed emissions equipment on diesel equipment,
 - d. Where a vehicle is stopped at a traffic control signal; in heavy traffic at a TRAX line or railroad crossing; traveling through a construction zone; and / or,
 - e. Where turning off the motor could jeopardize the health and safety of the driver or passenger.

Article 20 Environmentally Preferable Products

Subject to limitations and the review and approval requirements stated in the General Conditions and other Contract Documents regarding substitutions, substitution requests and the use of specified materials or products, the Contractor, where allowed, is encouraged to offer Energy Star certified products, EPEAT (Electronic Product Environmental Assessment Tool) recommended products, or products that meet FEMP (Federal Energy Management Program) standards for energy consumption. The University of Utah also encourages contractors to offer products or services, when allowed by Contract Documents, that have a lesser or reduced effect on human health and the environment when compared with competing products or services. Items considered may include raw materials acquisition, production, manufacturing, packaging, distribution, reuse, operation, maintenance, disposal, etc.

Article 21 Integrity of Fire Rated Partitions

For all construction work performed in patient care facilities, unless specifically shown on the drawings, neither the Contractor nor any Subcontractor shall allow holes, cuts, or any other type of penetration in any floor slab, partition above the ceiling, or any otherwise concealed partition, without first notifying the University or the University's representative of every such occurrence. The purpose of this notification is to enable the University to verify that each such penetration is properly sealed according to the requirements of current UBC and NFPA codes (as part of the Work of the Contractor) if required by the

University. Prior to covering concealed locations, and prior to Substantial Completion, the Contractor shall be responsible to arrange an inspection with the University or University's representative where personal inspection will verify that each such penetration is properly sealed.

Article 22 Roof Access

Access to University roofs is limited to authorized personnel only. Roof safety is the responsibility of the Contractor and includes any individual working for or contracting with the Contractor. Safety issues include potential falling hazards and roof integrity protection. Any individual intending to access a University roof must first obtain permission follow the procedures described at the Plant Operations web site under "Roof Access."

Article 23 Utility Connections

Connections to certain campus utilities require specific tasks. The following utilities have specific connection task requirements:

- 23.1 Trace Wire. For all underground piping, a #10 THW copper wire must be installed alongside of the pipe to serve as a trace wire. The trace wire must be brought to the interior of valve boxes and manholes when applicable. At building penetrations, trace wire must be brought to the surface outside of the building and secured inside a single valve irrigation box with cover. Any terminations of trace wire not described above shall be secured inside a single valve irrigation box with cover. Terminations of the trace wire shall be noted on As-Built drawings.

- 23.2 Electrical Power-Up. The following requirements must be met prior to activating electrical power at new or remodeled buildings on campus. The Contractor's Work will be subject to inspection by the University's Electric Shop and power-up will not be allowed until the following requirements are met.
 - a. Manholes
 - (1) Switchgear in manholes shall be labeled to identify the building being served.
 - (2) Each new and existing high voltage cable shall be fire-taped and racked on manhole walls.
 - (3) Each new and existing high voltage cable shall be marked to indicate feeder number and feeder voltage.
 - (4) Each conduit leaving the manhole shall be marked to show the next manhole or building.
 - (5) Each manhole shall be labeled with a manhole number.
 - (6) All ground wires in the manhole and all terminations shall be properly grounded.
 - (7) Prior to power-up, each manhole shall be cleaned of all trash.

- b. Above Ground High Voltage Switches and Transformers
 - (1) Switches and transformers shall be labeled to identify the voltage and building served.
 - (2) Properly ground all gear and terminations.
 - (3) Color code each feeder leaving the transformer per the voltage feeding the building. Colored tape shall be applied at all terminations, junction boxes and pull boxes. Conductors in sizes #6 and below shall be color coded with colored insulation. Power conductors shall be color coded as follows:

Conductor	208v	480v
phase A	black	brown
phase B	red	orange
phase C	blue	yellow
neutral	white	grey
ground	green	green

- c. Main Distribution Panels
 - (1) Each distribution panel shall be grounded.
 - (2) Each feeder entering the panel from a transformer shall be color coded (as described in paragraph “b” above) to identify the voltage.
 - (3) Each distribution panel shall be labeled to identify the voltage.
- d. Equipment Labeling
 - (1) Compliance with NFPA 70E 2009 130.3 C Equipment Labeling (including current updates) is required. All labels must be in place prior to connection to the University Electrical System.

23.3 High Temperature Water Connections. The following requirements must be met prior to activating high temperature water piping at new or remodeled buildings on campus. The Contractor will assist the University during system start-up.

- a. Prior to requesting start-up assistance, the Contractor shall check all parts of the system for leaks, and repack valve stem glands that indicate a need for additional packing.

- b No valve between existing and new HTW piping shall be opened until after all tests are approved, and internal cleaning operations are complete; then, system valves may be opened only with authorization and on-site-assistance from Campus Utility Services, the High Temperature Water Plant, and the University Project Manager.
- c The HTW Plant personnel will provide on site management of the start-up process and direct the Contractor in valve positioning. The Contractor shall not activate any valve during start-up until directed to do so by the University.
- d Additional requirements include:
 - (1) Shut-down and start-up will be accomplished by University personnel only. The Contractor shall follow “Request for Utility Shutdown” procedures, but allow additional lead time to allow adequate preparation time for University services.
 - (2) The Contractor shall boil out each HTW pipe system before connecting to a live HTW system. Water quality for start up must be 0 PPH and shall be verified by a University authorized water treatment specialist.
 - (3) Pressure test each pipeline at 800 lbs for 24 hours. If hydrostatic testing is not feasible, provide certification of a leak proof system through x-ray analysis.
 - (4) Before opening or cutting into any HTW pipe, the Contractor must verify 0 PSI in the line and receive approval from the HTW plant.
 - (5) All connections shall be welded and tested before start up. Threaded pipe connections will not be allowed.
 - (6) All pressure gauges, thermometers, valves, etc. shall be furnished and installed in the piping system prior to start-up.
 - (7) Pipe insulation will be installed in confined areas such as manhole vaults and any location where space limitations pose a risk of burn injury.
 - (8) Ladders shall be installed inside manhole vaults.

23.4 Natural Gas Main Connections. Natural gas piping shall be installed in accordance with State adopted code, DOT standards, Questar standards, and University of Utah standards.

- a. Exterior buried gas lines shall follow Questar approved specifications for plastic pipe and shall be bedded in sand the entire length of the line. 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 must have an approved protective coating.

- (1) For buried plastic pipe, yellow warning tape shall be installed 2 feet above the gas line, in addition to an 18 gage copper wire along the entire length of the pipe.
 - (2) When a gas pipe is run through a wall, the pipe shall be run through protective sleeve and sealed to prevent water from entering the building.
 - (3) All outside above ground gas piping shall be painted with a protective gray paint.
- b. 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.

23.5 Sanitary Sewer Connections. Sewer mains shall be installed in accordance with State adopted code, using procedures to keep dirt out of the sewer main. All installed piping shall be inspected by the University Plumbing Shop prior to backfill.

- a. Buried sewer mains shall be bedded in sand and supported throughout its entire length. Under no circumstances will a pipe be supported with rocks.
- b. Warning tape will be installed at 2 feet above the pipe when PVC pipe is installed.
- c. Each new sewer main shall be air tested between manholes by a certified testing company. If the air test fails, a camera shall be sent down the sewer main to inspect the line, and the damaged part of the main will be dug up and repaired.
- d. All building laterals shall be tied in with a manhole, not a WYE.

23.6 Steam System Connections. An extension to any campus steam piping system will not be allowed until a stamped professionally engineered plan, including drawings and specifications, is approved by the University. Isolation shut-off valves and steam trap design is required.

- a. Welded or threaded pipe connections are allowed on steam / condensate systems using only black steel pipe and fittings.
- b. Verify the steam demand for each building system before adding any steam appliance.
- c. Do not pipe condensate directly to sanitary sewer.
- d. Verify proper steam connection points and condensate return connection points before completing the installation and connecting to the existing system.

23.7 Piping Tie-In to Existing Building Systems. All piping shall be insulated and labeled. Specific requirements for connections to existing building systems are:

a. Pressure Testing

- (1) The Contractor shall apply a hydrostatic test to each piping system. Each system shall hold a minimum of 100 PSI of water or 1 ½ times the operating pressure, whichever is greater, for 30 minutes without any pressure drop on the gage.

b. Pipe Cleaning

- (1) Piping (black iron, PVC, copper) shall be cleaned with West B802 Alkaline Clean, 25 gallons in every 1000 gallons of water. Circulate the mix 24 to 48 hours, flush with potable city water, then final fill the system with chemicals described hereinafter. The Contractor shall provide documentation and certify that the required procedure was followed.

c. Chemical Fill

- (1) Each piping system to be connected to existing shall be filled with appropriate chemicals or antifreeze equal to the existing system before isolation valves are opened to the building system.
- (2) Close loop systems shall have West C-404, 50 to 100 PPM, MO+6.
- (3) Glycol systems shall have 30% minimum of either Jeffcool P150 or Dowfost.
- (4) Open loop systems shall have West C-313-U at 200 PPM; and shall include sodium hypochlorite at 0.5 to 1.5 PPM.

d. Black iron piping shall be American made schedule 40 seamless (only).

e. Copper Piping

- (1) Copper piping shall be type L with dielectric unions and sweat fittings.
- (2) Gas welded piping shall be nitrogen purged while welding. All fittings will be wiped clean.

23.8 Storm Drainage Connections. Storm drainage piping shall be installed in accordance with State adopted code, and in a manner as to keep dirt out of the piping. All installed piping shall be inspected by the University Plumbing Shop and the University's inspector (Office of the Building Official) prior to backfill or concealment.

- a. Exterior Piping
 - (1) Storm water from roofs, paved areas, yards, courtyards, etc. shall drain into a dedicated storm drainage system. Under no circumstance shall storm water be tied to a sanitary sewer line.
 - (2) Storm drainage piping shall be installed with a bedding material in the bottom of the trench. If PVC is used, 1 foot of sand on the bottom of the pipe, and 2 feet of sand over the top of the pipe will be required. Under no circumstance shall the pipe be resting on rocks.
 - (a) All storm drain laterals shall tie into a manhole or a collection box.
 - (b) A storm drain shall not reduce in size in the direction of flow.
 - (c) Buried storm drain piping 12 inches and smaller shall be tested by a certified testing company between manholes. If the test fails, a camera shall be sent down the line to determine the location of the bad section, it shall be dug up and repaired.
 - (d) Buried storm drain piping larger than 12 inches shall be inspected using a camera sent down the line to check joints for tightness. If a joint is not secure, it shall be dug up and repaired.
- b. Interior piping:
 - (1) Storm drain piping inside buildings shall be tested using either water or air.
 - (a) If water is used, all openings shall be tightly sealed, except at the highest point, and then filled with water to the point of overflow. No part of the system shall be tested with less than 10 feet of head of water. The static pressure shall be held for 15 minutes.
 - (b) If air is used, 5 PSI shall be maintained for a minimum of 15 minutes with no loss on the gage.

23.9 Water Main Connections. Installation and disinfection of water mains shall be in accordance with State adopted code. Before connecting new water mains to an existing water main; the following must be done:

- a. All water mains shall be kept clean during construction.
- b. All fittings shall be installed with restraining glands and thrust blocks.
- c. All water mains shall be swabbed and cleaned with a 1% hypochlorite disinfecting solution if dirt or trench water enters the pipe per State adopted code.

- d. All water lines shall be capped at the end of the work day to protect piping from animal entry and dirt inside the pipe.
- e. When C900 is used, it shall be bedded with sand one foot below the pipe and 2 feet above the pipe. Caution tape shall be installed at 2 feet above and all along the pipe.
- f. All building supply lines shall be installed with shut off valves on all three sides of the tee.
- g. To fill the water main with water, the Contractor must use an approved cross-connection control device. A hydrostatic pressure test will be required (200 PSI for 2 hours).
- h. All new water lines shall be chlorinated with a 50 PPM or higher and remain in the pipe for a 24 hour period. After the retention period, the heavily chlorinated water shall be flushed into a sanitary sewer only. Salt Lake City Sewer Department must be contacted to let them know that high chlorinated water is coming to them. Upon refilling the system with clean potable water, two bacteriological samples 24 hours apart shall be taken. 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 of Utah's Plumbing Shop before being buried or concealed and prior to start-up.

23.10 Water Line Connections Inside Buildings. Water lines entering each building shall have parallel pressure reducing valves and parallel backflow prevention devices with appropriate isolation valves on each parallel path.

- a. Backflow prevention devices shall be installed to separate potable water from industrial and/or non-potable water.
- b. Installation shall be in accordance with State adopted code and will be inspected by the University Plumbing Shop and Building Inspector.
- c. Each floor of the building shall have an isolation valve(s), accessible at the floor it serves.
- d. Each laboratory room shall have an isolation valve(s), accessible in the lab it serves, in addition to shut-off valves at each fixture in the lab.
- e. The Contractor shall test water piping at 2 times the operating pressure for 30 minutes. The test shall be in accordance with State adopted code.
- f. The Contractor shall clean the water piping system by first flushing with clean potable water until dirty water is no longer observed at outlet points. The system shall be filled with clean water including 50 PPM chlorine and held in the system for 24 hours (or 200 PPM for 3 hours). The system shall then be flushed with clean potable water until chlorine is no longer present. The heavily chlorinated

water shall be flushed into a sanitary sewer only. Salt Lake City Sewer Department must be contacted to let them know that high chlorinated water is coming to them.

Article 24 Additional OSHA Requirements

In addition to any safety regulations or practices which may otherwise be required or prudent, the Contractor shall establish and implement safety programs that comply with the following OSHA General Industry regulations when working inside University buildings or on or around University utility systems:

- 24.1 CFR 1910.146, Permit Required Confined Space
- 24.2 CFR 1910.147; Control of Hazardous Energy (Lock Out Tag Out)
- 24.3 CFR 1910.335; Electrical Safeguards for Personal Protection

End of Supplemental General Conditions

SUPPLEMENTAL GENERAL CONDITIONS FOR HEALTH INSURANCE

Effective March 17, 2016

Article 1. Intent and Purpose.

Current law: House Bill 282, 2016 Utah Legislative Session. Legislative History: The 2009 Utah Legislature passed House Bill 331 entitled "Health Reform – Health Insurance Coverage in State Contracts" which law became effective July 1, 2009. This bill has been amended by HB20 of the 2010 Utah Legislative Session, HB 128 of the 2011 Utah Legislative Session as well as HB 282 of the 2016 Utah.

These laws require certain state entities, including DFCM, to require a contractor who contracts with the state entity to offer the contractor's employees qualified health insurance coverage as defined in Utah Code Annotated (UCA) 26-40-115, and in accordance with the commercially equivalent benchmark provided by the Department of Health, the CHIP commercial benchmark for FY 2016 and posted on the following URL: <http://www.health.utah.gov/chip/PDF/2016Benchmark.pdf>, in accordance with UCA 26-40-115(2), during the duration of the contract if the contract is over a certain amount, and if the contract is a construction and/or or design contract. The intent of the Articles of these Supplemental General Conditions is to provide the necessary provisions to the General Conditions as a result of such Bills. The purpose of this Supplemental General Conditions for Health Insurance is to comply with UCA 63A-5-205 as well as Utah Code Administrative Rule R23-23 which are both hereby incorporated by reference herein. In case of conflict between UCA 63A-5-205 and Rule R23-23, UCA 63A-5-205 shall control.

Article 2. Applicability of these Supplemental General Conditions.

This Supplemental General Conditions for Health Insurance only applies to those contracts as required by UCA 63A-5-205.

As stated in UCA 63A- 5-205:

- (1) Except as provided in UCA 63A-5-205(4) below, UCA 63A-5- 205(3) applies to all design or construction contracts entered into by the Division or the Board on or after July 1, 2009, and
 - (a) applies to a prime contractor if the prime contract is in the amount of 2,000,000 or greater at the original execution of the contract; and
 - (b) applies to a subcontractor if the subcontract is in the amount of \$1,000,000 or greater at the original execution of the contract.
- (2) UCA 63A-5-205(3) does not apply if:
 - (a) the application of UCA 63A-5-205(3) jeopardizes the receipt of federal funds;
 - (b) the contract is a sole source contract;
 - (c) the contract is an emergency procurement;
 - (d) to a change order as defined in Section 63G-6a-103, or a modification to a contract, when the contract does not meet the threshold required by UCA 63A-5-205(3).

(3) A person who intentionally uses change order or contract modifications to circumvent the requirements of UCA 63A-5-205(3) is guilty of an infraction.

Article 3. Definitions.

The following definitions apply to this Supplemental General Conditions for Health Insurance:

3.1 "Contractor" means the person/entity under direct contract with the Division herein. If the direct contract includes a Design Professional, then the Design Professional is a "Contractor" for purposes of this Supplemental General Conditions for Health Insurance.

3.2 "Design Professional" means the Architect or Engineer, its Subconsultants or Subcontractors at any tier, or any of their agents, employees, including those employed directly or indirectly, or other persons or entities for whose acts the Design Professional or its Subconsultants/Subcontractors at any tier may be liable.

3.3 "Employee(s)" means an "employee," "worker" or "operative" as defined in UCA 34A-2-104 who:
(i) works at least 30 hours per calendar week; and
(ii) meets employer eligibility waiting requirements for health care insurance which may not exceed the first day of the calendar month following 60 days from the date of hire.

3.4 "Health benefit plan" means the same as that term is defined in UCA 31A-1-301.

3.5 "Qualified health insurance coverage" means the same as that term is defined in UCA 26-40-115.

3.6 "Subcontractor" means the same as that term is defined in Section 63A-5-208.

3.7 "State" means the State of Utah.

3.8 "Director" includes an authorized designee of the Director.

Article 4. Health Insurance Certification.

4.1 A Contractor (including Design Professional) shall demonstrate compliance with UCA 63A-5-205 (6)(a) or (b) at the time of execution of each initial contract described in UCA 63A-5-205(3). The compliance is subject to an audit by DAS, DFCM or the Office of the Legislative Auditor General. A Contractor (including Design Professional) subject to UCA Section 63A-5-205(3) shall demonstrate to the director that the Contractor has and will maintain an offer of qualified health insurance coverage for the Contractor's employees and employees' dependents. Such Certification shall be on the form provided by DFCM.

4.2 If a subcontractor of the contractor is subject to Subsection (3) of UCA 63A-5-205, the contractor shall:

(a) place a requirement in the subcontract that the subcontractor shall obtain and maintain an offer of qualified health insurance coverage for the subcontractor's employees and the employees' dependents during the duration of the subcontract; and

(b) certify to the director that the subcontractor has and will maintain an offer of qualified health insurance coverage for the subcontractor's employees and the employees' dependents during the duration of the prime contract.

4.3 The actuarially equivalent determination required for the qualified health insurance coverage is met by the Contractor if the Contractor provides the department or division with a written statement of actuarial equivalency, which is no more than one year old, regarding the contractor's offer of qualified health coverage from an actuary selected by the contractor or the contractor's insurer, or an underwriter who is responsible for developing the employer group's premium rates;



SUPPLEMENTAL **GENERAL CONDITIONS** **REGARDING ILLEGAL IMMIGRATION**

May 10, 2011

Article 1. Intent and Purpose. Senate Bill 81 modified by Senate Bill 39 – 2009. The 2009 Utah Legislature passed Senate Bills 81 and 39 regarding “**Illegal Immigration**” which laws became effective July 1, 2009 (hereinafter “SB81/39”). The 2011 Utah Legislature made further amendments that relate to this document in HB 116. These bills deal with provisions related to the immigration status of individuals within the state. The intent of Articles 1 through 3 of these Supplemental General Conditions is to provide the necessary provisions to the General Conditions as a result of such bills.

Article 2. Applicability. These “Supplemental General Conditions for Illegal Immigration” under SB 39 of the 2009 Utah General Legislative Session and HB 116 of the 2011 Utah General Legislative Session, only applies to Request for Proposals and includes sole sources that are part of Requests for Proposals. However, all entities under contract with DFCM as well as all others that are subject to applicable immigration laws, including their subcontractors/subconsultants, at any tier, shall comply with all applicable immigration laws. This document does not apply to procurements that are done by the Competitive Sealed Bidding process (often referred to as “low-bid”), the Multi-Step Process, direct awards, sole sources awards that are not part of Requests for Proposals, and emergency procurements. This document also does not apply to good faith contract modifications to contracts that existed prior to July 1, 2009.

There is a Program Start Date defined in said HB 116 of the 2011 Utah General Legislative Session. At such time that knowledge is obtained about when that Program Start Date is, DFCM will post an amendment to this “Supplemental General Conditions Regarding Illegal Immigration.”

Article 3. E-Verify Clause. Certify registration and use of employment “Status Verification System”.

- 3.1 Each offeror and each person signing on behalf of any offeror certifies as to its own entity, under penalty of perjury, that the named Contractor has registered and is participating in the Status Verification System to verify the work eligibility status of the Contractor’s new employees that are employed in the State of Utah in accordance with 63G-12-302 as described in HB 116 of the 2011 Utah General Legislative Session. *(A copy of 63G-12-302 is provided at the end of this document for your convenience.)*
- 3.2 The Contractor shall require that the following provision be placed in each subcontract at every tier: “The subcontractor shall certify to the main (prime or general) contractor by affidavit that the subcontractor has verified through the Status Verification System the employment status of each

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May 10, 2011

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new employee of the respective subcontractor, all in accordance with Section 63G-11-103 and to comply with all applicable employee status verification laws. Such affidavit must be provided prior to the notice to proceed for the subcontractor to perform the work.”

- 3.3 The State of Utah or DFCM will not consider a proposal for award, nor will it make any award where there has not been compliance with this Article.
- 3.4 Manually or electronically signing the Proposal is deemed the Contractor’s certification of compliance with all provisions of this employment status verification certification required by all applicable status verification laws including UCA Section 63G-12-302 as described in HB 116 of the 2011 Utah General Legislative Session. *(A copy of 63G-12-302 is provided at the end of this document for your convenience.)*

Article 4. Indemnity

- 4.1 Contractor (includes, but is not limited to any Contractor, Design Professional, Designer or Consultant) shall protect, indemnify and hold harmless, the State of Utah, the DFCM and its officers, employees, agents, representatives and anyone that the State of Utah or the DFCM may be liable for, against any claim, damages or liability arising out of or resulting from violations of these Supplemental General Conditions Regarding Illegal Immigration whether violated by employees, agents, or contractors of the following:
 - 4.1.1 Contractor;
 - 4.1.2 Subcontractor at any tier; and/or
 - 4.1.3 any entity or person for whom the Contractor or Subcontractor may be liable.
- 4.2 Notwithstanding 4.1 above, Design Professionals or Designers under direct contract with the DFCM shall only be required to indemnify the State of Utah or the DFCM for a liability claim that arises out of the design professional's services, unless the liability claim arises from the Design Professional's negligent act, wrongful act, error or omission, or other liability imposed by law except that the Design Professional shall be required to indemnify the State of Utah or the DFCM in regard to subcontractors or subconsultants at any tier that are under the direct or indirect control or responsibility of the Design Professional, and includes all independent contractors, agents, employees or anyone else for whom the Design Professional may be liable at any tier.

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*** The following is provided for your convenience: Note: The definitions of "Public Employer," "Status Verification System," "Unauthorized Alien," and "Program Start Date" as well as other relevant definitions are located in Section 63G-12-102. Other provisions of Utah Code Title 63G, Chapter 12, should be read as well as all applicable immigration laws.)**

63G-12-302. Status verification system -- Registration and use -- Performance of services -- Unlawful practice.

(1) As used in this section:

(a) "Contract" means an agreement for the procurement of goods or services that is awarded through a request for proposals process with a public employer and includes a sole source contract.

(b) "Contractor" means a subcontractor, contract employee, staffing agency, or any contractor regardless of its tier.

(2) (a) Subject to Subsection (5), a public employer shall register with and use a Status Verification System to verify the federal employment authorization status of a new employee.

(b) This section shall be enforced without regard to race, religion, gender, ethnicity, or national origin.

(3) (a) Subject to Subsection (5), beginning July 1, 2009:

(i) a public employer may not enter into a contract for the physical performance of services within the state with a contractor unless the contractor registers and participates in the Status Verification System to verify the work eligibility status of the contractor's new employees that are employed in the state; and

(ii) a contractor shall register and participate in the Status Verification System in order to enter into a contract with a public employer.

(b) (i) For purposes of compliance with Subsection (3)(a), a contractor is individually responsible for verifying the employment status of only new employees who work under the contractor's supervision or direction and not those who work for another contractor or subcontractor, except as otherwise provided in Subsection (3)(b)(ii).

(ii) Each contractor or subcontractor who works under or for another contractor shall certify to the main contractor by affidavit that the contractor or subcontractor has verified through the Status Verification System the employment status of each new employee of the respective contractor or subcontractor.

(c) Subsection (3)(a) does not apply to a contract:

(i) entered into by the entities referred to in Subsection (3)(a) prior to July 1, 2009, even though the contract may involve the physical performance of services within the state on or after July 1, 2009; or

(ii) that involves underwriting, remarketing, broker-dealer activities, securities placement, investment advisory, financial advisory, or other financial or investment banking services.

(4) (a) It is unlawful for an employing entity in the state to discharge an employee working in Utah who is a United States citizen or permanent resident alien and replace the employee with, or have the employee's duties assumed by, an employee who:

(i) the employing entity knows, or reasonably should have known, is an unauthorized alien hired on or after July 1, 2009; and

(ii) is working in the state in a job category:

(A) that requires equal skill, effort, and responsibility; and

(B) which is performed under similar working conditions, as defined in 29 U.S.C., Sec. 206 (d)(1), as the job category held by the discharged employee.

(b) An employing entity, which on the date of a discharge in question referred to in Subsection (4)(a) is enrolled in and using the Status Verification System to verify the

employment eligibility of its employees in Utah who are hired on or after July 1, 2009, is exempt from liability, investigation, or lawsuit arising from an action under this section.

(c) A cause of action for a violation of this Subsection (4) arises exclusively from the provisions of this Subsection (4).

(5) On and after the program start date:

(a) a public employer, after hiring an employee, shall verify the employment eligibility of the new employee:

(i) through the status verification system if the individual does not hold a permit; and

(ii) through the u-verify program if the individual holds a permit; and

(b) a contractor is considered to be in compliance with this section if, after hiring an employee, the contractor verifies the employment eligibility of the new employee:

(i) through the status verification system if the individual does not hold a permit; and

(ii) through the u-verify program if the individual holds a permit.

Renumbered and Amended by Chapter 18, 2011 General Session



SUPPLEMENTAL GENERAL CONDITIONS FOR CONSTRUCTION AGREEMENTS

July 15, 2008

Article 1. Intent and Purpose: Senate Bill 220 – 2008.

The 2008 Utah Legislature passed Senate Bill 220 entitled “Cause of Action for Defective Construction” which law became effective May 5, 2008 (hereinafter “SB220”). The intent purpose of Article 1 through 3 of these Supplement General Conditions is to provide the necessary provisions to the General Conditions as a result of such Bill.

Article 2. “Entities under the Contractor” shall mean any and all agents, independent contractors, subcontractors, suppliers, manufacturers and providers at every tier under the General Contractor.

Article 3. General Provisions

3.1 Conditions. The General Conditions impose duties and performance obligations on the parties. This includes, but is not limited to, the provisions of Article 5.2.1 (regarding subcontractor’s compliance with Contract Documents), Article 4.13 (indemnification which discusses acts, omissions, and negligence responsibility) and other provisions of the General Conditions which list many performance obligations of the General Contractor and those under the General Contractor.

3.2 Third Party Beneficiary. The State of Utah and DFCM shall be an intended third party beneficiary to all contracts entered into with Entities under the Contractor. Upon written request by DFCM, DFCM shall be entitled to obtain copies of all such contracts. The General Contractor shall be responsible for assuring that all such third party beneficiary agreements are in place and shall bear the responsibility for any lack of required language in any contracts with an Entity under the Contractor which does not contain this required provision.

3.3 “Economic Loss Rule.” The “Economic Loss Rule” as it has been referred to in Utah law shall be deemed to be interpreted in accordance with prevailing Utah law.

- 3.4 Toxic Torts.** “Defective Construction” for purposes of any limitation of any cause of action or right as contemplated by SB220 does not, under these Supplemental General Conditions and for purposes of any Entities under the Contractor, include the use or installing of a defective or inherently dangerous, hazardous or toxic product, substance, or material. The State has third party beneficiary rights and other rights allowed by law to pursue a direct cause of action against the manufacturer and/or distributor of such defective or inherently dangerous, hazardous or toxic product, substance or material, except that the General Contractor and other subcontractors, exclusive of manufacturers and distributors, under the General Contractor shall not be responsible to the State of Utah for said “product, substance or material” unless the General Contractor or such subcontractor knew or should reasonably have known that the product, substance or material was defective or inherently dangerous, hazardous or toxic at the time it was provided or installed on the Project.
- 3.5 Subsection 3 of SB 220.** For purposes of Subsection (3) of SB 220, the phrase “property damage” shall be deemed to refer to damage to “other property” meaning property that is other than the exact specific construction defect itself.
- 3.6 “Failure of the Construction to Function as Designed.”** The language “failure to function as designed” as used in SB 220 shall not be deemed to refer to the failure of the construction to be constructed in accordance with the Contract Documents.
- 3.7 Independent Duty.** The State of Utah and DFCM maintain the right to pursue a cause of action against the General Contractor and directly against any Entities under the Contractor, for violation of any independent duty owed to the State of Utah or DFCM.
- 3.8 Not create Contract Right by Entity under the Contractor with State of Utah or DFCM.** These Supplemental General Conditions shall not be construed in any manner which would create a contract between the State of Utah/DFCM and any Entity under the Contractor, except for the Third Party Beneficiary rights of the State of Utah/DFCM provided herein. Any pursuit of a claim by an Entity under the Contractor, including payment claims, shall be maintained either against the payment bond or the upper tier Contractor in accordance with Utah law.

Article 4. Warranties and Obligations

Every Entity under the Contractor has an obligation to comply with the requirements of this Contract, including the indemnification of the Owner for negligent or intentional construction defects and to provide materials and construction that meets all express or implied warranties under the Uniform Commercial Code, including fitness for a particular purpose, merchantability, workmanlike construction (work completed in a skillful manner and is non-defective) and habitability, and is performed with the reasonable care to protect persons and property. In regard to toxic, hazardous materials and other matters of construction where applicable statutory and case law allows, strict liability shall apply.



SUPPLEMENTAL GENERAL CONDITIONS FOR DESIGN AGREEMENTS

July 15, 2008

Article 1. Intent and Purpose: Senate Bill 220 – 2008.

The 2008 Utah Legislature passed Senate Bill 220 entitled “Cause of Action for Defective Construction” which law became effective May 5, 2008 (hereinafter “SB220”). The intent purpose of these Supplement General Conditions is to provide the necessary provisions to the General Conditions as a result of such Bill.

Article 2. “Entities under the Designer” shall mean any and all agents, independent contractors, consultants, subconsultants, subcontractors, suppliers, manufacturers and providers at every tier under the Designer.

Article 3. General Provisions

- 3.1 Design Agreement.** The Design Agreement for the subject Project imposes duties and performance obligations on the parties. This includes, but is not limited to, the standard of care provisions provided in said Design Agreement.
- 3.2 Third Party Beneficiary.** The State of Utah and DFCM shall be a third party beneficiary to all contracts entered into with Entities under the Designer. Upon written request by DFCM, DFCM shall be entitled to obtain copies of all such contracts. The Designer shall be responsible for assuring that all such third party beneficiary agreements are in place and shall bear the responsibility for any lack of required language in any contracts with an Entity under the Designer which does not contain this required provision.
- 3.3. “Economic Loss Rule.”** The “Economic Loss Rule” as it has been referred to in Utah law shall be deemed to be interpreted in accordance with prevailing Utah law.
- 3.4 Toxic Torts.** “Defective Construction” for purposes of any limitation of any cause of action or right as contemplated by SB220 does not, under these Supplemental General Conditions and for purposes of any Entities under the Designer, include the use or installing of a defective or inherently dangerous,

hazardous or toxic product, substance, or material. The State has third party beneficiary rights and other rights allowed by law to pursue a direct cause of action against the manufacturer and/or distributor of such defective or inherently dangerous, hazardous or toxic product, substance or material, except that the Designer and other consultants/subconsultants under the Designer, exclusive of manufacturers and distributors, shall not be responsible to the State of Utah for said “product, substance or material” unless the Designer or such consultants/subconsultants knew or should reasonably have known that the product, substance or material was defective or inherently dangerous, hazardous or toxic at the time it was made a part of the Contract Documents by the Designer.

- 3.5 Subsection 3 of SB 220.** For purposes of Subsection (3) of SB 220, the phrase “property damage” shall be deemed to refer to damage to “other property” meaning property that is other than the exact specific construction defect itself.
- 3.6 “Failure of the Construction to Function as Designed.”** The language “failure to function as designed” as used in SB 220 shall not be deemed to refer to the failure of the construction to be constructed in accordance with the Contract Documents.
- 3.7 Independent Duty.** The State of Utah and DFCM maintain the right to pursue a cause of action against the Designer and directly against any Entities under the Designer, for violation of any independent duty owed to the State of Utah or DFCM.
- 3.8 Not create Contract Right by Entity under the Designer with State of Utah or DFCM.** These Supplemental General Conditions shall not be construed in any manner which would create a contract between the State of Utah/DFCM and any Entity under the Designer, except for the Third Party Beneficiary rights of the State of Utah/DFCM provided herein. Any pursuit of a claim by an Entity under the Designer, including payment claims, shall be maintained against the upper tier entity in accordance with Utah law



SUPPLEMENTAL GENERAL CONDITIONS
FOR DRUG AND ALCOHOL TESTING
DESIGN AND/OR CONSTRUCTION CONTRACTS

July 1, 2010

1. These Supplemental General Conditions shall only apply to design or construction contracts in compliance with UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7. (Note: the Administrative Rule is anticipated to have an effective date in early July, 2010 and will upon its being effective apply to those design and construction contracts issued on or after July 1, 2010, and the Statute itself is effective on July 1, 2010.) All applicable provisions of UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7 are incorporated herein by reference as if fully set forth herein. The provisions below provide some, but not all of the provisions of said statute and administrative rule. The absence of the recitation of a provision of UCA Section 63G-6-604 or Utah Administrative Code Rule R23-7 below, shall not lessen its importance. Contractors and Designers are encouraged to read the complete UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7 in order to assure compliance with all the applicable provisions.

2. Definitions. For the purpose of these Supplemental General Conditions, the definitions in UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7 shall apply. For convenience, the following definitions are provided below:

a. **“Contractor” for purposes of these Supplemental General Conditions includes the Prime Contractor, a Designer (Architect/Engineer), and any of their subcontractors, consultants or subconsultants at any tier involved in design and/or construction. “Contractor” for purposes of these Supplemental General Conditions does not include a supplier who provide only materials, equipment or supplies to a Contractor, Designer or any of their subcontractors, consultants or subconsultants at any tier.**

b. "Covered Individual" means an individual who: (i) on behalf of the Contractor provides services directly related to design or construction under the contract; and (ii) is in a safety sensitive position, including a design position that has responsibilities that directly affect the safety of an improvement to real property that is the subject of a state construction contract

3. Contractor shall have a drug and alcohol testing policy in accordance with UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7 during the period of the contract that applies to the “Covered Individuals” hired by the Contractor. Contractor shall post in one or more conspicuous places notice

SUPPLEMENTAL GENERAL CONDITIONS FOR DRUG AND ALCOHOL TESTING
JULY 1, 2010
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to “Covered Individuals” hired by the Contractor that the Contractor has the drug and alcohol testing policy described in UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7-4(1)(a)(i). Said “Covered Individuals” shall be subject to random drug and alcohol testing under said policy if at any time during the period of the contract there are ten (10) or more “Covered Individuals” hired by the Contractor.

4. Contractor hereby certifies the following:

a. By executing this Contract, that the Contractor, including all entities included in the definition of Contractor in paragraph 2.a. above, shall comply with all provisions of Utah Administrative Code Rule R23-7 as well as UCA 63G-6-604, including having and maintaining a drug and alcohol testing policy, the posting and random testing requirements during the period of the contract that applies to Covered Individuals hired by the Contractor, including all entities included in the definition of Contractor in paragraph 2.a. above;

b. That the Contractor, including all entities included in the definition of Contractor in paragraph 2.a. above, shall have these requirements placed in all subcontracts for design or construction at any tier, in order that all such subcontractors, consultants and subconsultants at any tier have notice of these requirements and understand the need for compliance with these requirements;

c. That the subcontractors, consultants and subconsultants at any tier referred to in paragraph 4.b. above shall comply with the same requirements as the Contractor for having and maintaining a drug and alcohol testing policy, the posting and random testing requirements during the period of their contract;

d. That the Contractor, or any entity included in the definition of Contractor in paragraph 2.a. above may be suspended or debarred in accordance with the Utah Procurement Code for failure to comply as provided in UCA Section 63G-6-604(3)(a) and Utah Administrative Code Rule R23-7-4(3)(b); and

e. That the prime contractor or prime designer shall on a semi-annual basis throughout the term of this Contract, report to the Division in writing, information that indicates compliance with the provisions of UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7.

5. Reasonable notice and an opportunity to cure any violation of UCA 63G-6-604 shall be provided to the Contractor before any suspension or debarment may be undertaken by the Division against the Contractor in light of the circumstances of the Contract or the violation. The greater the risk to person(s) or property as a result of noncompliance, the shorter this notice and opportunity to cure shall be, including the possibility that the notice may provide for immediate compliance if necessary to protect person(s) or property.

6. If a Contractor meets the requirements of UCA Section 63G-6-604 and Utah Administrative Code Rule R23-7, said statute and rule may not be construed to restrict the Contractor’s ability to impose or implement an otherwise lawful provision as part of a drug and alcohol testing policy.

SECTION 01 1000 - SUMMARY

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. Project information.
- 2. Work covered by Contract Documents.
- 3. Contractor's use of site and premises.
- 4. Coordination with occupants.
- 5. Work restrictions.

- B. Related Requirements:

- 1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: University of Utah University of Utah, Building 303 – Phase# 5

- 1. University of Utah Project Number: 22508.
- 2. FFKR Project Number: 18136.
- 3. Project Location: University of Utah, Building 303 Salt Lake City, UT 84123.

- B. Owner: State of Utah; University of Utah.

- 1. Owner's Representative:

- a. University of Utah: Steve Laraway, David Quinlivan, Rich Wilcox, Scott Hartwig.

- C. Architect: FFKR Architects, 730 Pacific Avenue, Salt Lake City, Utah 84104, (801) 521-6186.

- 1. Contact: Jackson Ferguson / Ying Peng.

- D. General Contractor/Construction Manager:

- 1. Construction Manager for this Project is Project's constructor. The terms "Construction Manager" and "Contractor" are synonymous.

- E. Web-Based Project Software: Project software will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Section 01 3100 "Project Management and Coordination." for requirements for using web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. Work of Project: Phase #2 of seismic upgrade and other improvements to existing Building 303 and surrounding areas on the University of Utah Campus. Project will be issued in 6 Phases as follows:
 - 1. Phase #1: Scope of Work as indicated in Contract Documents for Phase #1, including, but not limited to, the following site work:
 - a. Demolition of existing curbs and construction of new curbs as required to align curbs.
 - b. Demolition of existing Northwest brine tank and construction of new brine tank.
 - c. Removal of indicated electrical items and construction of new electrical Work.
 - d. Demolition of existing Northeast gas line and chill water line and construction of new gas line and chill water line.
 - e. Demolition of indicated dumpster enclosure.
 - f. Capping of indicated water lines inside building.
 - g. Coordination of moving of MCC #5 with Gen 5/9 project.
 - 2. Phase #2: Scope of Work as indicated in Contract Documents for Phase #2, including, but not limited to, the following work:
 - a. Demolition of existing screen wall on roof.
 - b. Demolition of existing roof assembly.
 - c. Demolition of stairs by Gen 4.
 - d. Removal of existing roof exhaust fans, oil cooler, condensate tank, and hoppers.
 - e. Construction of new oil cooler.
 - f. Construction of new interior diaphragm.
 - g. Construction of new roof assembly, including bracing, decking, roof system, curbs, and parapets and roof drains.
 - h. Construction of new condensate tank, roof top exhaust fans, and water tank for research project.
 - 1. Phase #3: Scope of Work as indicated in Contract Documents for Phase #3, including, but not limited to, the following work:
 - a. Demolition of existing asphalt indicated.
 - b. Construction at buttresses foundations, including micropiles, underpinnings, concrete capping, internal links and buttress structural links.
 - 1. Phase #4: Scope of Work as indicated in Contract Documents for Phase #4, including, but not limited to, the following work:

- a. Selective demolition of indicated portion of building, including existing control room east of Gridline A, indicated office space, and indicated existing west brick wall.
 - b. Construction of new office wing.
 - c. Construction of new west exterior wall assembly and insulated metal panel system.
 - d. Construction of new southwest buttress exterior walls.
 - e. Construction of new fire sprinkler system.
1. Phase #5: Scope of Work as indicated in Contract Documents for Phase #5 including, but not limited to, the following work:
 - a. Selective demolition of brick walls on south and east sides of building.
 - b. Construction of new east and south exterior wall assemblies, including new structural framing, air and water barriers, and insulated metal panel systems.
 2. Phase #6: Scope of Work completing project as indicated in Contract Documents for Phase #6, including, but not limited to, the following work:
 - a. Selective demolition of brick walls on north side of building.
 - b. Construction of new north exterior wall assemblies, including new structural framing, air and water barriers, and insulated metal panel systems.
 - c. Construction of new equipment bracing, pipe bracing, and pipe insulation.
 - d. Repairing existing asphalt and construction of new asphalt paving.
 - e. Construction of new make-up air unit on roof for both supply and exhaust air.
 - f. Construction of new penthouse and access stair from Fan level to roof,
 - g. Construction of new dumpster enclosure.

B. Type of Contract: Single prime contract.

1.5 CONTRACTOR'S USE OF SITE AND PREMISES

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.9 Use of Site; 4.9.1 in General.
- B. See University of Utah U Facilities; General Conditions; Article 2 The University; 2.2 Construction by the University or by Separate Contractors; 2.2.1 University's Right to Perform Construction and to Award Separate Contracts.
- C. 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.
- D. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Driveways, Walkways and Entrances: Keep driveways 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.
- E. 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.
- F. 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.

1.6 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day 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 approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.7 WORK RESTRICTIONS

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.9 Use of Site; 4.9.2 Access to Neighboring Properties.
- B. Employee Identification: All Contractor personnel will be required to obtain University of Utah identification badges.
- C. 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.
- D. 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.
- E. 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. Notify Owner not less than two days in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.
- F. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances within the existing building is not permitted.
- 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

SECTION 01 2500 - SUBSTITUTION PROCEDURES

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 administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 6000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 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 in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Proposed Products List and Substitution Requests:
 - 1. Intent:
 - a. To fully identify, prior to beginning the Work, the products Contractor intends to provide, and substitutions the Contractor requests.
 - b. To facilitate timely submittal processing by avoiding rejection of unacceptable products and unspecified products later during construction.
 - 2. Proposed Products List:
 - a. Within 14 calendar days after date of receipt of notice to proceed and before submitting any Product Submittals, submit for approval the list of the products

proposed for installation. Include the name of the manufacturer for each product and, where applicable, the name of Subcontractor.

- b. The list shall be tabulated by and be complete for each Specification Section.
- c. For each product listed, clearly indicate: a) As Specified, or b) Not As Specified. For each product designated Not As Specified, clearly indicate: c) Comparable Product, or d) Proposed Substitution.

B. Substitution Requests Accompanying the Proposed Products List:

- 1. A request for substitution will be considered, subject to the following requirements:
 - a. Include with the proposed products list a completed substitution request form for each proposed substitution anticipated for the Project. Check the box indicating the request is submitted with the proposed products list.
 - b. Submit each proposed substitution using a separate copy of the substitution request form. Use substitution request form included in the Project Manual, or request form from the Architect. See Section 01 2510 Substitution Request Form. Submit in number of copies specified for proposed product list.
 - c. The substitution request is submitted at the time the proposed products list is submitted. A request submitted after the time set for submittal of the proposed products list is subject to automatic rejection.
 - d. Include with the request complete data on the proposed substitution. Such data shall include:
 - 1) Product Data highlighted to show applicability to the proposed substitution and project conditions.
 - 2) Performance and test data.
 - 3) References, and samples, where applicable.
 - 4) An itemized comparison of the proposed substitution with the product features specified in the Contract Documents, including data relating to design and artistic effect, where applicable.
 - e. Include copies of the pertinent Contract Documents, clearly marked and highlighted to show changes necessary to accommodate the proposed substitution.
 - f. If the proposed substitution is due to unavailability of a specified product, a written statement shall accompany it, written by the supplier of the specified product, confirming lack of availability.
 - g. By submitting the substitution request, Contractor affirms that: 1) the proposed substitution conforms to the required dimensions and meets or exceeds the standards of required function, appearance, and quality set by the specified product: and 2) the burden of proof rests with the Contractor.
 - h. By submitting a substitution request, Contractor agrees to absorb all costs resulting from acceptance of the proposed substitution, including both known and subsequently discovered revisions to other construction needed to accommodate the substitution, and other expected and unforeseen costs, such as delays, code approval-related expenses, and additional architectural services.

C. Substitution Requests After Proposed Products List:

1. Use no product in the Work that is not named in the Contract Documents, or not listed in the Proposed Products List, or not approved as a substitute or comparable product. Products specified solely by reference standard or performance requirements do not require naming.
 2. During construction of the Work, products not listed on the accepted Proposed Products List shall not be used without receipt of an approved substitution request for a listed product. A substitution request will be considered under one of the following conditions:
 - a. The product listed on the accepted Proposed Product List becomes unavailable. Include with the substitution request a letter from the listed manufacturer, on the manufacturer's letterhead, verifying that the product is no longer available.
 - b. Conditions uncovered at the Site render the listed product inappropriate, or an undesirable choice for the conditions uncovered. Include with the substitution request a full description of the uncovered conditions and why the requested substitution is preferable to the listed product.
 3. Make each substitution request on the specified substitution request form. Fully execute form in accordance with the provisions of Article, Proposed Products List and Accompanying Substitution Requests, except for provisions requiring submittal concurrent with proposed products list. Check the box indicating the Contractor's request is being submitted separate from and after submittal of the proposed products list
- D. A request for substitution forwarded by the Contractor means that Contractor:
1. Has investigated the proposed substitution.
 2. Has determined that the substitution is equal to or superior in quality and serviceability (performance) to the product specified in the Contract Documents.
 3. Will provide the same guarantee for the substitution that is required for the product specified in the Contract Documents.
 4. Waives all claims for additional costs that subsequently become apparent as a result of the substitution.
 5. Will coordinate the installation of the accepted substitution into the Work, and will make such changes in the Work of the various trades as may be required to provide a completed condition.
- E. A request for a substitution will not be considered if:
1. The substitution is merely indicated or implied on the Shop Drawing or Product Data submittal without the specified formal request and documented proof of conformance. Submittal approvals for items not meeting specifications are not valid. Completed construction related to such items is subject to rejection.
 2. Implementation requires a major revision of the Contract Documents in order to accommodate the substitution.
 3. The substitution request is substantially incomplete.
- F. Architect's Review of Proposed Products List and Substitution Requests:
1. The Architect will review properly submitted proposed products list and accompanying substitution requests.

2. The Architect will evaluate each substitution request and inform Contractor in writing whether the proposed substitution is accepted, accepted as noted, or not accepted.
 - a. Substitution requests that do not conform to requirements, including submittal timing, are subject to return without review.
 - b. A substitution will not be considered accepted by the Owner until it has been documented by Change Order.
3. The Architect's decision as to conformance and acceptability will be consistent with the intent of the Contract Documents.
4. In the absence of written acceptance of a substitution request, proposed substitutions shall be understood as not accepted.
5. The Architect will endeavor to evaluate the substitution request in a reasonable period of time. With the request, the Contractor shall inform the Architect of the deadline for final decision on the request. In the absence of Architect's decision within the critical time, the Contractor shall proceed with the specified product.

G. Product List and Substitution Request Format:

1. Product List: Provide PDF of the list.
2. Substitution Requests: Provide PDF of requests.

1.5 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.

1.6 PROCEDURES

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

1.7 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: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 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 01 2500

SECTION 01 2510 - SUBSTITUTION REQUEST FORM

Project: Refer to page header above. Additional Package/Contract Info: _____

Date of Request: CM/GC Tracking No.: AE Tracking No.:

This substitution request is governed by the provisions of Section 01 2500.

This Substitution Request is submitted during the bidding period.

This Substitution Request is submitted with Proposed Products List dated: _____

This Substitution Request is submitted separate from and after submittal of the Proposed Products List.

RE:

Specifications Section Title	Section No.	Page	Paragraph
------------------------------	-------------	------	-----------

PROPOSED SUBSTITUTION:

This substitution request is governed by, and complies with, the provisions of Section 01 2500 "Substitution Procedures."

Reason for Substitution: For Cause For Convenience

General Description:

The accompanying attachments, per the provisions governing substitutions, provide a full description of the proposed substitution. The proposed substitution includes the following changes:

To Contract Sum: None Add: Deduct: \$

To Contract Time: None Add: Deduct: days

Assumption of Responsibility for Equal Performance

The Construction Manager/General Contractor that is submitting this request affirms that the proposed substitution conforms to required dimensions and meets or exceeds the standards of required function, appearance, and quality established by the specified product. Requester understands and affirms compliance with the provisions governing substitutions.

Requester's Name: Date:

Requesting Firm: CM or CG only

Notes:

1. Transmit substitution request to Architect's Project Manager.
2. Do not transmit substitution request as part of product submittal.
3. Do not transmit product submittal for substitution item until substitution is accepted by Owner and Architect.
4. Owner's Acceptance of substitution request is not complete until documented through addendum or contract modification.

ARCHITECT'S REVIEW:

Proposed substitution is: Not Reviewed Not Accepted Accepted As Noted Accepted

Remarks:

Name Date

cc: Owner; CM/GC, project specifier

OWNER'S REVIEW:

Proposed substitution is: Not Reviewed Not Accepted Accepted As Noted Accepted

Remarks:

Name Date

cc: Architect; CM/GC, project specifier

END OF SECTION 01 2500

SECTION 01 2600 - 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 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

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, through Unifier.

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 20 days, when not otherwise specified, 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: Submit through Unifier.
- 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 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Submit through Unifier.

1.4 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor through Unifier.

1.5 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive through Unifier. 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 01 2600

SECTION 01 2900 - 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 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Section 01 3200 "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.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - d. Schedule of Values to match with Schedule of values in Unifier.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than 30 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. Name of Architect.

- c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
2. Arrange schedule of values consistent with format of AIA Document G703.
3. 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.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. Include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

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 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.
- C. Application for Payment Forms: Use DFCM Application and Certificate of Payment as form for Applications for Payment.
- D. 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.
- E. 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.
- F. Transmittal: Submit one signed and notarized copy of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
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. Submittal schedule (preliminary if not final).
 5. List of Contractor's staff assignments.
 6. Copies of building permits.
 7. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 8. Initial progress report.
 9. Report of preconstruction conference.
 10. Certificates of insurance and insurance policies.
 11. Performance and payment bonds.
 12. 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.
 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."

5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. 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.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

SECTION 01 3100 - 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. Requests for Information (RFIs).
 - 4. Project Document Transfer site.
 - 5. 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 01 3200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Section 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

- A. See University of Utah U Facilities; General Conditions; Article 5 Subcontractors; 5.1 Award of Subcontracts and Other Contracts for Portions of the Work; 5.1.1.2.
- B. 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. Use CSI Form 1.5A. Include the following information in tabular form:
 - 1. Name, address, and telephone number 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.

- C. 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 and telephone numbers, including home, office, and 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, and by each temporary telephone. 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. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.
 - 8. Startup and adjustment of systems.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out 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.

1.5 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop

Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - e. Indicate required installation sequences.
 - f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, 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 ceiling plenum to accommodate layout of light fixtures 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 in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
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 the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

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

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.
3. 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 Revit.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.6 REQUESTS FOR INFORMATION (RFIs)

- A. See University of Utah U Facilities; General Conditions; Article 7 Modifications, PRs & PCOs, PRE and Claims Process; 7.2 Contractor Initiated Requests; 7.2.1 The Request for Information (RFI) Process and Time to File
- B. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

- C. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
1. Project name.
 2. Project number.
 3. Date.
 4. Name of Contractor.
 5. Name of Architect.
 6. RFI number, numbered sequentially.
 7. RFI subject.
 8. Specification Section number and title and related paragraphs, as appropriate.
 9. Drawing number and detail references, as appropriate.
 10. Field dimensions and conditions, as appropriate.
 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 12. Contractor's signature.
 13. 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.
- D. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 10 working 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 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 01 2600 "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 10 days of receipt of the RFI response.
- F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than 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.
- G. 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 seven days if Contractor disagrees with response.
1. RFI Forms: Unifier Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1.7 PROJECT INFORMATION MANAGEMENT

- A. Use University of Utah's Project Web site (Unifier System) for purposes of hosting and managing the following project communication and documentation until Final Completion. Architect's Project Web site includes the following functions:
1. Project directory.
 2. RFI forms.
 3. Task and issue management.
 4. Submittals forms and logs.
 5. Drawing and specification document hosting, viewing, and updating.
 6. Online document collaboration.
 7. Reminder and tracking functions.
 8. Archiving functions.
- B. Architect will issue Drawings and Specifications through the Information Management Site.
- C. Architect will accept and return RFIs and submittal documents only through the Project Information Management Site, unless otherwise arranged.

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.
 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 seven days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Critical work sequencing and long-lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communications.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Submittal procedures.
 - j. Use of the premises.
 - k. Work restrictions.
 - l. Working hours.
 - m. Owner's occupancy requirements.
 - n. Responsibility for temporary facilities and controls.
 - o. Procedures for moisture and mold control.
 - p. Procedures for disruptions and shutdowns.
 - q. Construction waste management and recycling.
 - r. Parking availability.
 - s. Office, work, and storage areas.
 - t. Equipment deliveries and priorities.
 - u. First aid.
 - v. Security.
 - w. Progress cleaning.
 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. 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) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) 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 01 3100

SECTION 01 3200 - 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. Contractor's construction schedule.
 - 2. Construction schedule updating reports.
 - 3. Daily construction reports.
 - 4. Site condition reports.
 - 5. Special reports.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting schedules and reports.
 - 2. Section 01 4000 "Quality Requirements" for submitting a schedule of tests and inspections.

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. 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 when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. 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.

F. Resource Loading: The allocation of manpower and equipment necessary for the completion of 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, where indicated.
2. PDF electronic file.

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

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

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

D. Daily Construction Reports: Submit at monthly intervals.

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

F. Special Reports: Submit at time of unusual event.

1.4 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, 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.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.6 Time and Contractor's Construction Schedules; 4.6.4 Schedule Content Requirements.

- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final 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 story 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. Procurement Activities: Include procurement process activities for long lead 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.
 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 4. Startup and Testing Time: Include no fewer than 30 days for startup and testing.
 5. 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.
 6. 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 by Owner: Include a separate activity for each portion of the Work performed by Owner.
 2. 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.
 3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.

- g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.
 4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
1. See University of Utah Facilities Management; General Conditions; Article 4 Contractor; 4.7 Time and Contractor's Construction Schedules; 4.7.4 Interim Completion Dates and Milestones.
 2. Temporary enclosure and space conditioning.
- F. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 01 2900 "Payment Procedures" for cost reporting and payment procedures.
- G. 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 Contract Time.
- H. 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, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.6 Time and Contractor's Construction Schedules; 4.6.2 Schedule Preparation.
- B. General: Prepare network diagrams using AON (activity-on-node) format.
- C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Owner that may affect or be affected by Contractor's activities.
 - i. Testing.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
 2. Description of activity.
 3. Main events of activity.
 4. Immediate preceding and succeeding activities.
 5. Early and late start dates.
 6. Early and late finish dates.
 7. Activity duration in workdays.
 8. Total float or slack time.
 9. Average size of workforce.
 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
 2. Changes in early and late start dates.
 3. Changes in early and late finish dates.
 4. Changes in activity durations in workdays.
 5. Changes in the critical path.
 6. Changes in total float or slack time.
 7. Changes in the Contract Time.

2.3 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. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (see special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial completions and occupancies.
 19. Substantial Completions authorized.
- B. 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.

2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: 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, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. See University of Utah Facilities Management; General Conditions; Article 4 Contractor; 4.7 Time and Contractor's Construction Schedules; 4.7.2 Schedule Preparation.
- B. 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.
- C. 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.

END OF SECTION 01 3200

SECTION 01 3233 - PHOTOGRAPHIC DOCUMENTATION

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 administrative and procedural requirements for the following:
 - 1. Periodic construction photographs.
 - 2. Final completion construction photographs.
- B. Related Requirements:
 - 1. Section 01 7700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
 - 2. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 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 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 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.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels, and with vibration-reduction technology. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time and GPS location data from camera.
- D. File Names: Name media files with date and sequential numbering suffix.

1.5 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. 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.
- C. Provide electronic photographs when specified in the Contract Documents starting with a series of photographs before the start of any physical construction, and continuing for as long as the Work progresses:
- D. Preconstruction Photographs:
 - 1. 20 photographs showing existing conditions adjacent to property before starting the Work.
 - 2. 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
- E. Periodic Construction Photographs: Take 20 photographs monthly 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.
- F. Final Completion Construction Photographs: Take 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.
- G. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
- H. Upon completion of the Work, submit all electronic pictures on disc. Architect may request hard copies of the pictures.
- I. Secure Architect's approval if a video tape is to be substituted for the photograph prints.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3233

SECTION 01 3300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

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."
- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.3 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by 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. Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
3. 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 date of fabrication.
 - h. Scheduled dates for purchasing.
 - i. Scheduled dates for installation.
 - j. Activity or event number.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. See University of Utah U Facilities; General Conditions; Article 3 A/E; 3.1 A/E's Administration of the Contract; 3.1.5 A/E Review of Contractor's Submittals
- B. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.6 Time and Contractor's Construction Schedule; 4.6.8 Schedule of Submittals.
- C. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
 1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in Revit.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
- D. 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 different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- E. 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 working 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. Resubmittal Review: Allow 15 working days for review of each resubmittal.
 3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 working days for initial review of each submittal.

- F. Electronic Submittals: Identify and incorporate information in each electronic submittal file 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.
 - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.

- l. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number, numbered consecutively.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
- a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- G. Options: Identify options requiring selection by Architect.
- H. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- I. 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.
- J. 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.
- K. 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.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Post electronic submittals as PDF electronic files directly Document Transfer site for Project.

- a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Certificates and Certifications Submittals: Provide 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.
 - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
 - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before or concurrent with Samples.
 6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. 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.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.
 3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
 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 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. Mark up and retain one returned Sample set as a project record sample.
 - 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.
- E. 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.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 3200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 2900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."
- L. 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.

- M. **Welding Certificates:** Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. **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.
- O. **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.
- P. **Product Certificates:** Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. **Material Certificates:** Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- R. **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.
- S. **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.
- T. **Research Reports:** Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- U. **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.
- V. **Compatibility Test Reports:** Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- W. 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.
- X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 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 Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file 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.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. See University of Utah U Facilities; General Conditions; Article 3 A/E; 3.1 A/E's Administration of the Contract; 3.1.5 A/E Review of Contractor's Submittals
- B. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.6 Time and Contractor's Construction Schedule; 4.6.8 Schedule of Submittals.
- C. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- D. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 7700 "Closeout Procedures."
- E. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date

of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. See University of Utah U Facilities; General Conditions; Article 3 A/E; 3.1 A/E's Administration of the Contract; 3.1.5 A/E Review of Contractor's Submittals.
- B. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.8 Shop Drawings, Product Data and Samples; 4.8.6 Direct Specific Attention to Revisions.
- C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- D. 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.
- E. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- F. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- G. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 3300

SECTION 01 4000 - QUALITY REQUIREMENTS

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. See University of Utah U Facilities; General Conditions; Article 9 Tests and Inspections, Substantial and Final Completion, Uncovering, Correction of Work and Guaranty Period; 9.1 Tests and Inspection; 9.1.1 in General.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting 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. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Requirements:
 - 1. Divisions 02 through 33 Sections for specific test and inspection requirements.

1.3 DEFINITIONS

- A. See University of Utah U Facilities; General Conditions; Article 2 The University; 2.1 Information and Services Required of University; 2.1.2 Specialists and Inspectors.
- B. 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.
- C. 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. Services do not include contract enforcement activities performed by Architect.

- D. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
 - 1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
- E. 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.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. 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, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- K. Experienced: When used with an entity or individual, "experienced" 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.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits.

To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- B. 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.

1.6 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, and telephone number 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 inspecting.
 - 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 Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.

5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, 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 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Delegated-Design Services: For products and systems assigned to Contractor to be designed and certified by Contractor's design professional to be in compliance with performance and design criteria.

C. 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.

D. 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.

E. Installer Qualifications: A firm or individual experienced in installing, erecting, 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.

F. 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 are similar in material, design, and extent to those indicated for this Project.

G. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

H. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

- I. Manufacturer's 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.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated.
 - 2. Notify Architect and testing agency seven days in advance of dates and times when mockups will be constructed.
 - 3. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
- K. Laboratory mockups constructed at testing facility.
- L. Civil Work Quality Assurance:
 - 1. Employ an agency or staff to assure installed product and materials comply with Contract Documents, and to assure inspections, tests, and other services comply with industry standards.
 - 2. Use an AMRL (AASHTO Materials Reference Library) certified laboratory that has personnel certified by WAQTC (Western Alliance for Quality Transportation Construction).
 - 3. When requested by engineer, provide a professional opinion from a testing agency concerning test results and quality of work covered by testing performed.
 - 4. Do more testing, if, in engineer's opinion, work is not being adequately controlled.

1.8 QUALITY CONTROL

- A. See University of Utah U Facilities; General Conditions; Article 2 The University; 2.1 Information and Services Required of University; 2.1.2 Specialists and Inspectors
- B. 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 inspecting they are engaged to perform.
 - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- C. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- D. **Manufacturer's Field Services:** Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.
- E. **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.
- F. **Testing Agency Responsibilities:** Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 2. Determine the location 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 any duties of Contractor.
- G. **Associated Services:** Cooperate with agencies 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 inspecting. 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 inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

- A. See University of Utah U Facilities; General Conditions; Article 2 The University; 2.1 Information and Services Required of University; 2.1.2 Specialists and Inspectors.
- B. Special Tests and Inspections: Owner will Engage a qualified testing agency or 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 reviews the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect 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 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.

1.10 MOCK-UP PROVISIONS

- A. Prepare mock-ups for Work specifically requested in specifications. Include work for Sections required to provide mock-ups.
- B. Construct in locations indicated.
- C. Prepare mock-ups for Architect and Testing Agency review in reasonable promptness and in orderly sequence, to not cause delays of Work.
- D. Failure to prepare mock-ups in ample time is not considered sufficient reason for extension of Contract time and no claim for extension by reason of such default will be allowed.

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 reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 7300 "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 01 4000

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities, to extent not already provided in previously issued bid packages.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.
 - a. Provide temporary facilities and controls to extent not already provided.
 - b. For site work, comply with mobilization and demobilization requirements per APWA (Utah) Standards: Plan 412 Invert Cover.

1.2 DEFINITIONS

- A. Mobilization includes bringing all necessary equipment to the site to do the Work. It includes all labor, materials, and equipment to set up temporary offices, buildings, facilities, signs, and utilities.
- B. Demobilization includes removing all construction equipment and debris so site is left clean.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

- B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
 - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 - 3. 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.
- D. 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. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions (dust barriers) 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.
- E. 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.

1.5 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 U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 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. Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top rails.
- B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

2.2 TEMPORARY FACILITIES

- A. Common-Use Field Office: Inside existing Building 521, of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
 - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - 2. Conference room of sufficient size to accommodate meetings of 20 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- square tack and marker boards.
 - 3. Drinking water and private toilet.
 - 4. Copy machine and supplies.
 - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- 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 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 01 7700 "Closeout Procedures".
- C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 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.
- 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.

3.2 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.
 - 2. Install meters for measuring use of power, water, and gas.
- 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, 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.
- D. 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.

- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
 - 1. Install electric power service overhead or underground unless otherwise indicated.
- 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 a WiFi access point, Internet service, and desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.
- I. Invert Cover: Install covers as shown in APWA Plan 412 or Drawings. Installation must be tight so no debris can by-pass the cover and enter the piping below.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 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.
 - 3. Access Routes: Provide traffic plan that describes access routes for concrete trucks, delivery trucks, and other vehicles.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings provided by Architect.
 - a. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
 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 touchup signs so they are legible at all times.
- E. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."
- F. 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.
- G. 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.

3.4 SITE SUPPORT FACILITIES INSTALLATION

A. Noise Control:

1. Use equipment that is equipped with noise attenuation devices. Comply with local Laws and Regulations.
2. Control construction noise in residential areas from 9:00 pm to 7:00 am.

B. Dust and Mud Control:

1. Comply with Utah State air quality regulations.
2. Provide suitable equipment to control dust or air pollution caused by construction operations.
3. Provide suitable mud and dirt containment, so Work site, access roadways and properties adjacent to the Work site are kept clean.

C. Surface Water Control:

1. Control all on-site surface water. Provide proper drainage so flooding of the site or adjacent property does not occur.

2. Provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the site.
3. Immediately before suspension of construction operations for any reason, provide proper and necessary drainage of Work site area.
4. Provide berms or channels as necessary to prevent flooding or saturation of Subgrade. Promptly remove all water collecting in depressions.
5. Dispose of water in a manner that will not cause damage to adjacent areas or facilities.

D. Ground Water Control:

1. Provide a dewatering system sufficient to maintain excavations and foundations dry and free of water on a 24-hour basis.
2. Notify Engineer, in writing, if groundwater conditions differ from conditions shown in the Bid Documents, or in any soil test data that has been supplied.
3. Remove all dewatering facilities when no longer required.
4. Dispose of water in a manner that will not cause damage to adjacent or downstream areas or facilities.

E. Pollution Control:

1. Soil: Prevent contamination of soil from discharge of noxious substances (including engine oils, fuels, lubricants, etc.). Excavate and legally dispose of any such contaminated soil off-site, and replace with acceptable compacted fill and topsoil.
2. Water: Prevent disposal of wastes, effluent, chemicals, or other such substances adjacent to or into streams, waterways, sanitary sewers, storm drains, or public waterways. Perform any emergency measures required to contain any spillage.
3. Air: Control atmospheric pollutants.

F. Erosion Control:

1. Use measures such as berms, dikes, dams, sediment basins, fiber mat netting, gravel, mulches, slopes, drains and other erosion control devices or methods to prevent erosion and sedimentation.
2. Provide construction and earthwork methods which control surface drainage from cut, fill, borrow, and waste disposal areas, to prevent erosion and sedimentation.
3. Inspect earthwork during execution to detect any evidence of the start of erosion. Apply corrective measures as required.

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.
- 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 01 1000 "Summary."

- C. 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.
- D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- E. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
 - 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.
- F. 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 work day.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. 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.
- J. 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 two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches 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 between doors. Maintain water-dampened foot mats in vestibule.
 - 2. Insulate partitions to control noise transmission to occupied areas.

3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 4. Protect air-handling equipment.
 5. Provide walk-off mats at each entrance through temporary partition.
- 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 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.
 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to 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. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: 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 Phase: 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, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: 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. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Remove 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 01 7700 "Closeout Procedures."

END OF SECTION 01 5000

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

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 general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 01 50 00 "Temporary Facilities and Controls" for temporary site fencing.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 12 inches above the ground for trees larger than 4-inch size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches above the ground line.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.

- b. Arborist's responsibilities.
- c. Quality-control program.
- d. Coordination of Work and equipment movement with the locations of protection zones.
- e. Trenching by hand or with air spade within protection zones.
- f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 2. Detail fabrication and assembly of protection-zone fencing and signage.
 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
 1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.
 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 1. Species and size of tree.
 2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- E. Quality-control program.

1.7 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Moving or parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: Stockpiled soil mixed with planting soil of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
1. Mixture: Well-blended mix of two parts stockpiled soil to one-part planting soil.
 2. Planting Soil: Planting soil as specified in Section 32 91 15 "Soil Preparation (Performance Specification)."
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
1. Type: Shredded hardwood.
 2. Size Range: 3 inches maximum, 1/2 inch minimum.
 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements: Previously used materials may be used when approved by Architect.
1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch-OD corner and pull posts; with 1-5/8-inch-OD top rails and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 72 inches.
 2. Gates: Single- swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
1. Text: As per Owner's Representative.
 2. Lettering: 3-inch- high minimum, white characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Flag each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install to comply with ASTM F567 and with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install; adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 31 20 00 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Do not paint cut root ends.
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots 12 inches outside of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as directed by arborist.
 - 1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 - 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 - 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning, reducing and thinning where indicated.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and dispose of off-site.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
 - 2. Large Trees: Provide two new tree(s) of at least 2-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.
 - a. Species: As indicated on drawings.
 - 3. Plant and maintain new trees as specified in Section 329300 "Plants."

- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 2-inch uniform thickness to remain.

- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

SECTION 01 6000 - PRODUCT REQUIREMENTS

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 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 01 2500 "Substitution Procedures" for requests for substitutions.

1.3 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. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved by Architect through submittal process 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. 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.
- 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, if applicable.

1.4 ACTION SUBMITTALS

- A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Architect's Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 3300 "Submittal Procedures." Show compliance with requirements.

1.5 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. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
 - 2. If a dispute arises between 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-connected 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 identification requirements.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
1. Store products to allow for inspection and measurement of quantity or counting of units.
 2. Store materials in a manner that will not endanger Project structure.
 3. Store products that are subject to damage by the elements, under cover in a weather tight enclosure above ground, with ventilation adequate to prevent condensation.
 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 6. Protect stored products from damage and liquids from freezing.
 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.
1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
 2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Section 01 7700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 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
 4. Contract Documents.
 5. Where products are accompanied by the term "as selected," Architect will make selection.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 7. **Or Equal:** For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. 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 not be considered unless otherwise indicated by the addition of "Or As Approved" or "Or Approved Comparable Product".
 - 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, which 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: ..."
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 not be considered unless otherwise indicated by the addition of "Or As Approved" or "Or Approved Comparable Product".
 - 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, which 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: ..."
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 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 01 2500 "Substitution Procedures" for substitutions for convenience.
8. Reference Standards: Where Specifications describe a product by referring to a reference standard without listing product/manufacturer, propose a product that meets the standard. Where additional product description modifies the reference standard, proposed product shall meet the standard as modified.
- a. A product specified by reference standard shall comply with the requirements of the standard in effect on the date of the Bidding Documents, except:
 - 1) Where a date is specified with the standard; then the edition of the standard so dated shall govern.
 - 2) Where the governing code requires compliance to another edition of the standard.
- C. Product Uniformity: It is the intent of the Documents that the completed construction be uniform throughout the Project. For each type of product, the manufacturer and model shall not vary. After a particular product has been identified and approved for an application, that product shall be used for that application across all the subcontracts and other Work-related contracts held by the Contractor or Construction Manager. This provision applies equally to accepted substitutions.
- D. Visual Matching Specification: Where Specifications require "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 01 2500 "Substitution Procedures" for proposal of product.
- E. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or 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.
- 2.2 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 these requirements:

1. The product option and selection procedure, as described in this Section, governing the specified product:
 - a. Allows the Contractor to make comparable product requests.
 - b. Does not require the use of the product substitution procedure.
 2. 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. Detailed comparison of significant qualities of proposed product with those named in the Specifications. 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.
 6. By proposing a product that is not listed, for consideration as a comparable product, the Contractor affirms that it meets requirements, except where clearly indicated otherwise. Approval, if granted, will be contingent upon the product meeting requirements as comparable product. In the absence of clear indication of non-compliance in product submittal, approval of the comparable product by Architect, will be based on Contractor's affirmation, whether explicit or implicit.
- B. Submittal Requirements: 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - 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. Installation of the Work.
 - 3. Cutting and patching.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for limits on use of Project site.
 - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
 - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
 - 4. Structural integrity of any element of Project.
 - 5. Integrity of weather-exposed or moisture-resistant element.
 - 6. Efficiency, maintenance, or safety of any operational element.
 - 7. Visual qualities of sight-exposed elements.
 - 8. Dates: Indicate when cutting and patching will be performed.

9. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
 10. Include in cutting and patching plan:
 - a. Identification of Project.
 - b. Location and description of affected work.
 - c. Necessity for cutting and patching.
 - d. Description of proposed work, and products to be used.
 - e. Alternatives to cutting and patching.
 - f. Effect on work of Owner or separate contractor.
 - g. Written permission of affected separate contractor.
 - h. Date and time work will be executed.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

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, 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.
 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.
 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. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- 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.

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, 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.
 - 3. Beginning of Modification work constitutes acceptance of existing conditions.
- 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. 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 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. Provide supports to assure structural integrity of surroundings, devices and methods to protect other portions of work from damage.
- E. Provide protection from elements for areas which may be exposed by work.
- F. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "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. If discrepancies are discovered, notify Architect promptly.
- B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- C. 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 INSTALLATION

- A. General: 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 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- 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 the best possible results. 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.
- 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: Do not use tools or equipment that produce harmful 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 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.
 - 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. Execute work by methods to avoid damage to existing structures and other work, and which will provide proper surfaces to receive patching and finishing.
- J. Employ original installer if possible to be responsible for modification work on weather-exposed and moisture-resistant elements, and exposed to view surfaces.
- K. Restore Work with new products per requirements of Contract Documents.

- L. Fit Work, to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- A. E. Refinish surfaces to match adjacent finishes. For continuous
- B. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- C. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. 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.
 - 2. Uncover work to install work done out of sequence.
 - 3. Remove and replace defective and non-conforming work.
 - 4. Remove Samples of installed work for testing.
 - 5. Provide openings in non-structural elements for penetrations of mechanical and electrical work.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "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. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Ceilings: Patch, repair, or 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.

3.6 PROGRESS CLEANING

- A. See University of Utah Facilities Management; General Conditions; Article 4 Contractor; 4.9 Use of Site; 4.9.1 In General.

- B. General: 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.
- C. Site: Maintain Project site free of waste materials and debris.
 - 1. Clean exposed-to-view surfaces.
 - 2. Remove waste, debris, and surplus materials from site. Clean grounds; paved areas and sweep clean.
 - 3. Rake clean other surfaces.
- D. 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.
- E. 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.
- F. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- G. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- H. 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 01 7419 "Construction Waste Management and Disposal."
- I. 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.
- J. 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.

- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

3.8 PROTECTION 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. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

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 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.

1.3 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, 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 reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition and construction waste becomes property of Contractor.

1.5 PERFORMANCE GOALS

- A. Salvage/Recycle Goals: Owner's intent is to salvage and recycle as much nonhazardous demolition waste as possible. Contractor is encouraged to use remaining salvageable or recyclable items to add value to the bid. Items that may be salvaged or recycled include all building and site components, packaging, and temporary construction elements.
- B. Comply with Salt Lake City's sustainability initiative.
 - 1. Website: <https://www.slc.gov/sustainability/waste-management/construction-demolition-waste/>

1.6 ACTION SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for the Notice to Proceed.
 - 1. Fill out the following form as provided by SLCgreen:
 - a. Salt Lake City Corporation Construction and Demolition Waste Management Plan.
 - 1) Website http://www.slcdocs.com/slcgreen/C&D_WMgtPlan.pdf
 - 2. Submit copy of Waste Management Plan to constructionrecycling@slcgov.com for city approval and review.

1.7 INFORMATIONAL SUBMITTALS

- A. Waste Management Report: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Report waste management using the following form as provided by SLCgreen:
 - a. Salt Lake City Corporation Construction and Demolition Waste Management Report.
 - 1) Website http://www.slcdocs.com/slcgreen/C&D_WMgtReport.pdf
 - 2. Submit copy of Waste Management Report to constructionrecycling@slcgov.com for approval and review.
 - a. Construction waste report shall be filled out by the company that hauls the waste from the site and shall include at least the following:
 - 1) Pictures
 - 2) Itemized list of materials collected.
 - 3) Percentage of types of waste (by weight) of the material recycled, reused, or taken to the Landfill.

3. A certificate of occupancy will be issued by the city once all of the required documents, including the waste management report, has been submitted and recorded.
- B. 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.
- C. 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.
- D. Qualification Data: For refrigerant recovery technician.

1.8 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with transportation and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "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.

1.9 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to requirements in this Section. 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 and construction waste generated by the Work.
- C. Waste Management Plan: To comply with city requirement, include the following:
 1. Description of how minimum of 55 percent of waste will be recycled or reused.
 2. Description of efforts to be employed to reduce the amount of waste generated by the project.
 3. Description of procedure that will be used to train construction employees and ensure performance of proper recycling and reuse methods.

4. Listing of total amount and types of waste reused, recycled, or composted and what amount and types of the waste will be taken to the Landfill.
 - a. List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
5. Names of facilities where waste materials will be taken.
 - a. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - b. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - c. 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 (NOT USED)

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 01 5000 "Temporary Facilities and Controls."
- B. 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.
- C. 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 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

- D. Provide bilingual signage at dumpsters at bins.

3.2 SALVAGING DEMOLITION WASTE

- A. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- B. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- C. Lighting Fixtures: Separate lamps by type and protect from breakage.
- D. 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. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 1-1/2-inch size.
 2. Crush concrete and screen to comply with requirements in Section 31 2000 "Earth Moving" for use as satisfactory soil for fill or subbase.
- B. Concrete Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
1. Pulverize masonry to maximum 3/4-inch size.
 - a. Crush masonry and screen to comply with requirements in Section 31 2000 "Earth Moving" for use as general fill.
 2. Clean and stack undamaged, whole masonry units on wood pallets.
- C. Wood Materials: Chip demolished wood.
- D. Metals: Separate metals by type.
1. Structural Steel: Stack members according to size, type of member, and length.
 2. Remove and dispose of rebar, bolts, nuts, washers, and other rough hardware.
- E. 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.
- F. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
1. Store clean, dry carpet and pad in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- G. Carpet Tile: Remove debris, trash, and adhesive.
1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by carpet reclamation agency or carpet recycler.
- H. Piping: Reduce piping to straight lengths and store by material and size. Separate supports, hangers, valves, sprinklers, and other components by material and size.
- I. Conduit: Reduce conduit to straight lengths and store by material and size.
- J. 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.

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. Burning: Do not burn waste materials.

END OF SECTION 01 7419

SECTION 01 7700 - 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. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

- B. Related Requirements:
 - 1. Section 01 7300 "Execution" for progress cleaning of Project site.
 - 2. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Section 01 7900 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. See University of Utah U Facilities; General Conditions; Article 9 Tests and Inspections, Substantial and Final Completion, Uncovering, Correction of Work and Guaranty Period; 9.3 Inspections: Substantial and Final; 9.3.1 Substantial Completion Inspection.
- B. 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.
- C. 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, final completion construction photographic documentation, 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 maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
 5. Submit testing, adjusting, and balancing records.
 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- D. 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 01 7900 "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.

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, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- E. 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. Reinspection: 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.

1.6 FINAL COMPLETION PROCEDURES

- A. See University of Utah Facilities Management; General Conditions; Article 9 Tests and Inspections, Substantial and Final Completion, Uncovering, Correction of Work and Guaranty Period; 9.2 Inspections: Substantial and Final; 9.3.2 Final Completion Inspection.
- B. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 2900 "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 shall 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.
- C. 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- 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, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, 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. MS Excel electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. 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, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. 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.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.

- j. 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.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. 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 Standard 1992-01. Provide written report on completion of cleaning.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.

4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

C. Substantial Completion:

1. When Work, or designated portion thereof, is substantially complete, submit written notice with list of any outstanding items to be completed or corrected.
2. After receipt of Contractor's certification of Work Completion, Architect will make final inspection to determine status of completion.

D. Should Work not be substantially complete, remedy deficiencies and re- submit a written notice.

E. Acceptance of Work:

1. Protect Work until it is accepted.
2. Neither Architect's determination that Work is complete, nor acceptance thereof by the Owner, shall operate as a bar to claim against the Contractor under the provisions of the contract documents.

F. Closeout Submittals:

1. Record Documents: Section 01 7839.
2. Operation and Maintenance Data; Section 01 7823.
3. Evidence of payment to Subcontractors and Suppliers: Document 00 7200, Final Application for Payment.
4. Final Summary Report of Contractor's Testing Agency: Section 01 4500 requirements.

END OF SECTION 01 7700

SECTION 01 7823 - 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.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "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. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

- b. Enable inserted reviewer comments on draft submittals.
2. One paper copy. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.
- C. 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 will return copy with comments.
 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 1. List of documents.
 2. List of systems.
 3. List of equipment.
 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: 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 Architect.
 7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
 8. 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. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-

- reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
- b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. 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.
- C. 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.
- D. 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.

2.4 OPERATION MANUALS

- A. 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.
- B. 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.
- C. 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.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. 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.
- B. 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.
- C. 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.
- D. 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.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. 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.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. 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 warranty and bond information, as described below.
- B. 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.

- C. **Manufacturers' Maintenance Documentation:** Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 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.

- D. **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.

- E. **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.

- F. **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.

- G. **Maintenance Service Contracts:** Include copies of maintenance agreements with name and telephone number of service agent.

- H. **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 3 - EXECUTION

3.1 MANUAL PREPARATION

- 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. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
 - 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.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, 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.
 - 1. 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.
- E. 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 operation and maintenance manuals.
 - 2. Comply with requirements of newly prepared record Drawings in Section 01 7839 "Project Record Documents."
- F. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 7823

SECTION 01 7839 - 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 01 7700 "Closeout Procedures" for general closeout procedures.
 - 2. Section 01 7823 "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 one set of marked-up record prints.
 - 2. Number of Copies: Submit copies of record Drawings as follows:
 - a. Submittal:
 - 1) Submit one paper-copy set of marked-up record prints.
 - 2) Submit record digital data files and three sets of record digital data file plots.
 - 3) Plot each drawing file, 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.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.7 Documents and Samples at the Site, Certifying “As-Built”.
- B. 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.
 - 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. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. 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 sets 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.

- C. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 3300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Format: Annotated PDF electronic file with comment function enabled.
 2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 3. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.7 Documents and Samples at the Site, Certifying "As-Built".
- B. 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. Note related Change Orders, record Product Data, and record Drawings where applicable.
- C. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.7 Documents and Samples at the Site, Certifying “As-Built”.
- B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- C. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. See University of Utah U Facilities; General Conditions; Article 4 Contractor; 4.7 Documents and Samples at the Site, Certifying “As-Built”.
- B. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- C. Maintenance of Record Documents and Samples: Store record documents and Samples 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.

3.2 DOCUMENTS ON SITE

- A. Keep at job site 1 copy of each of the following, if issued for the Work:

1. Contract Drawings.
 2. Project Manual.
 3. Addenda.
 4. Reviewed Shop Drawings, product data and Samples.
 5. Modifications to the Contract Documents.
 6. Field test records.
 7. Inspection certificates.
 8. Manufacturer's certificates.
 9. Survey documentation.
 10. Storm water pollution prevention plan (SWPPP).
 11. All related permits.
- B. Do not use record documents for construction purposes.
- C. Store Record Documents in a location, apart from documents used for construction.
- D. Maintain Record Documents in a clean, dry, legible condition.
- E. Provide adequate files and racks for storage of Record Documents that will allow ready access for review and updating.
- F. Make Record Documents available at all times for review and Inspection by Engineer.

3.3 MARKING DEVICES

- A. Red colored waterproof for all marking unless requested otherwise.

3.4 RECORDING

- A. Clearly and legibly label each document "PROJECT RECORD".
- B. Number Record Documents in a manner which will allow ready retrieval of documents and allow indexing of documents for submittal to Architect.
- C. Update Record Documents as work occurs to show the current status of the Work.
- D. Do not permanently cover or conceal any work until all required information has been recorded on the Record Documents.
- E. Contract Drawings: Legibly mark contract Drawings to record following actual construction information:
1. Measured depths of various elements of foundation or finish grading in relation to finish floor datum or other permanent benchmark.
 2. Measured horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 3. Measured location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of construction.
 4. Field changes of dimension and detail.

5. Changes made by contract Modifications.
 6. Details not contained in original contract Drawings.
- F. Project Manual and Addenda: Legibly update each to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 2. Changes made by contract Modifications.
 3. Other technical matters and details included in the Work, but not originally specified.
- G. Shop Drawings: Maintain reviewed Shop Drawings as Record Documents; legibly annotate drawings to record changes made to Shop Drawings.
- H. Product Data and Samples: Maintain reviewed product data and Samples as Record Documents; update and document any variations from the reviewed product data and Samples after acceptance.
- I. Submittal of Documents:
1. At the completion of the Work, submit all Record Documents.
 2. Accompany the submittal with a transmittal letter, in duplicate, containing:
 3. Submittal date.
 4. Project title and number.
 5. Contractor's name and address.
 6. Title and number of each Record Document.
 7. Certification that each document as submitted is complete and accurate.
- J. Signature of Contractor, or Contractor's authorized representative.

END OF SECTION 01 7839

SECTION 01 7900 - 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. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
 - 3. Demonstration and training video recordings.

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 or instructor.
- 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

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
 - 1. Identification: On each copy, provide an applied label with the following information:
 - a. Name of Project.
 - b. Name and address of videographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date of video recording.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
3. At completion of training, submit complete training manual for Owner's use in PDF electronic file format on compact disc.

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. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 "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 content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 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. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. 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.

PART 3 - EXECUTION

3.1 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 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

3.2 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, through Architect, 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.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
 - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Architect, on electronic media.
 - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
 - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
 - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.

4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
 - a. Name of Contractor/Installer.
 - b. Business address.
 - c. Business phone number.
 - d. Point of contact.
 - e. E-mail address.

- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.

- D. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

- E. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 01 7900

SECTION 02 4119 - SELECTIVE DEMOLITION

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. Demolition and removal of selected portions of building or structure.

- B. Related Requirements:

- 1. Section 01 1000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
 - 2. Section 01 5639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
 - 3. Section 01 7300 "Execution" for cutting and patching procedures.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For refrigerant recovery technician.
- B. Engineering Survey: Submit engineering survey of condition of building.
- C. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- D. 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.
- E. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Comply with Section 01 3233 "Photographic Documentation." Submit before Work begins.
- F. 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.
- G. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

1.9 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: It is not expected that hazardous materials will be encountered in the Work.
 - 1. Hazardous materials will be removed by Owner before start of the Work.
 - 2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- 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.

1.10 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 ASSE A10.6 and NFPA 241.

1. Maintain the existing building structure, envelope, and interior nonstructural elements not indicated to be demolished. Do not demolish such existing construction beyond indicated limits.

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. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
- D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.
- E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video and templates.
 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

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. Arrange to shut off utilities with utility companies.

2. 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.
3. 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. Equipment to Be Removed: Disconnect and cap services and remove equipment.
 - c. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

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 01 5000 "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 2 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 01 7419 "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. 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.
- D. 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 reinstalled in their original locations after selective demolition operations are complete.
- 3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS
- A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- B. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 5419 "Polyvinyl-Chloride (PVC) Roofing" for new roofing requirements.
1. Remove existing roof membrane, insulation, flashings, copings, and roof accessories.
 2. Remove existing roofing system as indicated.

- a. Remove existing decking where indicated.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and recycle or dispose of them according to Section 01 7419 "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 01 7419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

3.8 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.

3.9 SELECTIVE DEMOLITION SCHEDULE

- A. Existing Construction to Be Removed: Items and construction as indicated on Drawings.
- B. Existing Items to Be Removed and Reinstalled: Items and construction as indicated on Drawings. Includes, but is not limited to, the following:
 1. Existing removed brick for patching and repair.

END OF SECTION 02 4119

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

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. Structural steel.
- 2. Shear stud connectors.
- 3. Shrinkage-resistant grout.

- B. Related Requirements:

- 1. Section 05 3100 "Steel Decking" for field installation of shear stud connectors through deck infill as needed.
- 2. Section 05 5000 "Metal Fabrications" for miscellaneous steel fabrications and other steel items not defined as structural steel.

1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.
- B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.
- C. Heavy Sections: Rolled and built-up sections as follows:
 - 1. Shapes included in ASTM A6/A6M with flanges thicker than 1-1/2 inches.
 - 2. Column base plates thicker than 2 inches.
- D. Protected Zone: Structural members or portions of structural members indicated as "protected zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.
- E. Demand-Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the seismic-load-resisting system and which are indicated as "demand critical" or "seismic critical" on Drawings.

1.4 COORDINATION

- A. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data:

1. Structural-steel materials.
2. High-strength, bolt-nut-washer assemblies.
3. Shear stud connectors.
4. Anchor rods.
5. Threaded rods.
6. Forged-steel hardware.
7. Slide bearings.
8. Prefabricated building columns.
9. Shop primer.
10. Shrinkage-resistant grout.

- B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment Drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Identify members and connections of the seismic-load-resisting system.
6. Indicate locations and dimensions of protected zones.
7. Identify demand-critical welds.
8. Identify members not to be shop primed.

- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural-steel materials, including chemical and physical properties.
- E. Product Test Reports: For the following:
 - 1. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - 2. Direct-tension indicators.
 - 3. Tension-control, high-strength, bolt-nut-washer assemblies.
 - 4. Shear stud connectors.
- F. Survey of existing conditions.
- G. Source quality-control reports.
- H. Field quality-control reports.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- A. Installer Qualifications: A qualified installer who complies with the AISC Quality Certification Program (or Equal) and is designated an AISC-Certified Erector (or Equal), Category ACSE or Category CSE (or Equal).
 - 1. Installers that are not AISC certified shall provide documentation, prior to bid, showing an equal level of certification and a list of recent projects of similar size and type. A list of approved alternate-AISC installers will be issued to the bidding Contractors by Addenda.
- B. Shop-Painting Applicators: Qualified in accordance with AISC's Sophisticated Paint Endorsement P1 or to SSPC-QP 3.
- C. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
 - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
 - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
 - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
 - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
 - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.
 - 3. ANSI/AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connection Design Information:
 - 1. Option 1: Connection designs have been completed and connections indicated on the Drawings.
- C. Moment Connections: Type PR, partially or Type FR, fully restrained as indicated on the structural drawings.
- D. Construction: system of moment frame and braced frame.

2.2 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.
- B. Channels, Angles, M-Shapes, S-Shapes: ASTM A36/A36M.
- C. Plate and Bar: ASTM A36/A36M and ASTM A572/A572M.

- D. Cold-Formed Hollow Structural Sections: ASTM A500/A500M, Grade C structural tubing.
- E. Steel Pipe: ASTM A53/A53M, Type E or Type S, Grade B.
 - 1. Weight Class: Standard.
 - 2. Finish: Black.
- F. Steel Castings: ASTM A216/A216M, Grade WCB, with supplementary requirement S11.
- G. Steel Forgings: ASTM A668/A668M.
- H. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS AND CONNECTORS

- A. High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- B. High-Strength A490 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts or Grade F2280 tension-control, bolt-nut-washer assemblies with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- C. Zinc-Coated High-Strength A325 Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Hot-dip zinc coating.
- D. Shear Stud Connectors: ASTM A108, AISI C-1015 through C-1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

2.4 RODS

- A. Headed Anchor Rods: ASTM F1554, Grade 55, weldable, straight.
 - 1. Nuts: ASTM A563 heavy-hex carbon steel.
 - 2. Plate Washers: ASTM A36/A36M carbon steel.
 - 3. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 4. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.
- B. Threaded Rods: ASTM A36/A36M.
 - 1. Nuts: ASTM A63 heavy-hex carbon steel.
 - 2. Washers: ASTM F436, Type 1, hardened carbon steel.
 - 3. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C.

2.5 FORGED-STEEL STRUCTURAL HARDWARE

- A. Clevises and Turnbuckles: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1035.
- B. Eye Bolts and Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1030.
- C. Sleeve Nuts: Made from cold-finished carbon-steel bars, ASTM A108, AISI C-1018.

2.6 PRIMER

- A. Steel Primer:
 - 1. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

2.7 SHRINKAGE-RESISTANT GROUT

- A. Metallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.
- B. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.8 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
 - 1. Camber structural-steel members where indicated.
 - 2. Fabricate beams with rolling camber up.
 - 3. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
 - 4. Mark and match-mark materials for field assembly.
 - 5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
 - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 1.
- F. Shear Stud Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Weld using automatic end welding of headed-stud shear connectors in accordance with AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural-steel frame. Straighten as required to provide uniform, square, and true members in completed wall framing. Build up welded framing, weld exposed joints continuously, and grind smooth.
- H. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
 - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
 - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
 - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.9 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

2.10 SHOP PRIMING

- A. Shop prime all steel surfaces.
- B. Surface Preparation of Steel: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces in accordance with the following specifications and standards:
 - 1. SSPC-SP 3.
- C. Priming: Immediately after surface preparation, apply primer in accordance with manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

2.11 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
 2. Bolted Connections: Inspect and test shop-bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 3. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - a. Liquid Penetrant Inspection: ASTM E165/E165M.
 - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
 - c. Ultrasonic Inspection: ASTM E164.
 - d. Radiographic Inspection: ASTM E94/E94M.
 4. In addition to visual inspection, test and inspect shop-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
 - a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear stud connector.
 - b. Conduct tests in accordance with requirements in AWS D1.1/D1.1M on additional shear stud connectors if weld fracture occurs on shear stud connectors already tested.
 5. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.
 - 1. Do not remove temporary shoring supporting structural-steel framing until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
 - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
 - 2. Weld plate washers to top of baseplate.
 - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - 4. Promptly pack shrinkage-resistant grout solidly between bearing surfaces and plates, so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for grouting.
- C. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 - 1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
 - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts" for bolt and joint type specified.
 - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
 - 1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
 - 2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
 - 3. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

3.5 REPAIR

- A. Touchup Painting:
 - 1. Immediately after erection, clean exposed areas where primer is damaged or missing, and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

3.6 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
 - 1. Verify structural-steel materials and inspect steel frame joint details.
 - 2. Verify weld materials and inspect welds.
 - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
 - 1. Bolted Connections: Inspect and test bolted connections in accordance with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
 - 2. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
 - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
 - 1) Liquid Penetrant Inspection: ASTM E165/E165M.

- 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
- 3) Ultrasonic Inspection: ASTM E164.
- 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 05 1200

SECTION 05 3100 - STEEL DECKING

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. Roof deck where requires to be ectended.

- B. Related Requirements:

- 1. Section 05 1200 "Structural Steel Framing" for shop- and field-welded shear connectors.
 - 2. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Roof deck.

- B. Shop Drawings:

- 1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

- B. Product Certificates: For each type of steel deck.

- C. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

- 1. Power-actuated mechanical fasteners.

- D. Research Reports: For steel deck, from ICC-ES.

- E. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2 ROOF DECK

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASC Profiles, Inc.
 - 2. Canam Steel Corporation; Canam Group, Inc.
 - 3. Cordeck.
 - 4. DACS, Inc.
 - 5. Epic Metals Corporation.
 - 6. Marlyn Steel Decks, Inc.
 - 7. New Millennium Building Systems, LLC.
 - 8. Nucor Corp.
 - 9. Roof Deck, Inc.
 - 10. Valley Joist.
 - 11. Verco Decking, Inc., a Nucor company.
- B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
 - 1. Prime-Painted Steel Sheet: ASTM A1008/A1008M, Structural Steel (SS), Grade 50 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

- a. Color: White.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches.
4. Design Uncoated-Steel Thickness: As indicated in the structural drawings.
5. Span Condition: As indicated in the structural Drawings.
6. Side Laps: Overlapped.

2.3 ACCESSORIES

- A. Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
- H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- I. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 INSTALLATION OF ROOF DECK

- A. Fasten roof-deck panels to steel supporting members as indicated in the structural drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated in the structural drawings.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. mechanically fasten to substrate to provide a complete deck installation.
- E. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 REPAIR

A. Repair Painting:

1. Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
2. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Field welds will be subject to inspection.
- C. Prepare test and inspection reports.

END OF SECTION 05 3100

SECTION 05 4000 - COLD-FORMED METAL FRAMING

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. Load-bearing wall framing.
- 2. Exterior non-load-bearing wall framing.

- B. Related Requirements:

- 1. Section 05 5000 "Metal Fabrications" for miscellaneous steel shapes, and connections used with cold-formed metal framing.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Cold-formed steel framing materials.
- 2. Load-bearing wall framing.
- 3. Exterior non-load-bearing wall framing.
- 4. Vertical deflection clips.
- 5. Single deflection track.
- 6. Drift clips.
- 7. Post-installed anchors.
- 8. Power-actuated anchors.
- 9. Sill sealer gasket.

- B. Shop Drawings:

- 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Miscellaneous structural clips and accessories.

E. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.6 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

B. 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 or the Steel Stud Manufacturers Association.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AllSteel & Gypsum Products, Inc.
 2. CEMCO; California Expanded Metal Products Co.
 3. ClarkDietrich.
 4. Consolidated Fabricators Corp.; Building Products Division.
 5. Craco Manufacturing, Inc.
 6. Custom Stud.
 7. Design Shapes in Steel.
 8. Formetal Co. Inc. (The).
 9. Jaimes Industries.
 10. MarinoWARE.
 11. MBA Building Supplies.
 12. MRI Steel Framing, LLC.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated on Drawings.
 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
 - a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft.
 - b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/240 of the wall height.
 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1/2 inch.
 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 - 1. Wall Studs: AISI S211.
 - 2. Headers: AISI S212.
 - 3. Lateral Design: AISI S213.

- D. 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's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 - 1. Grade: ST50H.
 - 2. Coating: G60, A60, AZ50, or GF30.

- B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 - 1. Grade: 33.
 - 2. Coating: G60.

2.4 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches.
 - 3. Section Properties: As indicated on structural drawings.

- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches or as indicated on the structural drawings.

- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches.
 - 3. Section Properties: As indicated on the structural drawings.

- D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Top Flange Width: 1-5/8 inches.
 3. Section Properties: As indicated on the structural drawings.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: 1-5/8 inches.
 3. Section Properties: As indicated on the structural drawings.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
 2. Flange Width: 1-1/4 inches or as indicated on the structural drawings.
- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AllSteel & Gypsum Products, Inc.
 - b. ClarkDietrich.
 - c. MarinoWARE.
 - d. SCAFCO Steel Stud Company.
 - e. Simpson Strong-Tie Co., Inc.
 - f. Steel Construction Systems.
 - g. Steeler, Inc.
 - h. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
1. Minimum Base-Metal Thickness: 0.0428 inch.
 2. Flange Width: As indicated on the structural drawings.
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole-reinforcing plates.
 - 11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Anchor Bolts: ASTM F1554, Grade 36, threaded carbon-steel hex-headed bolts carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C.
- C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; 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 AC01 and ICC-ES AC193 as appropriate for the substrate.
 - 1. Uses: Securing cold-formed steel framing to structure.
 - 2. Type: Torque-controlled expansion anchor.
 - 3. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
- D. Power-Actuated 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 AC70.
- E. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M, MIL-P-21035B or SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C1107/C1107M, and with a fluid consistency and 30-minute working time.
- D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.
- E. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.
 - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
 - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.
- C. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF LOAD-BEARING WALL FRAMING

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 - 1. Anchor Spacing: As shown on structural drawings.
- B. Squarely seat studs against top and bottom tracks, with gap not exceeding 1/8 inch between the end of wall-framing member and the web of track.
 - 1. Fasten both flanges of studs to top and bottom tracks.
 - 2. Space studs as follows:
 - a. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame. Fasten jamb members together to uniformly distribute loads.
 2. Install tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically as indicated on Drawings. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges, and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges; terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- 3.5 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING
- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.

2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging as indicated on the structural drawings. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
1. Install solid blocking at centers indicated.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.

- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 4000

SECTION 05 5000 - METAL FABRICATIONS

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. Steel framing and supports for overhead doors.
- 2. Steel framing and supports for mechanical and electrical equipment.
- 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- 4. Slotted channel framing.
- 5. Shelf angles.
- 6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

- B. Related Requirements:

- 1. Section 05 1200 "Structural Steel Framing" for steel framing, supports and other steel items attached to the structural-steel framing.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Fasteners.
- 2. Shop primers.
- 3. Shrinkage-resisting grout.

4. Slotted channel framing.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for overhead doors.
 2. Steel framing and supports for mechanical and electrical equipment.
 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 4. Shelf angles.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research Reports: For post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 - 2. Material: Galvanized steel, ASTM A653/A653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
- F. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- E. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- F. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 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.

- G. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where exposed to exterior conditions.

2.7 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.

2.8 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.9 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.

- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.10 STEEL AND IRON FINISHES

- A. Shop prime steel prior to its delivery to the job site.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- C. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- D. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- E. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- F. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for overhead doors securely to, and rigidly brace from, building structure.

3.3 INSTALLATION OF BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 REPAIRS

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

- a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 5000

SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

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. Wood blocking, cants, and nailers.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for sheathing.

1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.4 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 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.
 - 2. 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.
 - 3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:

1. Fire-retardant-treated wood.
2. Power-driven fasteners.
3. Post-installed anchors.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: 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.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber 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. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded 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. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED MATERIALS

- 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 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.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
 1. Concealed blocking.
 2. Roof framing and blocking.
 3. Wood cants, nailers, blocking, and similar members in connection with roofing.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Cants.
- B. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
 1. Hem-fir or hem-fir (north), Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 2. Northern species, No. 2 Common grade; NLGA.
 3. Western woods, Construction or No. 2 Common grade; WCLIB or WWPA.
- C. 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.
- D. 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.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. Where carpentry is exposed to weather or in ground contact, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 or ICC-ES AC193 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

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. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs or other structure as indicated; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- D. Do not splice structural members between supports unless otherwise indicated.
- E. 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.
- F. Securely attach 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.
 - 2. ICC-ES evaluation report for fastener.
- G. 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 NAILER

- A. Install where indicated and where required for 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.

END OF SECTION 06 1053

SECTION 06 1600 - SHEATHING

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. Wall sheathing.
 - 2. Parapet sheathing.
 - 3. Sheathing joint and penetration treatment.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 WALL SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Gypsum; CertainTeed GlasRoc Type X Sheathing.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - d. USG Corporation; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.3 PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corporation; GlasRoc.
 - b. Georgia-Pacific Gypsum LLC; Dens-Glass Gold.
 - c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
 - d. USG Corporation; Securock.
 - 2. Type and Thickness: Type X, 5/8 inch thick.
 - 3. Size: 48 by 96 inches for vertical installation.

2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 - 1. For roof, parapet and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- 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. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 - 1. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

2.5 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 - 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
 - 2. ICC-ES evaluation report for fastener.
- D. Coordinate roof, wall and parapet sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

- C. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

- D. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

SECTION 07 2100 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board insulation.
- 2. Glass-fiber blanket insulation.

- B. Related Requirements:

- 1. Section 07 5423 "Thermoplastic-Polyolefin (TPO) Roofing" for insulation specified as part of roofing construction.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Extruded polystyrene foam-plastic board insulation.
- 2. Glass-fiber blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.

- 1. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type VI: ASTM C578, Type VI, 40-psi minimum compressive strength.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. DuPont de Nemours, Inc.
 - d. Kingspan Insulation Limited.
 - e. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
5. Thickness: As noted in drawings.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Unfaced: ASTM C665, Type I; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Johns Manville; a Berkshire Hathaway company.
 - c. Knauf Insulation.
 - d. Owens Corning.
2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
3. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

5. Install at exterior walls unless indicated otherwise.

2.3 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
 - c. Attic spaces.
- C. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.
 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. Gemco.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AGM Industries, Inc.
- b. Gemco.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 - 1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.

1. Fit courses of insulation between obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 4. For wood-framed construction, install blankets according to ASTM C1320 and as follows:
 - a. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100

SECTION 07 2726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

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. Vapor-permeable, fluid-applied air barriers.

- B. Related Requirements:

- 1. Section 06 1600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.
- B. Shop Drawings: For air-barrier assemblies.
 1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
 2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 3. Include details of interfaces with other materials that form part of air barrier.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer. Include list of ABAA-certified installers and supervisors employed by Installer, who work on Project.
- B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
- C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.
- D. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
 1. Protect substrates from environmental conditions that affect air-barrier performance.
 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
- B. VOC Content: 100 g/L or less.

2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

- A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils over smooth, void-free substrates.
 - 1. Basis of Design Products: GE Construction Sealants; Momentive Performance Materials Inc.; Elemax 2600.
 - a. Provide Basis of Design products or an equivalent product, subject to compliance with requirements, approved by Architect, one of the following:
 - 1) DuPont Safety and Construction; DuPont Tyvek Fluid Applied WB.
 - 2) Sto Corp; Sto AirSeal®.
 - 3) W.R. Meadows, Inc; Air-Shield LMP.
 - 2. Physical and Performance Properties:
 - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E2178.
 - b. Vapor Permeance: Minimum 10 perms; ASTM E96/E96M, Desiccant Method, Procedure A.
 - c. Ultimate Elongation: Minimum 250 percent; ASTM D412, Die C.
 - d. Adhesion to Substrate: Minimum 30 lbf/sq. in. when tested according to ASTM D4541.
 - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

- f. UV Resistance: Can be exposed to sunlight for 360 days according to manufacturer's written instructions.

2.4 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.
- C. Stainless-Steel Sheet: ASTM A240/A240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; US11000 UltraSpan.
 - b. Pecora Corporation; Pecora XL-Span.
 - c. The Dow Chemical Company; Dow Corning® 123 Silicone Seal.

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.
 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
 3. Verify that substrates are visibly dry and free of moisture.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- E. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.
- F. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- G. Bridge expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
 - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
 - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches of coverage is achieved over each substrate.
 - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
 - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.
- H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
 - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
 - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
 - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
 - 1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, applied in one or more equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
- C. Do not cover air barrier until it has been tested and inspected by testing agency.

- D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
 - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
 - 2. Air-barrier dry film thickness.
 - 3. Continuous structural support of air-barrier system has been provided.
 - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
 - 5. Site conditions for application temperature and dryness of substrates have been maintained.
 - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
 - 7. Surfaces have been primed, if applicable.
 - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
 - 9. Termination mastic has been applied on cut edges.
 - 10. Strips and transition strips have been firmly adhered to substrate.
 - 11. Compatible materials have been used.
 - 12. Transitions at changes in direction and structural support at gaps have been provided.
 - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
 - 14. All penetrations have been sealed.
- D. Air barriers will be considered defective if they do not pass inspections.
 - 1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
 - 2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Prepare inspection reports.

3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
 2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 07 2726

SECTION 07 4215 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Foamed-insulation-core metal wall panels.
- B. Product of this Section was issued as PR 002 in previously issued pricing package.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
 - 5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
 - 6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
 - 7. Review temporary protection requirements for metal panel assembly during and after installation.
 - 8. Review procedures for repair of metal panels damaged after installation.
 - 9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
 - B. Shop Drawings:
 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
 - C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.
 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
 - B. Product Test Reports: For each product, tests performed by a qualified testing agency.
 - C. Field quality-control reports.
 - D. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal panels to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
 - B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories.
 2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.
 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including rupturing, cracking, or puncturing.
- b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E72:
 1. Wind Loads: As indicated on Drawings.
 2. Other Design Loads: As indicated on Drawings.
 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 1. Test-Pressure Difference: 6.24 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.2 FOAMED-INSULATION-CORE METAL WALL PANELS

- A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.
 1. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
 - a. Closed-Cell Content: 90 percent when tested according to ASTM D6226.
 - b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D1622.
 - c. Compressive Strength: Minimum 20 psi when tested according to ASTM D1621.
 - d. Shear Strength: 26 psi when tested according to ASTM C273/C273M.

- B. Concealed-Fastener, Foamed-Insulation-Core Metal Wall Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.
1. Product: Use same insulated metal wall panel product and finish as used for previous phases of the Work.
 - a. Kingspan; KS Shadowline.
 2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
 - a. Nominal Thickness: 0.028 inch.
 - b. Exterior Finish: Non-embossed, with two-coat fluoropolymer.
 - 1) Color: Zinc Gray.
 - c. Interior Finish: Stucco texture, siliconized polyester
 - 1) Color: Zinc Gray.
 3. Backer Board: On back side of exterior facing.
 4. Panel Coverage: 36 inches nominal.
 5. Panel Thickness: 3.0 inches.

2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
1. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
 2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed opening and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
 - 1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2-inch-wide and 1/8 inch thick.
 - 2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
 - 3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Steel Panels and Accessories:
 - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that weather barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 1. Shim or otherwise plumb substrates receiving metal panels.
 - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 - 3. Install screw fasteners in predrilled holes.
 - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
 - 5. Install flashing and trim as metal panel work proceeds.
 - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
 - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
 - 2. Install vertically.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.
 - 1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
 - 2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

3.4 INSULATED METAL WALL PANEL INSTALLATION

- A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.
1. Fasten foamed-insulation-core metal wall panels vertically, as indicated, to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
 2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
 3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
 4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
 5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
 6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
- B. Foamed-Insulation-Core Metal Wall Panels: Fasten metal wall panels to supports with concealed clips at each joint at location and spacing and with fasteners recommended by manufacturer. Fully engage tongue and groove of adjacent panels.
1. Install clips to supports with self-tapping fasteners.
- C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.
- D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Metal wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4215

SECTION 07 5419 - POLYVINYL-CHLORIDE (PVC) ROOFING

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.
- B. DFCM's most current "Roofing Design Requirements" apply to Work of this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Mechanically fastened, polyvinyl chloride (PVC) roofing system.
 - 2. Vapor retarder.
 - 3. Roof insulation.
 - 4. Cover board.
 - 5. Walkways.
- B. Related Requirements:
 - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural-use roof deck panels.
 - 2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 - 3. Section 07 9200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
 - 2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

B. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, DFCM Roofing Program Manager, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.

B. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
2. Product Data: For adhesives and sealants, indicating VOC content.
3. Laboratory Test Reports: For adhesives and sealants, indicating compliance with requirements for low-emitting materials.

4. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.
 5. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
1. Layout and thickness of insulation.
 2. Base flashings and membrane terminations.
 3. Flashing details at penetrations.
 4. Tapered insulation thickness and slopes.
 5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
 6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
 7. Tie-in with adjoining air barrier.
- D. Samples for Verification: For the following products:
1. Roof membrane and flashing, of color required.
 2. Walkway rolls, of color required.
- E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
 - a. Submit evidence of compliance with performance requirements.
 2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.
 3. Manufacturer's Warranty Compliance Plan: Documented proof of how Manufacturer plans to meet all warranty obligations.
- C. Preinstallation Notice: Signed by an authorized representative of the Manufacturer prior to start of work. Preinstallation Notice includes the following:
1. Confirmation that membrane and all accessories used meet requirements of specification.
 2. Confirmation that scope of Work is in accordance with published technical data as per Manufacture.
 3. Confirmation that a warranty has been requested and will be issued on the DFCM manufacture warranty form at the completion of roofing.

- D. Manufacturer Required Inspections: Require Manufacturer to provide list of Manufacturer required inspections.
 - 1. Require Manufacturer to release all inspection reports concerning warranted roof systems to contractor to submit to Architect.
- E. Installer's DFCM Single Ply Roofing History Record: Require Installer to provide Installer's DFCM single ply roofing history record.
- F. Product Test Reports: For roof membrane and insulation, tests performed by independent qualified testing agency indicating compliance with specified requirements.
- G. Evaluation Reports: For components of roofing system, from ICC-ES.
- H. Field Test Reports:
 - 1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.
- I. Field quality-control reports.
- J. Sample Warranties: For manufacturer's special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roofing system to include in maintenance manuals.
- B. DFCM Required Roofing Closeout Documents: Require Installer to submit the following documents (available from DFCM) to project manager at completion of roofing Work. Project manager shall submit these documents to the roofing program manager. Keep copy of these documents in project file and delivered to agency.
 - 1. DFCM 25 year Manufacture Roofing Warranty. Signed by Manufacturer.
 - 2. DFCM 5-year Contractor Warranty.
 - 3. DFCM Roofing History Record.
 - 4. Roof Warranty Sign.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and listed in FM Approvals' RoofNav for roofing system identical to that used for this Project. Manufacturer must be listed in NRCA's low slope roofing materials guide and the following:
 - 1. Manufacturer must have 10-year successful history as a roofing manufacture.
 - 2. Provide system with minimum five year successful history with all components of system.
 - 3. Manufacture must show documented proof of how they plan to meet warranty obligations. Include in contractor's submittal package.

4. Manufactures must agree to and be willing to sign the appropriate State of Utah (DFCM) manufactures warranty for the roof system.
 5. Manufacture must have a certified installer/contractor program that includes continuing education for the Contractor.
 6. Manufacture will provide at no additional cost to owner, startup meeting, progress inspections and a final warranty inspection at project completion by a full time technical representative.
 7. Manufacture must have a history of complying with Warranty obligations.
 8. Manufacture is required to release all inspection reports concerning warranted roof system to the contractor to submit to project architect.
- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty. Installer/contractor shall comply the following requirements:
1. Roofing Contractor must have five (5) years of experience as a roofing contractor.
 2. Roofing Contractor must have five (5) years of experience with the specified product or a comparable product.
 3. Roofing Contractor must be a Manufacture certified Installer of roofing system to be installed.
 4. Roofing Contractor must document continuing education for the foreman that will daily oversee the work on the roofing system. A minimum of 12 hours per year is required.
 5. On site foreman must be able to clearly communicate with building owner and occupants.
 6. Require Installer to provide a 24 hour emergency phone number to project manager and agency contact person
 7. Roofing Contractor must be legally licensed to perform roofing work in the State of Utah and carry liability insurance as required by State of Utah law.
 8. Roofing Contractor must be willing to sign and agree to the terms of the DFCM 5-year contractor roofing warranty.
 9. Provide Installer's Preinstallation Notice confirming the following:
 - a. Membrane and all accessories being used comply with specification requirements.
 - b. Scope of Work is in accordance with published technical data as per the Manufacturer.
 - c. Warranty has been requested and will be issued on specified DFCM Manufacturer warranty form at completion of the roofing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Elevate off roof deck and cover with a weathertight barrier to protect from UV and moisture on all sides. Do not use factory wrap as cover material. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation. Remove wet or moisture-damaged insulation from job site.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: DFCM standard Single Ply Warranty form, minimum 99 mph wind warranty. Manufacturer agrees to warranty, on single ply roofing warranty form at end of this Section, to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
 - 2. The DFCM warranty, rather than the manufacture's standard warranty, will be required at project completion. By signing the State of Utah warranty, manufactures agree to relinquish any of the terms or conditions listed in any of their standard warranty conditions.
 - 3. Provide warrantee on appropriate DFCM form. (See "Warranty for Single Ply Roofing" form at the end of this Section.)
 - 4. Warranty Period: 30 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, vapor retarders, and walkway products, for the following warranty period:
 - 1. Provide warrantee on appropriate DFCM form. (See "Contractor Roofing Warranty" form at the end of this Section.)
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272/D4272M, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.
- B. Material Compatibility: Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. FM Approvals' RoofNav Listing: Roof membrane, base flashings, and component materials shall comply with requirements in FM Approvals 4450 or FM Approvals 4470 as part of a roofing system, and shall be listed in FM Approvals' RoofNav for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals Certification markings.
1. Fire/Windstorm Classification: Class 1A-90.
 2. Hail-Resistance Rating: FM Global Property Loss Prevention Data Sheet 1-34 MH.
- D. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- E. Energy Star Listing: Roofing system to be listed on the DOE's Energy Star "Roof Products Qualified Product List" for low-slope roof products.
- F. DFCM Requirements:
1. Do not use Asbestos Containing Material (ACM) during repairs or installation of roofing system under any circumstances.
 2. Where Manufacturer's standards show more than one possible approach for compliance with the standard, provide the most stringent approach defined by the Architect or DFCM Roofing Program Manager.
 3. Roofing system must have minimum five-year successful history with products specified.

2.2 POLYVINYL CHLORIDE (PVC) ROOFING

- A. PVC Sheet: ASTM D4434/D4434M, Type III, fabric reinforced, with stable or low-migrating plasticizers, low-wicking scrim, and a 10-year minimum performance history. Minor formulation changes are acceptable as long as membrane has successful performance history.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle SynTec Incorporated; SureFlex PVC Membrane.
 - b. Flex Membrane International Corp.; Flex MF/R 60 PVC Roof Membrane.
 - c. GAF; EverGuard® PVC 60 mil.
 - d. Sika Sarnafil; SikaPlan.
 - e. Versico Roofing Systems; VersiFlex PVC Membrane.
 2. Polymer Thickness: 60 mils.
 - a. Measure polymer between the scrim unless approved otherwise by DFCM Roofing Program Manager.
 3. Exposed Face Color: White.
 4. Use sheet that is balanced, with scrim near center of membrane and with no more than 30-26 mils polymer above the scrim.
 5. Comply with ASTM D4434 for linear dimension change and heat aging.
 6. Comply with ASTM D5635 for dynamic impact resistance.
 7. Comply with ASTM D2136 for low-temperature flexibility.
 8. Roll/Sheet Width: Not wider than 8 feet.
- B. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
1. Adhesives and Sealants: Comply with VOC limits of authorities having jurisdiction. Comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 2. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, type, reinforcement, thickness, and color as PVC sheet.
- C. Premanufactured Accessories: Use Manufacturer's recommended premanufactured pipe flashing, inside and outside corners, and other premanufactured accessories at any other locations where premanufactured accessories are available, as required by Manufacturer's warranty requirements.
- D. Bonding Adhesive: Manufacturer's standard, water based.
- E. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8-inch-thick; with anchors.
- F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
- G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Polyethylene film laminated to layer of butyl rubber adhesive, minimum 30-mil-total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.5 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by PVC roof membrane manufacturer and covered under specified warranty, approved for use in FM Approvals' RoofNav listed roof assemblies.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Atlas EPS; a Division of Atlas Roofing Corporation.
 - b. Atlas Roofing Corporation.
 - c. Carlisle SynTec Incorporated.
 - d. Firestone Building Products.
 - e. Flex Membrane International Corp.
 - f. GAF.

- g. Hunter Panels.
 - h. Insulfoam; Carlisle Construction Materials Company.
 - i. Rmax, Inc.
 - 2. Compressive Strength: 24 psi.
 - 3. Size: 48 by 48 inches.
 - 4. R-Values: minimum R-30. R-15 average minimum at drain sumps.
 - 5. Thickness:
 - a. Base Layer: 1-1/2 inches.
 - b. Upper Layer: Thickness as required to comply with required minimum R-value.
- C. Tapered Insulation: Provide factory-tapered insulation boards.
 - 1. Material: Match roof insulation.
 - 2. Minimum Thickness: 1/4 inch.
 - 3. Slope:
 - a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.6 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
 - 1. Full-spread, spray-applied, low-rise, two-component urethane adhesive.
 - 2. Adhesives and sealants shall comply with the following limits for VOC content:
 - a. Plastic Foam Adhesives: 50 g/L.
 - b. Gypsum Board and Panel Adhesives: 50 g/L.
 - c. Multipurpose Construction Adhesives: 70 g/L.
 - d. Fiberglass Adhesives: 80 g/L.
 - e. Contact Adhesives: 80 g/L.
 - f. PVC Welding Compounds: 510 g/L.
 - g. Other Adhesives: 250 g/L.
 - h. Single-Ply Roof Membrane Sealants: 450 g/L.
 - i. Nonmembrane Roof Sealants: 300 g/L.
 - j. Sealant Primers for Nonporous Substrates: 250 g/L.
 - k. Sealant Primers for Porous Substrates: 775 g/L.
 - 3. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and

Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- D. Cover Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M fiber-reinforced gypsum board.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Georgia-Pacific Gypsum LLC; Dens Deck.
 - b. National Gypsum Company; DEXcell FA Glass Mat Roof Board.
 - c. USG Corporation; Securock Glass Mat Roof Board.
 2. Thickness: 1/2 inch.
 3. Surface Finish: Unprimed.

2.7 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16-inch-thick and acceptable to roofing system manufacturer.
1. Size: Approximately 36 by 60 inches.
 2. Color: Contrasting with roof membrane.

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.
1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Where there are discrepancies between or within the bidding documents, the specification will be enforced that is more stringent, as determined by the Architect or DFCM Roofing Program Manager.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Perform fastener-pullout tests at existing steel deck according to roof system manufacturer's written instructions.
 - 1. Submit test result within 24 hours of performing tests.
 - a. Include manufacturer's requirements for any revision to previously submitted fastener patterns required to achieve specified wind uplift requirements.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.
- C. Install portions of this specification that do not meet Manufacture requirements per Manufacture requirements at no additional cost to Owner.
 - 1. Install portions of this specification that exceed the Manufacture's minimum requirements according to specifications rather than the Manufacture's minimum requirements.
- D. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition.

3.4 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.
 - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 - 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.5 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking: Install in minimum of two layers.
 - 1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
 - a. Locate end joints over crests of decking.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. At internal roof drains, slope insulation using factory-formed tapered insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches. Do not field fabricate sump profiles.
 - 1) Trim insulation so that water flow is unrestricted.
 - e. Fill gaps exceeding 1/4 inch with insulation.
 - f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - g. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
 - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
 - 2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.
 - a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
 - e. Trim insulation so that water flow is unrestricted.
 - f. Fill gaps exceeding 1/4 inch with insulation.
 - g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
 - h. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF MECHANICALLY FASTENED ROOF MEMBRANE

- A. Mechanically fasten roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Unroll roof membrane and allow to relax before installing.
- C. For in-splice attachment, install roof membrane with long dimension perpendicular to steel roof deck flutes.
- D. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owners testing and inspection agency.
- E. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.
- F. Mechanically fasten or adhere roof membrane securely at terminations, penetrations, and perimeter of roofing.
- G. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- H. In-Seam Attachment: Secure one edge of PVC sheet using fastening plates or metal battens centered within seam, and mechanically fasten PVC sheet to roof deck.
- I. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings to ensure a watertight seam installation.
 - 1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of roof membrane and sheet flashings.
 - 2. Verify field strength of seams a minimum of twice daily, and repair seam sample areas.

3. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- J. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.8 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.9 INSTALLATION OF WALKWAYS

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions. Attach to membrane surface.
 1. Install flexible walkways at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Between each roof hatch and each roof drain.
 - e. Top and bottom of each roof access ladder.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 2. Provide 6-inch clearance between adjoining rolls.
 3. Heat weld to substrate or adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.10 FIELD QUALITY CONTROL

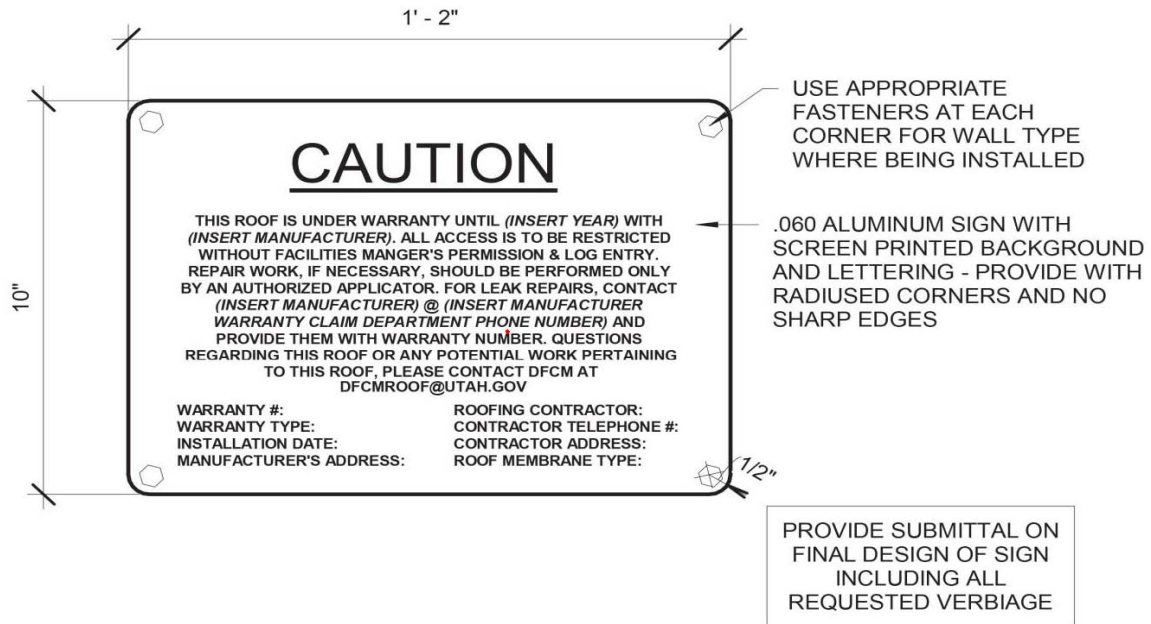
- A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 - 1. Flood Testing: Flood test each roofing area for leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of 2-1/2 inches with a minimum depth of 1 inch and not exceeding a depth of 4 inches. Maintain 2 inches of clearance from top of base flashing.
 - c. Flood each area for 48 hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.
 - e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.
 - 2. Testing agency shall prepare survey report indicating locations of initial discontinuities, if any.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.11 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.12 WARRANTY SIGN

- A. Warranty Sign: Provide metal sign with vinyl lettering containing the following information and similar format for roofs.
1. Install signs next to roof access points inside building as permissible, preferably next to roof hatch ladder. Fabricate signs with rounded corners and no sharp protrusions or edges. Signs are to be a minimum thickness of 20 gauge, and no larger than 10 by 14 inches, and as follows:



END OF SECTION 07 5419



WARRANTY FOR SINGLE PLY ROOFING

WHERE AS, _____ (manufacture name), a corporation whose address is, _____ hereinafter called the Manufacturer, has manufactured and sold and caused to have applied, pursuant to the specifications and inspection, the necessary roofing materials to construct a PVC, TPO, EPDM or other single ply roof of approximately _____ square feet and associated roof flashing of approximately _____ linear feet on the building described below:

OWNER: STATE OF UTAH

Owner: State of Utah

DFCM Project Number: _____

Building Name: _____

Location: _____

Date of Acceptance of Roofing: _____

Manufacturer Address: _____

Manufacturer's Warranty No: _____

Phone Number for Warranty Services: _____

Roofing Contractor Name: _____

Roofing Contractor Address: _____

AND WHEREAS, by careful examination of said roof by the Manufacturer's representative, it has been determined that roofing materials have been applied in conformance with Manufacturer's specifications.

AND WHEREAS, Manufacturer represents and wishes to warranty, subject to the limits stated herein, that its roofing when so applied is effectively watertight for a period of thirty (30) years despite normal wear and tear by the elements, as well as guaranteeing it against defects in workmanship or materials.

NOT withstanding any other provision herein, this warranty shall not cover damages related to winds in excess of _____ miles per hour

NOW THEREFORE, said Manufacturer warranties to the said Owner that, as set forth below, during a period of thirty (30) years from the date of acceptance of said single-ply roofing described above, Manufacturer will at its own expense, make or cause to be made, any repairs that may be necessary, as a result of defects in workmanship or materials supplied by the Manufacturer which results in leaks or of normal wear and tear by the elements which results in leaks, and will maintain said roof in water tight condition free from all leaks arising from such causes. For purposes of this warranty, damage to the roof caused by any unusual natural phenomena shall not be deemed to be “normal wear and tear by the elements”.

INCLUSIONS: This Warranty does cover, and Manufacturer shall be liable for the following:

1. Roofing membrane, membrane flashings, metal flashings, mechanical fastening system, anchors, adhesives, seaming materials, slip sheets, fabrics, insulations, under payments, and accessories furnished by the Manufacturer as incorporated into the roof membrane system.
2. Vapor barriers, insulations and / or materials furnished by the Manufacturer or approved to be incorporated into the roof membrane assembly and such damage as may result from failure of these materials.
3. Repair of splits, breaks, cracks, and seam failures in membrane system.
4. Leaks from failure in material or workmanship.

EXCLUSIONS: This Warranty does not cover, and Manufacturer shall not be liable for the following:

1. Metal work, including metal counter flashings, not a part of the roof membrane system and such damage as may result from application of these materials;
2. Any damage to the roof caused by structural defect in, or failure of, the building or defects in, or failure of, any structural roof deck, or other sheathing materials, used as the base over which the roof and roof insulation is applied;
3. Roof damage from special chemical conditions not disclosed to Manufacturer;
4. Any damage to the building or contents thereof, except replacement of damaged roof insulation and vapor barrier as noted under “INCLUSION” above;
5. Damage due to unauthorized alterations to roofing system.
6. Damage to the roof due to mechanical abrasion or abuse not caused by the Manufacturer.
7. Damage or failure directly caused by the re-use of existing material. (re-roof)
8. Reasonable care and maintenance will be the responsibility of the owner.

INSPECTION AND REPAIR: During the term of this Warranty, Manufacturer, its agents or employees, shall have free access to the roof during regular business hours. Upon verbal notice by Owner to Manufacturer within four days of the discovery of any leaks in the roofing system, or need of repair of roof, the Manufacturer shall have ten (10) days to inspect the roof. Following such inspection:

1. Manufacturer, at its own expense shall make such repairs as are required by this warranty.
2. In case owner or his agent has verbally notified Manufacturer that repairs are required and such repairs are not covered by the Warranty (including repairs required by owner's alteration, extension or addition to the roof) Manufacture, after having obtained Owner's consent thereto, in writing, shall make or cause to be made, such repairs at Owner's expense in accordance with specifications and procedures as established by Manufacturer and this warranty shall thereupon remain in effect for the un-expired portion of its original term. If Owner fails to so consent or if repairs are made by one other than the Manufacturer's authorized designee, this Warranty with respect to such area shall be automatically terminated.
3. In the event the (1) Owner notifies Manufacturer and has confirmed the need of repair of roof and (2) Manufacturer is unable to promptly inspect and repair same, and (3) an emergency condition exists which requires prompt repair in order to avoid substantial damage to owner, then owner may make such temporary repairs as may be essential and any such action shall not be a breach of the provision of this Warranty. Owner will bear emergency repair expenses.

INSPECTION SERVICE: Manufacturer agrees to re-inspect the completed roof not earlier than 18 nor later than 24 months after completion of the roofing, and if it is determined that there are defects in the roofing, then Manufacturer shall make, or cause to be made at its own expense, such repairs as are necessary to remedy said defects within the scope of its responsibility under the terms of this Warranty.

IN WITNESS WHEREOF, Manufacturer has caused this instrument to be signed and sealed by its duly authorized officer this day of _____.

BY: _____

TITLE: _____

CORPORATION: _____

SEAL:

Division of Facilities Construction and Management
Risk I.D. _____



CONTRACTOR ROOFING WARRANTY

WHEREAS:

Of (Address):	(Phone):
---------------	----------

Herein called the "Roofing Contractor," has performed roofing and associated ("Work") on the following project:

Owner: State of Utah

Agency:

Name of Building:

DFCM Project Number:

Address:

Description of Work:

Date of Acceptance:

Warranty Period: 5 Years

Date of Expiration:

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said Work against leaks and faulty or defective materials and workmanship for said designated Warranty Period.

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period, Roofing Contractor will at his own cost and expense, promptly make or cause to be made such repairs to or replacements of said Work as are necessary to correct faulty and defective Work, and as are necessary to maintain said Work in watertight condition. In addition to making the Work watertight, the Roofing Contractor shall promptly remove and/or repair blisters, ridges, flashings, splits and other irregularities which in the opinion of the Roofing Manufacturer's technical representative do not conform to acceptable roofing practices and conditions. These repairs shall be made promptly and to the satisfaction of the Roofing Manufacturer's technical representative. Upon notice of Owner to Roofing Contractor, Contractor agrees to make the necessary leak repairs according to manufacturer's specifications within five business days from written notice given by DFCM.



This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to Work and other parts of the building, and to building contents, not caused by the act or negligence of Contractor and caused by: a) lightning, windstorm in excess of manufacturer's specifications; b) fire; c) failure of roofing system substrate including cracking settlement, excessive deflection, deterioration, and decomposition; d) faulty construction of parapet walls, copings, chimneys, skylights, vents, and equipment supports, not part of contractors work and e) activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner, but only to the extent any of the above exclusions are not due to the failure of the Roofing Contractor to meet all required specifications and the customary practices of the performing the work. When Work has been damaged by any of the foregoing causes, Warranty shall be suspended until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by DFCM or by another responsible party so designated.
2. The Roofing Contractor is responsible for damage to Work covered by this Warranty, and is liable for consequential damages to building or building contents, resulting from leaks or faults or defects of Work that are related to Roofing Contractor's failure to meet.
3. During Warranty Period, if Owner allows alteration of Work by anyone other than Roofing Contractor or anyone not authorized by Roofing Contractor, including cutting, patching and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect Work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said Work, shall reasonably claim that said alterations would damage or deteriorate Work, thereby reasonably justifying a limitation or termination of this Warranty.
4. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void upon date of said change, but only to extent said change affects Work covered by this Warranty.
5. The DFCM shall notify Roofing Contractor of observed, known or suspected leaks, defect or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect Work, and to examine evidence of such leaks, defects or deterioration.



This Warranty is recognized to be the only Warranty of Roofing Contractor on said Work, and is in addition to the Roofing Warranty furnished by the Roofing Manufacturer, and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to it in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original Work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with DFCM or a subcontract with DFCM's General Contractor.

Any modification to the terms and conditions of this document will be submitted to the Attorney General's Office for investigation/prosecution.

IN WITNESS THEREOF, this instrument has been dully executed this

Day of _____, 20____

Signed by Roofing Contractor by:

Roofing Contractor

Business Address

Signature & Printed Name

Title

Cosigned by General Contractor by:

General Contractor

Business Address

Signature & Printed Name

Title

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

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. Formed low-slope roof sheet metal fabrications.
- 2. Formed wall sheet metal fabrications.

- B. Related Requirements:

- 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
- 2. Section 07 5419 "Polyvinyl-Chloride (PVC) Roofing" for installation of sheet metal flashing and trim integral with roofing.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

- 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
- 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
- 3. Review requirements for insurance and certificates if applicable.
- 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each of the following

1. Underlayment materials.
2. Elastomeric sealant.
3. Butyl sealant.
4. Epoxy seam sealer.

B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of roof-penetration flashing.
8. Include details of special conditions.
9. Include details of connections to adjoining work.
10. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from ICC-ES showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 - 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested and FM Approvals approved, shop shall be listed as able to fabricate required details as tested and approved.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
 - 1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 - 2. Protect stored sheet metal flashing and trim from contact with water.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.10 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 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. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. FM Approvals Listing: Manufacture and install copings and roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless Steel Sheet: ASTM A240/A240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
 - 1. Finish: ASTM A480/A480M, No. 4 (polished directional satin).
 - 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 of directional finishes with long dimension of each piece.
 - 2) When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet in accordance with ASTM A653/A653M, G90 coating designation or aluminum-zinc alloy-coated steel sheet in accordance with ASTM A792/A792M, Class AZ50 coating designation, Grade 40; prepainted by coil-coating process to comply with ASTM A755/A755M.
 - 1. Surface: Smooth, flat.
 - 2. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
 - 3. Color: Match color of flashing used in other phases for the same applications.

4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Carlisle WIP Products; a brand of Carlisle Construction Materials; WIP 300HT.
 - b. GCP Applied Technologies Inc., Grace Ice and Water Shield HT.
 2. Source Limitations: Obtain underlayment from single source from single manufacturer.
 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. minimum.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal.
 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
 - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
 - b. Blind Fasteners: High-strength aluminum or stainless steel rivets suitable for metal being fastened.
 - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
 2. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
 3. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel in accordance with ASTM A153/A153M or ASTM F2329.

- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

2.5 FABRICATION, GENERAL

- A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.
 - 1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Seams:
 - 1. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Curb Edge Flashing: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long sections. Furnish with 6-inch-wide, joint cover plates. Shop fabricate interior and exterior corners.
1. Joint Style: Butted with expansion space and 6-inch-wide, concealed backup plate.
 2. Fabricate with scuppers spaced 10 feet apart, to dimensions required with 4-inch-wide flanges and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.028 inch thick.
- B. Copings: Fabricate in minimum 96-inch-long, but not exceeding 12-foot-long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
1. Coping Profile: Profile as indicated in Drawings, in accordance with SMACNA's "Architectural Sheet Metal Manual."
 2. Joint Style: Butted with expansion space and 6-inch-wide, exposed cover plate.
 3. Fabricate from the following materials:
 - a. Galvanized Steel: 0.024 inch thick.
- C. Drip Edges: Fabricate from the following materials:
1. Galvanized Steel: 0.024 inch thick.
- D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
1. Galvanized Steel: 0.024 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
1. Galvanized Steel: 0.024 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
1. Galvanized Steel: 0.028 inch thick.
- G. Roof-Drain Flashing: Fabricate from the following materials:
1. Stainless Steel: 0.0156 inch thick.

2.7 WALL SHEET METAL FABRICATIONS

- A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch thick.
- B. Through-Wall Insulation Closure Flashing: Fabricate continuous flashings in minimum 96-inch-long, but not exceeding 12-foot-long, sections, under copings, and at shelf angles. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches beyond each side of wall openings; and form with 2-inch-high, end dams. Fabricate from the following materials:
 - 1. Stainless Steel: 0.0156 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
 - 1. Verify compliance with requirements for installation tolerances of substrates.
 - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.
- B. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.

2. Lapp joints not less than 4 inches.

3.3 INSTALLATION, GENERAL

- A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.
 1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
 3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
 8. Do not field cut sheet metal flashing and trim by torch.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
 1. Coat concealed side of stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
 1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - 1) Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."

3.4 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.
 1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Curb Edge Flashing:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
 3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- C. Copings:
 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 2. Slope copings structurally to drain back to drain.
 3. Provide continuous 24 gauge coated metal hold down clip, fastened in two rows at 6 inches o.c. with corrosion resistant, barbed annular ring, or screw shank nails of length to achieve approximately 1-1/4 inches penetration into treated wood nailer. Use solid wood nailer that has direct structural attachment to parapet, with no insulation between structure and nailer. Extend nailer over top of wall finishes. Fasten bottom row of nails near bend at hold down clip for increased uplift resistance. Provide a continuous bead of sealant behind the hold down clip.
 4. No exposed screws on outside edge of horizontal surfaces. Gasket all exposed screws in color matching coping.
 5. Install edge metal to cover entire face height of nailer and top of wall finishes.
 6. Weld 6 inch wide continuous flashing membrane to field membrane and coated metal
 7. Install 24 gauge prefinished fascia metal over hold-down clip and crimp top over coated metal. Provide continuous bead of sealant at base of fascia behind drip edge.

8. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
 - a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
 - b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
 1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 2. Extend counterflashing 4 inches over base flashing.
 3. Lap counterflashing joints minimum of 4 inches.
 4. Secure in waterproof manner by means of snap-in installation and sealant or lead wedges and sealant unless otherwise indicated.
- F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.6 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.7 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.

3.8 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

- B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
- C. Maintain sheet metal flashing and trim in clean condition during construction.
- D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 6200

SECTION 07 7200 - GUARDRAIL AT ROOF HATCH

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe and tube safety rail system and gate at existing roof hatch.

1.2 COORDINATION

- A. Coordinate layout and installation of guardrail and gate with roofing membrane and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. 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.

1.3 ACTION SUBMITTALS

A. Product Data: For pipe and tube safety rail system and gate.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For pipe and tube safety rail system and gate.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E894 and ASTM E935.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Safety rail system and gate shall withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Performance: Safety railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces

2.2 SAFETY RAILING SYSTEM AT ROOF HATCH

- A. Steel Pipe and Tube Railings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kee Safety, Inc.
 - b. Trex Commercial Products, Inc.
 - c. Wagner Companies (The); R&B Wagner, Inc.
 - d. Equal.
- B. Safety Railing System: Complete safety rail system including rails, clamps, fasteners, self-closing swing gate at railing opening, and accessories required for a complete installation; attached to existing roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.
 1. Height: 42 inches above finished roof deck.

2. Posts and Rails: Galvanized-steel pipe, 1-1/4 inches in diameter or galvanized-steel tube, 1-5/8 inches in diameter.
3. Maximum Opening Size: System constructed to prevent passage of a sphere 21 inches in diameter.
4. Self-Latching Gate: Fabricated of same materials and rail spacing as safety railing system.
 - a. Self-closing hinges with 180-degree outward swing.
 - b. Self-latching mechanism.
5. Post and Rail Tops and Ends: Weather resistant, closed or plugged with prefabricated end fittings.
6. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.
7. Fabricate joints exposed to weather to be watertight.
8. Fasteners: Manufacturer's standard, finished to match railing system.
9. Finish: Manufacturer's standard.
 - a. Color: As selected by Architect from manufacturer's full range.

2.3 FASTENERS

- A. Fasteners: Safety rail manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
- B. 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 tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

2.4 METAL MATERIALS

- A. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

2.5 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

- B. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- 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. Shop Primers: Provide primers that comply with Section 09 9600 "High-Performance Coatings."
- F. Intermediate Coats and Topcoats: Provide products that comply with Section 09 9600 "High-Performance Coatings."
- G. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant as recommended by safety railing manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

2.6 FABRICATION

- A. General: Fabricate safety 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 and gate to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. 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. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with either 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 surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- J. Close exposed ends of railing members with prefabricated end fittings

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize steel safety railings, including hardware, after fabrication.
 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with primers specified in Section 09 9600 "High-Performance Coatings".

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of existing roof hatch.

- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
 - 1. 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.
 - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
- C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.
- D. Safety Railing Installation:
 - 1. Attach safety railing system to existing roof hatch curb.
 - 2. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
 - a. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
 - 3. Install pipe and tube safety rail system and gate level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 4. Anchor pipe and tube safety rail system and gate securely in place so they are capable of resisting indicated loads.
 - 5. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of pipe and tube safety rail system and gate and fit them to substrates.
 - 6. Install pipe and tube safety rail system and gate to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- E. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
- F. Seal joints with elastomeric or butyl sealant as required.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 9600 "High-Performance Coatings".
- C. Clean off excess sealants.

- D. Replace pipe and tube safety rail system and gate that has been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7200

SECTION 07 9200 - JOINT SEALANTS

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. Nonstaining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Butyl joint sealants.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's 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 kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-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.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
 - 1. Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.
- D. Where conflicting information is found in the Construction Documents related to products, details or dimensional discrepancies, comply with the most stringent requirements regardless of cost.

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.
 - 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 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. VOC Content: Sealants and sealant primers shall comply with the following:
1. Architectural sealants shall have a VOC content of 250 g/L or less.
 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; Silpruf NB.
 - b. Sika Corporation; Joint Sealants; Sikasil WS-295.
 - c. The Dow Chemical Company; DOW CORNING® 756 SMS BUILDING SEALANT.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, T, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade NS, Class 25, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation; MasterSeal NP 1 (Pre-2014: Sonolastic NP1).
 - b. LymTal International Inc; Iso-Flex 330.

2.4 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 300.
 - b. Pecora Corporation; BC-158.

2.5 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Adfast; Adseal BR 2600.
 - b. Alcot Plastics Ltd.; ALCOT Soft Type Backer Rod.
 - c. BASF Corporation; MasterSeal 920 & 921(Pre-2014: Sonolastic Backer Rod).
- 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.

2.6 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. Concrete.
 - 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 kind 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 according to 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 per Figure 8A in ASTM C1193 unless otherwise indicated.
 - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C1193.
 - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C1193.
 - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

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.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Joints between metal panels.
 - b. Perimeter joints between materials listed above and frames of doors and windows.
 - c. Control and expansion joints in overhead surfaces.
 - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - 2. Joint Sealant: Urethane, S, NS, 25, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Concealed mastics.
 - 1. Joint Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - 2. Joint Sealant: Butyl-rubber based.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 9200

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

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. Exterior standard steel doors and frames.
- B. Related Requirements:
 - 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.4 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.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of door type.
2. Details of door, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.

C. 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.

1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of thermally rated door assemblies for tests performed by a qualified testing agency indicating compliance with performance requirements.
- B. Field quality control reports.

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-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door; ASSA ABLOY.
 2. Curries Company; ASSA ABLOY.
 3. Custom Metal Products.
 4. DCI Hollow Metal.
 5. Deansteel Manufacturing Company, Inc.

6. Fleming Door Products Ltd.; Assa Abloy Group Company.
7. Megamet Industries, Inc.
8. Mesker Door Inc.
9. MPI Group, LLC (The).
10. North American Door Corp.
11. Philipp Manufacturing Co (The).
12. Pioneer Industries.
13. Premier Products, Inc.
14. Republic Doors and Frames.
15. Rocky Mountain Metals, Inc.
16. Shanahan's Manufacturing Limited.
17. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C518.

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- 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. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A.
 1. Doors:
 - a. Thickness: 1-3/4 inches.
 - b. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (nominal 16 gage), with minimum A40 coating.
 - c. Edge Construction: Model 2, Seamless.
 - d. Edge Bevel: Provide manufacturer's standard beveled or square edges.
 - e. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
 - f. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
 - g. Core: Polyisocyanurate.
 2. Frames:
 - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (nominal 16 gage), with minimum A40 coating.
 - b. Construction: Full profile welded.
 3. Exposed Finish: Prime.

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 of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch-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. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z 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 according to ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

C. 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.

2.6 FABRICATION

A. 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. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to 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.

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.
 - 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.
 - 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. Solidly pack mineral-fiber insulation inside frames.
 - 4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

- d. Plumbness: Plus or minus 1/16 inch, 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.

3.3 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. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08 1113

SECTION 08 3323 - OVERHEAD COILING DOORS

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. Insulated service doors.

- B. Related Requirements:

- 1. Section 05 5000 "Metal Fabrications" for miscellaneous steel supports and door-opening framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of overhead coiling door and accessory.

- 1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

- 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
 - 4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
 - 5. Show locations of controls, locking devices, and other accessories.
 - 6. Include diagrams for power, signal, and control wiring.

- C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

- 1. Include similar Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
1. Curtain slats, including full vision window secured to slat.
 2. Bottom bar with sensor edge.
 3. Guides.
 4. Brackets.
 5. Hood.
 6. Locking device(s).
 7. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.
- B. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 1. Design Wind Load: As indicated on Drawings.
 2. Testing: According to ASTM E330/E330M.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20-lbf/sq. ft. wind load, acting inward and outward.
- C. Seismic Performance: Overhead coiling doors shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. Component Importance Factor: 1.0.

2.3 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. City-Gates.
 - b. Cookson Company.
 - c. Cornell.
 - d. Lawrence Roll-Up Doors, Inc.
 - e. McKeon Rolling Steel Door Company, Inc.
 - f. Overhead Door Corporation.
- B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283 or DASMA 105.
- D. Curtain R-Value: 6.0 deg F x h x sq. ft./Btu.
- E. Door Curtain Material: Galvanized steel.
- F. Door Curtain Slats: Flat profile slats of 3-1/4-inch center-to-center height.

1. Vision Panels: Approximately 10- by 1-5/8-inch openings spaced approximately 2 inches apart and beginning 12 inches from end guides; in two rows of slats at height indicated on Drawings; installed with insulated vision-panel glazing.
 2. Insulated-Slat Interior Facing: Metal.
 3. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from hot-dip galvanized steel and finished to match door.
- H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- I. Hood: Match curtain material and finish.
1. Shape: Square.
 2. Mounting: Face of wall.
- J. Locking Devices: Equip door with locking device assembly.
1. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from inside with thumbturn.
- K. Electric Door Operator:
1. Usage Classification: Heavy duty, 25 or more cycles per hour and more than 90 cycles per day.
 2. Operator Location: Top of hood.
 3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
 4. Motor Exposure: Interior.
 5. Emergency Manual Operation: Push-up type.
 6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar; self-monitoring type.
 - a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.
 7. Control Station(s): Interior mounted.
- L. Curtain Accessories: Equip door with weatherseals, push/pull handles, pull-down strap, and poll hook.
- M. Door Finish:
1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range.
 2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.4 MATERIALS, GENERAL

- 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.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
 - 1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural-steel sheet; complying with ASTM A653/A653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
 - 2. Vision-Panel Glazing: Manufacturer's standard clear glazing, fabricated from transparent acrylic sheet or fire-protection-rated glass as required for type of door; set in glazing channel secured to curtain slats.
 - 3. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
 - 4. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with minimum aluminum thickness of 0.032 inch.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
 - 1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A653/A653M.
 - 2. Exterior-Mounted Doors: Fabricate hood to act as weather protection and with a perimeter sealant-joint-bead profile for applying joint sealant.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.

- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weatherseals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.
- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Pull-Down Strap: Provide pull-down straps for doors more than 84 inches high.
- D. Pole Hooks: Provide pole hooks and poles for doors more than 84 inches high.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.
- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. 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.
- F. Obstruction-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.
 - 1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- 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.

2.12 STEEL AND GALVANIZED-STEEL FINISHES

- A. Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.
- D. Power-Operated Doors: Install according to UL 325.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
- C. Repair or remove and replace installations where 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. 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 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Perform maintenance, including emergency callback service, during normal working hours.
 - 2. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 3323

SECTION 08 7100 - 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. Section Includes:
 - 1. Mechanical door hardware for the following:
 - a. Swinging doors.
- B. Related Sections include the following:
 - 1. Section 08 1113 "Hollow Metal Doors and Frames."

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 A156.18: Materials and Finishes, 2006 edition
 - 3. Door and Hardware Institute (DHI)
 - a. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames, 2004 edition
 - b. Installation Guide for Doors and Hardware, 1994 edition
 - c. Sequence and Format for the Hardware Schedule, 2001 edition

1.4 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. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.6 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. Door Hardware Schedule: Prepared by or under the supervision of Installer's Architectural Hardware Consultant. Coordinate door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - 1. Submittal Sequence: Submit door hardware schedule after or concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - 2. Format: Use same scheduling sequence and format and use same door numbers as in door hardware schedule in the Contract Documents.
 - 3. Content: Include the following information:
 - a. Identification number, location, hand, size, and material of each door and frame.
 - b. Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
 - c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
 - d. Fastenings and other installation information.
 - e. Explanation of abbreviations, symbols, and designations contained in door hardware schedule.
 - f. Mounting locations for door hardware.
 - g. 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.
 - h. List of related door devices specified in other Sections for each door and frame.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers.
 - 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.
- B. Installer shall have warehousing facilities in Project's vicinity.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware.
- C. Supplier's Qualifications: Must purchase products directly from the manufacturer to ensure appropriate warranty and service requirements.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. 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.

1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of door hardware Installer. 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 one of the following:

- a) Hinges: Ives, Hager, McKinney
- b) Locks and Latches: Schlage, Owner's Standard
- c) Cylinders and Cores: Furnished and keyed by Owner
- d) Accessories and Trim: Ives, Rockwood, Hager
- e) Weather Strip and Gasket: Zero, National Guard, Pemko

B. Source Limitations: Obtain each type of door hardware from single manufacturer.

2.2 HINGES

A. Acceptable Products:

- 1. Ives: 5BB1 5BB1HW
- 2. Hager: BB1279 BB1168
- 3. McKinney: TB2714 TB3386

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.
- 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.

2.3 LOCKS AND LATCHES

A. General:

1. Lock Chassis: Shall be made from steel, with locking spindles of stainless steel.
2. Latch Bolt: Shall be constructed of stainless steel with 3/4 inch throw on mortise locks and 1/2 inch throw otherwise. Latch to be deadlocking on keyed functions.
3. Lever Trim: Shall be pressure cast brass, bronze, zinc, or steel with wrought rose design. Levers are to be solid with no voids or plastic inserts.
4. Fire Rating: Lock shall be listed for up to 3 hours.
5. Strike Plates: Provide ANSI 4-7/8 inch strike plates. At pairs of doors, provide strike with 7/8 inch flat lip. At single doors, provide round-lipped strike with lip length as required to minimally clear jamb and trim. Provide dust box at each strike location.

B. Mortise Locks

1. Acceptable Products:
 - a. Schlage: L Series
 - 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.
 - b. Where specified, provide indicator window measuring a minimum 2 inch x 1/2 inch with 180 degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
 - 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.
 - c. 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.
 - d. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.

3. 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".

2.4 CYLINDERS AND CORES

A. Provided by Owner

B. Requirements:

1. Temporary Construction Keying: Provide each cylinder housing and/or lock lever with keyed construction core during the construction period. Cores will remain property of the contractor and will be returned upon installation of owner's permanent key system.

2.5 OVERHEAD STOPS AND HOLDERS

A. Acceptable Products:

- | | | | |
|----|----------------|-------------|-------------|
| 1. | Glynn Johnson: | 100 Series | 90 Series |
| 2. | ABH: | 1000 Series | 9000 Series |

B. Requirements:

1. Provide overhead stops and holders as scheduled, sized per manufacturer's recommendations based on door width.
2. Provide concealed overhead stops with adjustable jamb bracket.
3. Where possible without conflicting with other hardware, mount surface overhead stops on least public side of door.
4. Provide stops with any special templates, brackets, plates, or other accessories required for interface with header, door, wall, and other hardware.

2.6 SADDLE AND PANIC THRESHOLDS

A. Acceptable Products:

- 1. Zero International: 655A
- 2. National Guard: 425HD
- 3. Pemko: 1715A

B. Requirements:

- 1. Saddle thresholds: Provide with length equal to the width of the opening.
- 2. Provide stainless steel machine screws and lead anchors for each threshold.

2.7 WEATHERSTRIP AND GASKET

A. General:

- 1. Provide weather strip and gasketing as scheduled.
- 2. Size weather strip and gasket to provide a continuous seal around opening and at meeting stiles.

B. Perimeter Seals

1. Acceptable Products:

- a. Zero: 488S-BK 42
9A
- b. National Guard: 5050B 70
0S
A
- c. Pemko: S88D 28
91
AS

C. Door Bottoms

1. Acceptable Products:

- a. Zero: 39
A
- b. National Guard: 200
NA
- c. Pemko: 345
2C
NB

2.8 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 industry-recognized 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.

2.9 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location.
 - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware unless otherwise indicated.
 - 1. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, wall and floor construction, and other conditions affecting performance of the Work.
- 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.

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. 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."

- F. 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.

3.4 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. 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.

3.5 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.

3.6 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

3.7 DOOR HARDWARE SCHEDULE

HW SET:

DOOR NUMBER: (INCLUDES BUT IS NOT LIMITED TO THE FOLLOWING DOORS)

3	EA	HINGE	5BB1 4.5 X 4.5	630	IVE
1	EA	OFFICE/ENTRY LOCK	L9050L 06A L583-363	626	SCH
1	EA	OVERHEAD STOP	100 Series	630	GLYN
1	EA	DOOR SWEEP	39A	A	ZER
1	EA	THRESHOLD	655A-223	A	ZER

END OF SECTION 08 7100

SECTION 08 8000 - GLAZING

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. Glass for aluminum framed windows.
 - 2. Glazing sealants and accessories.

1.3 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 according to ASTM C1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches square.
 - 1. Insulating glass.
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- 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 the qualified professional engineer responsible for their preparation.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer glass testing agency and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For insulating 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.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.
- B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

1.9 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.11 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.

1.12 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 Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to

glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Guardian Glass; SunGuard.
 2. Oldcastle BuildingEnvelope™.
 3. Pilkington North America.
 4. Viracon, Inc.
 5. Vitro Architectural Glass.
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

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 the following: 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 01 4000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E1300.
 1. Design Wind Pressures:
 - a. As indicated on Drawings.
 - b. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - 1) Wind Design Data: As indicated on Drawings.
 2. Design Snow Loads: As indicated on Drawings.

3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
1. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
 3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
 4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

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. GANA Publications: "Glazing Manual."
 2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. 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. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) 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. Rollerwave peak to valley shall be 0.003 or below.

2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E2190.
1. Use Basis of Design glass scheduled at the end of this Section, or an equivalent product complying with requirements, but one if the other listed manufacturers.
 2. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
 3. Perimeter Spacer: Manufacturer's standard spacer material and construction.
 4. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.6 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. Sealant shall have a VOC content of 250 g/L or less.
4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant:

1. Acid-curing silicone glazing sealant complying with ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Bostik; Arkema.
 - 2) GE Construction Sealants; Momentive Performance Materials Inc.
 - 3) Pecora Corporation.
 - 4) Sika Corporation.
 - 5) The Dow Chemical Company.
 - 6) Tremco Incorporated.

2.7 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 804.3 tape, where indicated.
 - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 - 3. 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 the 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.

2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of 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 by sealant or glass manufacturer.
- D. Spacers:
 - 1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 - 2. Type recommended by sealant or glass manufacturer.
- E. Edge Blocks:
 - 1. Type recommended 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.

2.9 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, ambient; 180 deg F, 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.

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.

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.
 - 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 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 according to 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 by gasket manufacturer.

3.4 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. Apply heel bead of elastomeric sealant.

- G. 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.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 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 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 by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.6 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.

3.7 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. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into 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.

3.8 INSULATING GLASS SCHEDULE

- A. Glass Type G-2T: Low-E-coated, clear insulating tempered glass.
 - 1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 70.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of Each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Fully tempered float glass.
 - 5. Interspace Content: Argon.
 - 6. Indoor Lite: Fully tempered float glass.
 - 7. Low-E Coating: Sputtered on second surface.
 - 8. Winter Nighttime U-Factor: 0.28 maximum.
 - 9. Summer Daytime U-Factor: 0.26 maximum.
 - 10. Visible Light Transmittance: 64 percent minimum.
 - 11. Solar Heat Gain Coefficient: 0.27 maximum.
 - 12. Safety glazing required.

END OF SECTION 08 8000

SECTION 09 9123 - INTERIOR PAINTING

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 surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel.

1.3 DEFINITIONS

- A. MPI Gloss Level 5 (semigloss): 35 to 70 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Submitted products must meet or exceed performance levels of basis of design products listed in each category.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- D. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 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.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 WARRANTY

- A. Use paints that carry a minimum 5-year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Paint Manufacturers: Subject to compliance with requirements, provide products by Sherwin-Williams; Paint Stores Group.

2.2 PAINT, GENERAL

- A. MPI Standards: Unless indicated otherwise, provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:
 - 1. Provide materials for use within each paint system that are 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, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
- C. VOC Content: For field applications that are inside the weatherproofing system, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Nonflat Paints and Coatings: 50 g/L.
 - 2. Primers, Sealers, and Undercoaters: 100 g/L.

3. Rust-Preventive Coatings: 100 g/L.
4. Zinc-Rich Industrial Maintenance Primers: 100 g/L.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

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. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- C. 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 in "MPI Manual" applicable to substrates 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.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 1. SSPC-SP 3, "Power Tool Cleaning."
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 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. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. 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.
- 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. Steel Substrates: Doors and Frames and other exposed steel.
 - 1. Latex System, Alkyd Primer MPI INT 5.1QQ:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - 1) Sherwin-Williams: Protective & Marine; Kem Kromik Universal Primer - B50WZ1.
 - b. Intermediate Coat: Latex, interior, matching topcoat.
 - c. Topcoat: Latex, interior, semi-gloss (MPI Gloss Level 5), MPI #54.
 - 1) Sherwin-Williams: ProMar 200 Zero VOC; Interior Latex Gloss - B21W12651.
 - d. Colors: As selected by Architect.

END OF SECTION 09 9123

SECTION 09 9600 - HIGH-PERFORMANCE COATINGS

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 surface preparation and the application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Galvanized metal doors.
 - b. Steel door frames.

1.3 DEFINITIONS

- A. MPI Gloss Level 6 (gloss): 70 to 85 units at 60 degrees, according to ASTM D523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- B. Shop-Applied Primer Verification for Steel: Provide written verification that shop surface preparation and specified shop primer was applied as specified in this Section or in the steel specification sections.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches 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.

- E. Product List: Cross-reference to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

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. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. 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. 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.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

- C. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints.
 - 3. Sherwin-Williams Company (The).
- B. Products: Subject to compliance with requirements, provide one of the products listed in the Exterior High-Performance Coating Schedule or Interior High-Performance Coating Schedule for the coating category indicated.
 - 1. Equivalent Products: Substitutions of comparable products by other manufacturers will be considered prior to bid if the product complies with specified product requirements and is the same in quality and appearance to the specified product, as judged by the Architect.

2.2 HIGH-PERFORMANCE COATINGS, 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.
 - 3. Products shall be of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 - 1. Nonflat Paints and Coatings: 100 g/L.
 - 2. Primers, Sealers, and Undercoaters: 100 g/L.
 - 3. Rust-Preventive Coatings: 250 g/L.
 - 4. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
- C. Colors: As selected by Architect from manufacturer's full range.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:

1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

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. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. 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 in "MPI Architectural Painting Specification Manual" applicable to substrates and coating 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 coatings, 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 coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 1. SSPC-SP 6/NACE No. 3.

- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- C. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass 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 coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating 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.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, 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 coated surfaces.

3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

A. Steel Substrates:

1. Pigmented Polyurethane System:

- a. Prime Coat: Primer, rust inhibitive, water based MPI #107.
 - 1) Sherwin-Williams: Pro Industrial: Pro-Cryl Universal Primer - B66W00310.
 - 2) Equal, complying with requirements.
- b. Intermediate Coat: Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
- c. Topcoat: Waterbased urethane, pigmented, gloss (MPI Gloss Level 6).
 - 1) Sherwin-Williams: Pro Industrial; Waterbased Acrolon 100 Waterbased Urethane - B65-720 Series.
 - 2) Equal, complying with requirements.

B. Galvanized-Metal Substrates:

1. Pigmented Polyurethane over Vinyl Wash Primer:

- a. Prime Coat: Primer, vinyl wash.
 - 1) Sherwin-Williams: DTM Wash Primer – B71Y0001.
 - 2) Equal, complying with requirements.
- b. Intermediate Coat: Intermediate Coat: Polyurethane, two-component, pigmented, matching topcoat.
- c. Topcoat: Waterbased urethane, pigmented, gloss (MPI Gloss Level 6).
 - 1) Sherwin-Williams: Pro Industrial; Waterbased Acrolon 100 Waterbased Urethane - B65-720 Series.
 - 2) Equal, complying with requirements.

END OF SECTION 09 9600

SECTION 23 0500 – COMMON WORK RESULTS FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.
- B. All electrical work installed under Division 23 shall be in compliance with Division 26.

1.2 DRAWINGS AND SPECIFICATIONS

- A. The drawings are diagrammatic in character indicating design concept and do not indicate every required duct or piping offset, valve, fitting, etc.
- B. All drawings relating to this structure, together with these specifications, shall be considered in bidding and construction. The drawings and specifications are complementary, and what is called for in either of these shall be as binding as though called for by both. Should any conflict or omissions arise between the drawings and specifications, such conflict shall be brought to the attention of the Architect/ Engineer for resolution.
- C. Unless otherwise indicated, all equipment and performance data listed is for job site conditions (elevation 4783 feet).
- D. Drawings are not to be scaled.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
 - 1. CPVC: Chlorinated polyvinyl chloride plastic
 - 2. PE: Polyethylene plastic
 - 3. PVC: Polyvinyl chloride plastic

- G. The following are industry abbreviations for rubber materials:
1. EPDM – Ethylene propylene diene terpolymer rubber
 2. NBR – Acrylonitrile-butadiene rubber

1.4 SUBMITTALS – GENERAL REQUIREMENTS FOR ALL DIV 21, 22, 23 SECTIONS

A. Submittal Data and Shop Drawings:

1. Refer to Division 01, for general submittal requirements.
2. Contractor agrees that Shop Drawings and Submittals processed by the Engineer are not Change Orders; that the purpose of shop drawings and submittals by the Contractor is to inform the Engineer which equipment and materials he intends to furnish and install.
3. Submittals and shop drawings are to be edited to show specific data and all options for the products and systems that the Contractor intends to provide.
4. Submittals and shop drawings are to be identified with numbers or letters identical to those listed on the drawings and specifications.
5. All submittals shall be transmitted electronically in .pdf format. Engineer will review electronic files and return as .pdf files with comments as required. Hardcopies will not be processed unless special arrangements are made prior to submittal.
6. Approved Manufacturers and Substitutions:
 - a. Equipment and materials manufactured by any one of the manufacturers listed in this specification or on the drawings shall be acceptable if the equipment and material is equivalent in performance, capacity, weight, utility requirements, and configuration to the Basis of Design identified on the drawings or these specifications.
 - b. Substitution Requests prior to bid: Refer to Division 01. No prior approvals will be given by the Engineer unless specifically mentioned in these specifications.
 - c. Substitution Requests after Execution of Contract: If Contractor wishes to furnish or use a substitute item of material and equipment, he must submit a change order request to the Engineer. The request for change order shall itemize each of the proposed substitutions identified by applicable specification section, paragraph number, and drawing number. A price change (increase or decrease) shall be listed for each item along with complete data showing performance over entire range, physical dimensions, electrical characteristics, material construction, operating weight, and other applicable data. Justification of substitution must be more than just cost justification. The Engineer will review the change order request for equality, suitability, and reasonableness of price differential. A single substitution change order listing the approved items will be issued with the net cost of the change order being the sum of the approved item costs. No subsequent substitution change orders will be considered. The Engineer's decision will be final.
 - d. It shall be the responsibility of the Contractor to assure that the substitute material and equipment fits into the space provided, system connections and building penetrations are compatible with the contract document layout, utility requirements are equal, venting and intake openings are similar, and weight is equal or less than the basis of design. The Contractor shall pay all extra costs incurred by other trades for any and all changes necessitated by these substitutions. No time extension will be allowed due to substitution on equipment.
7. Organization: Submittals shall be organized by spec section. All product of one section shall be submitted together, unless identified in the submittal schedule or otherwise approved prior to submittal. Where partial section submittals are allowed, each portion shall have a unique designation.
8. Submittals Schedule: Comply with Division 01 construction progress documentation and submittal requirements and the additional submittal requirements specified below. Unless

otherwise specified in Division 01, comply with the submittal periods specified below. Engineer will schedule submittal reviews based on the submittal schedule. Failure to submit the schedule may result in inability to review submittals within the periods stated in the submittal schedule. These delays shall not be cause for extension of Contact completion date.

- a. Processing Time: Allow enough 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.
 - b. Submit schedule within 14 days of commencement of work. 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.
 - c. Allow 15 days for review of each resubmittal.
 - d. Arrange the following information in a tabular format:
 - 1) Scheduled date for first submittal.
 - 2) Specification Section number and title.
 - 3) Submittal category (action or informational).
 - 4) Name of subcontractor.
 - 5) Description of the Work covered.
 - 6) Scheduled date for Architect's final release of reviewed submittal.
9. Deviations: Equipment and material submittals of approved manufacturers, including Basis of Design manufacturer, shall be provided with a written itemization of exceptions to the specification and deviations from the Basis of Design for all features, design, configuration, physical dimension, performance, and operation of the submitted product. Those elements not identified and itemized as exceptions in the submittal shall not be reviewed by the Engineer and shall be provided as specified.
10. Non-Responsive Submittals: Submittals are intended to be reviewed in an initial submittal with comments corrected and submitted in a resubmittal. Non-responsiveness to the initial submittal comments in the resubmittal will result in return of the documents for correction and additional resubmittals. Any time charged by the Engineer in review of additional resubmittals due to non-responsiveness shall be deducted from the Contractor's billings

B. Close-out Submittals:

1. Operating and Maintenance (O&M) Manual:
 - a. Provide O&M manuals in accordance with Division 01 and the following.
 - b. Format shall be as agreed to between Contractor and Owner. Follow Owner's standards where available.
 - c. Contractor shall prepare an Operating & Maintenance (O&M) manual that shall cover all systems and equipment installed under Division 21, 22 and 23. Incorporate the standard technical literature into system-specific formats for this facility as designed and actually installed. The resulting manual shall also serve as the training manual and shall be specific, concise, to the point, and tailored specifically for this facility.
 - 1) In addition, Record Documents for Division 21, Fire Protection, comply with the requirements of NFPA 13, 14, 20, and 25.
 - d. Provide manufacturers' literature for the actual products and systems provided for this project. The manual shall be adequately indexed and contain the following information:
 - 1) Contractors' names, addresses, and telephone numbers

- 2) Alphabetical list of all system components with the name and address and 24-hour phone number of the company responsible for servicing each item during the first year of operation
 - 3) Guarantees and warranties of all equipment whenever applicable.
 - 4) All manufacturers' data that is applicable to the installed equipment, with appropriate highlighting, such as the following:
 - a) Shop drawings (latest copy)
 - b) Installation and Operating instructions
 - c) Lubrication instructions
 - d) Wiring diagrams
 - 5) A simplified description of the operation of all systems including the function of each piece of equipment within each system, including both normal and emergency operations. These descriptions shall be supported with a schematic flow diagram when applicable.
2. Record Drawings:
- a. Comply with record drawing requirements in Division 01 and the following.
 - b. Maintain a Field Record Set of documents, showing all approved changes as well as field coordinated deviations from the Contract Documents.
 - c. At the time of Project Close-out, Contractor may request an updated set of Contract Documents in .pdf format from the Engineer, if available. All RFIs, Change Orders, and other directives, if not recorded on the updated Contract Drawings and Amendments, shall be red-lined on the Record Drawings. Record Drawings simply tabulating the amendments onto the drawings shall be returned for clarification of installed conditions and red-line mark-up. Deviations in dimensions, size, layout ,or location between Contract Documents and actual installed conditions shall be red-lined on the .pdf record documents.

1.5 SUBMITTAL – FOR WORK OF THIS SECTION

- A. Product Data: Provide for all products of this specification.
1. Motor Submittal Data: The following data shall be submitted for all motors:
 - a. Full load current and service factor running current at operating voltage
 - b. Locked rotor current, starting power factor, and power factor at full load
 - c. Efficiency at full load
 - d. Data to substantiate Class F insulation with Class B rise at 100% load.
 - e. Full load speeds (rpm).
 - f. Enclosure type (ODP, TEFC, explosion proof, TENV, WPI, etc.)
 2. Motor Controllers:
 - a. Torque, speed, and horsepower requirements of the load
 - b. Power factor and harmonic distortion mitigation
 - c. Ratings and characteristics of supply circuit including voltage, amperage, and Short Circuit Current Rating
 - d. Ambient and environmental conditions of installation location
 - e. Enclosure IP rating
 3. Identification: Submit schedule of identification nomenclature for each system and equipment.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code – Steel."

- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

- C. Electrical Characteristics for Mechanical Equipment: Equipment of lower or higher electrical characteristics may be furnished provided such proposed equipment variations are specifically identified as a deviation from contract documents and approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost to the Owner. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

- B. Store plastic pipes protected from direct sunlight. Support piping to prevent sagging and bending.

1.8 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installations.

- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

- C. Identification:
 - 1. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
 - 2. Coordinate installation of identifying devices with locations of access panels and doors.
 - 3. Install identifying devices before installing acoustical ceilings and similar concealment.

- D. Coordinate with all trades to maintain clearances to access panels, equipment, control and electrical panels. Intrusions into access space shall be brought to the attention of other trades. Notify Engineer of conflicts shown on drawings prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles throughout Divisions 21, 22, and 23, where subparagraph titles introduce lists of manufacturers, the following requirements apply for product selection:
 - 1. Subject to compliance with requirements, provide products by one of the manufacturers listed.
 - 2. Manufacturers other than the ones listed may be proposed under the provisions for Substitutions in this Part 1 and the provisions of Division 01.

2.2 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
 - d. JCM Industries.
 - e. Smith-Blair, Inc.
 - f. Viking Johnson
 - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
 - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
 - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturer: Eslon Thermoplastics
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
 - 1. Available Manufacturer: Thompson Plastics
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
 - 1. Available Manufacturers:
 - a. NIBCO Inc.
 - b. NIBCO, Inc.; Chemtrol Division
- E. Flexible Transition Couplings for Underground Non-Pressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Co.
 - d. Plastic Oddities, Inc.

2.3 DIELECTRIC FITTINGS

- A. Description: Fittings designed to interrupt the passive dielectric current between dissimilar materials in the presence of an electrolyte.
 - 1. Notify the Electrical Contractor of systems not electrically conductive where bonding for grounding purposes may be required.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.

- C. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Co.
 - c. Epcos Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Division
- D. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150 or 300 psig minimum working pressure where required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300 psig minimum working pressure at 225°F. Designed to isolate internal conducting fluid (electrolyte) on either side of the fitting, while maintaining electrical conductivity of the pipe.
- F. Dielectric Unions: Not allowed. Use dielectric couplings.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. PSI/Thunderline/Link-Seal
 - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Zinc dichloromate or glass reinforced plastic. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A53, Type E, Grade B, Schedule 40, galvanized, plain ends.

- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.6 GROUT

- A. Description: ASTM C1107, Grade B, non-shrink and non-metallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, non-corrosive, non-gaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.7 ELECTRIC MOTORS

- A. General: All motors (except as noted) shall conform to the following specifications:
 - 1. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or sections.
 - 2. 1/2 hp and Smaller: Single-phase.
 - 3. Larger than 1/2 hp shall be 3-phase, except where specifically noted otherwise.
 - 4. Comply with NEMA MG 1 unless otherwise indicated.
 - 5. Motors shall be UL listed for intended use.
- B. Motor Characteristics:
 - 1. Duty: Continuous duty at ambient temperature of 40°C and at site elevation.
 - 2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- C. Polyphase Motors:
 - 1. Description: General purpose NEMA MG 1, Design B, except "C" where required for high starting torque, medium induction motor.
 - 2. Efficiency: NEMA Premium Efficiency, as defined in NEMA MG 1 when available, otherwise energy efficient, as also defined therein.
 - 3. Service Factor: 1.15.
 - 4. Multispeed Motors: Separate winding for each speed.
 - 5. Rotor: Random-wound, copper windings, squirrel cage.
 - 6. Bearings:
 - a. Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading, minimum 80,000 hour L10 life.
 - b. Sleeve type bearings are permitted for fractional horsepower and light-duty motors.
 - c. Designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
 - 7. Insulation: Class F.
 - 8. Code Letter Designation:
 - a. Motors 15 hp and Larger: NEMA starting Code F or Code G.
 - b. Motors Smaller than 15 hp: Manufacturer's standard starting characteristic.

9. Enclosure:
 - a. Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.
 - b. Open drip-proof motors for indoor use where satisfactorily housed and properly ventilated during operation.
 - c. Weather protected Type I for outdoor use when enclosed or housed with adequate ventilation, or TEFC when exposed to weather or moist locations.
 - d. Special enclosures required for hazardous areas (explosion proof, etc.) per equipment schedules. Explosion-proof motors shall be UL listed.
 10. Motor Selection Criteria:
 - a. Motor sizes shall be large enough so that the driven load does not require the motor to operate above 80% of its rated horsepower. Minimum horsepower ratings are shown or scheduled on the drawings.
 - b. Pump motors shall be "non-overloading"; i.e. shall not operate in service factor at any point on pump curve.
- D. Additional Requirements for Special Polyphase Motors.
1. Motors Used with Reduced-Voltage and Multi-speed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
 2. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - b. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
 - d. Shaft grounding kits, Aegis SGR, Shaft Grounding Systems, Model G JR, or approved equal.
- E. Single Phase Motors:
1. Motors shall be in compliance with DOE Energy Conservation Standards for Small Electric Motors
 2. Motors shall be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor (PSC).
 - b. Split phase.
 3. Multispeed Motors:
 - a. Electronically commutated motor (ECM): Provide ECM motors with speed control when available as an option.
 - b. Variable-torque, permanent-split-capacitor type.
 4. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
 5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

F. Electrically Commutated Motors

1. Motor shall be electronic commutation (EC) type specifically designed for application.
2. Motors shall be permanently lubricated with heavy duty ball bearings to match the driven load.
3. Motor speed shall be speed controllable down to 20% of full speed (80% turndown.)
4. Speed shall be controlled by either a potentiometer dial mounted on the motor or by a 0-10 VDC signal. Both capabilities shall be provided.

2.8 MOTOR CONTROLLERS

A. General Motor Controller Characteristics:

1. Single speed and multi-speed motor controllers shall be combination type, IEC starters with fused or non-fused for all motors provided.
Exception: Starters that are shown to be provided integral within packaged equipment, control panels with door mounted disconnects or in motor control centers.
2. All combination starters shall be adequately braced for the fault current available. 42,000 AIC @ 480V, 3-phase and 65,000 AIC @ 208V, 3-phase shall be the minimum ratings.
3. All starters, whether separately furnished or integral with equipment, shall comply with the following:
 - a. Enclosures: NEMA Type 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA Type 4 with conduit hubs, or units in hazardous locations that shall have NEC proper class and division explosion-proof enclosure.
 - b. 3-phase Starters:
 - 1) All starters for 3-phase motors shall be magnetic complete with the following accessories.
 - a) Three-leg electronic overload protection with 3-phase voltage monitor to provide quick-trip on single phasing, phase reversal, or high/low voltage with externally operated manual reset and visual trip indicator. Trip setting shall be adjustable with locking cover; initial trip setting shall be Class 10.
 - b) Control transformers with fused primary and secondary per NEC.
 - c) 120V holding coils.
 - d) Integral Hand-Off-Auto switch for single-speed motors.
 - e) Integral High-Low-Off-Auto switch for two-speed starters.
 - f) High- to low-speed compelling time delay relay for two-speed starters.
 - g) Auxiliary contacts, one normally open and one normally closed minimum.
 - h) "Run" pilot light.
 - c. Single-phase Starters: Starters shall be shall be horsepower-rated thermal overload switches.

2.9 MISCELLANEOUS ELECTRICAL DEVICES

- A. Furnish all necessary control devices such as speed controls, transformers, and relays as required for proper operation of all equipment furnished under this Division.
- B. Furnish all remote switches and pushbutton stations required for manually operated equipment complete with low energy pilot lights of an approved type.
- C. Enclosures: NEMA Type 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA Type 4 with conduit hubs, or units in hazardous locations that shall have NEC proper class and division explosion proof enclosure.

- D. Furnish circuit and purpose identification for each remote manual switch and pushbutton station furnished herein. Identification may be either engraved plastic sign for permanent mounting to wall below switch, or stamping on switch cover plate. All such identification signs and switch covers in finished areas shall match other hardware in the immediate area.

2.10 ELECTRIC HEAT TRACE CABLE

- A. Provide electric heat trace cable at the locations shown on the drawings and as specified herein.
1. Self-regulating type cable with conductive polymer core whose electric resistance varies with temperature, flame retardant insulation jacket of polyolefin or fluoropolymer jacket over tinned copper braid.
 - a. For above ground freeze protection of water lines where fuel oil or aqueous chemicals are not present, use a modified polyolefin with ultraviolet inhibitor.
 - b. For below-grade applications, grease waste, or where fuel oil or aqueous chemicals are present, use a fluoropolymer with ultraviolet inhibitor.
 - c. Outer jacket to be printed with cable model number, agency listings, batch number, and meter marks (for ease of installation within maximum circuit length).
 2. UL listed for the location installed.
 3. Provide complete with the required end seals, power terminations, and splicing kits.
- B. Freeze prevention applications for pipe operating at or below 180°F pipe temperature: nVent - Raychem XL Trace cable, volts, wattage, and length as required to provide the heating rate specified or shown on the drawings.
1. Or engineer approved equivalent.
- C. Single Circuit Local Digital Controller for Freeze Prevention Heat Trace – indoor location:
1. Basis-of Design Product: nVent Raychem-460.
 2. Provide one controller for each heat-tracing circuit.
 3. Controller to include self-test function to verify heat-tracing integrity.
 4. Controller Capabilities:
 - a. Supply Voltage: 100 to 277 V ac.
 - b. Enclosure: NEMA 12 polycarbonate.
 - c. Operating Temperature Range: -40 to 140 deg F (-40 to 60 deg C).
 - d. Display: 5" color touch screen.
 - e. Output Relay. Double pole single throw relay, 24 A @ 120/208/240/277.
 - f. Alarm Relay: Single pole double throw relay, volt-free; maximum switching capacity (resistive load only) 1 A/24 VDC, 1 A/24 VAC
 - g. Ground fault 30 mA, complies with UL 1053 standard
 - h. USB port: For pre-setup in power off mode; for firmware upgrades
 5. Temperature Sensor Inputs:
 - a. Quantity: one – configurable for line sensing or ambient sensing.
 - b. Type: Thermistor 2 KOhm / 77°F (25°C), 2-wire.
 6. Alarm Conditions:
 - a. Ground fault current
 - b. Low system temperature
 - c. High system temperature
 - d. Temperature sensor failure
 - e. Internal error
 - f. Loss of continuity
 - g. Loss of incoming supply voltage

D. Accessories

1. Cable Installation Accessories: Fiberglass tape, cable ties, connection kits, and end seals all furnished by manufacturer, or as recommended in writing by manufacturer.
2. Identification: Provide and install "Electric Heat Traced" labels on exterior of pipe insulation every 10 ft. (3 m) on opposite sides of pipe, and on all splices, tees, crosses, and power connections for entire length of heat traced piping.

2.11 IDENTIFICATION

A. Equipment Labels:

1. Metal Labels for Equipment:
 - a. Material and Thickness: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch.
 - c. Minimum Letter Size: 1/4 inch for name of units. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
 - d. Fasteners: Stainless steel rivets or self-tapping screws.
 - e. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
2. Plastic Labels for Equipment:
 - a. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - b. Letter Color: White.
 - c. Background Color: Black or blue.
 - d. Maximum Temperature: Able to withstand temperatures up to 160°F.
 - e. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 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-fourths 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.
3. Label Content: Include equipment's unique equipment number.
4. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2" x 11" bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the specification section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

B. Pipe Labels:

1. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
2. Pretensioned Pipe Labels: Precoiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
3. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
4. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

5. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
 - b. Lettering Size: At least 1-1/2 inches high.
- C. Duct Labels:
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°F.
 5. Minimum Label Size: Length and width vary for required label content, but not less than 4 x 12 inch.
 6. Minimum Letter Size: 2 inch. Include secondary lettering two-thirds to three-fourths 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.
 9. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
 - a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
 - b. Arrow Size: At least 6 inches high.
- D. Stencils:
1. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 2 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 2. Stencil Material: Fiberboard or metal.
 3. Stencil Paint: Exterior, gloss enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 4. Identification Paint: Exterior enamel in colors according to ASME A13.1 unless otherwise indicated.
- E. Valve Tags:
1. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - a. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - b. Fasteners: Brass wire-link or beaded chain; or S-hook.
 2. Valve Schedules: For each piping system, on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - a. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 MECHANICAL DEMOLITION

- A. Refer to Divisions 01 for general demolition requirements and procedures.
- B. Disconnect and remove mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping To Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping To Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Equipment To Be Removed: Disconnect and cap services and remove equipment.
 - 4. Equipment To Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 5. Equipment To Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to the Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21, 22, or 23 Sections specifying Mechanical piping systems.
- B. 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.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.

- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
1. 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: Split, cast-brass type with spring clips.
 - d. Bare Piping at Wall, Floor, and Ceiling Penetrations in Finished Spaces, Unfinished Service Spaces, and Equipment Rooms: One-piece or split, cast-brass type with polished chrome-plated finish.
 2. Existing Piping: Use the following:
 - a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Insulated Piping: Split, cast-brass type with spring clips.
 - c. Bare Piping at Wall, Floor, and Ceiling Penetrations in Finished Spaces, Unfinished Service Spaces, and Equipment Rooms: Split, cast-brass type with polished chrome-plated finish.
- M. Sleeves are not required for core-drilled holes.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum board partitions, and concrete floor and roof slabs.
1. Cut sleeves to length for mounting flush with both surfaces.
Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials, seismic installation may require additional clearance:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions. Seal space outside of sleeve fittings with grout.
- O. Verify final equipment locations for roughing-in.
- P. Refer to equipment specifications in other sections of these specifications for roughing-in requirements.
- Q. Install dielectric fittings or approved adaptor fittings on all joints between different piping materials on steam, hot water, chilled water, condenser water, steam condensate, ground source heat pump loop systems and other hydronic mechanical piping systems.
- R. Old Pipe Lines: If any old sewer, water, gas, or other pipes are encountered that interfere with the proper installation of new work and that will not be used in connections with the new work, close all openings in proper manner or, if necessary, relocate or remove the pipes as shown on plans. Should any old pipes and electrical lines not shown on plans be encountered, immediately notify Owner's representative before taking any action.

3.3 IDENTIFICATION COMMON REQUIREMENTS

- A. Preparation: Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- B. Equipment Label Installation:
 - 1. Install or permanently fasten labels on each major item of equipment.
 - 2. Locate equipment labels where accessible and visible.
- C. Duct Label Installation:
 - 1. Install plastic-laminated self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:
 - a. Black on white on HVAC ducts
 - b. ASME A13.1 Colors and Designs for hazardous material exhaust
 - 2. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option.
 - 3. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.
- D. Valve Tag Installation: Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
 - 1. Valve Tag Application: Tag all valves with indicating service and number. Tags 1-1/2 inches in diameter, brass, with 1/4-inch-high letters. Securely fasten with chain and hook. Match service abbreviations given on drawings.

3.4 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES & GROUT

- A. Concrete Base:
 - 1. Anchor equipment to concrete base according to equipment manufacturer's written instructions.
 - 2. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
 - 4. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 5. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 6. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 7. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 8. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03.

9. Coordinate base with Division 23, Section "Wind, Seismic, and Vibration Controls for Mechanical Systems" for additional requirements.

B. Grouting:

1. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.
2. Clean surfaces that will come into contact with grout.
3. Provide forms as required for placement of grout.
4. Avoid air entrapment during placement of grout.
5. Place grout, completely filling equipment bases.
6. Place grout on concrete bases and provide smooth bearing surface for equipment.
7. Place grout around anchors.
8. Cure placed grout.

C. Seismic Coordination: Coordinate base with Section 23 05 48 "Wind, Seismic, and Vibration Controls for Mechanical Systems" for additional requirements.

3.6 CLEANING

A. Cleaning and Flushing:

1. All water circulating systems for the project shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil, and any and all other material foreign to the water being circulated.
2. Extreme care shall be exercised during construction to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped, and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting, or valve shall be visually examined and all dirt removed.
 - a. Heating Water Systems: Hot water heating systems, including converters, pumps, coils, and piping shall be cleaned with a solution of trisodium phosphate. This cleaning also applies to glycol systems prior to filling. Apply heat while circulating, slowly raising system to design temperature; maintain for a minimum of 24 hours. Remove heat and allow to cool; then drain and refill with clean water. Circulate for 6 hours at design temperature, then drain. Refill with clean water and repeat until system cleaner is removed.
 - b. Chilled Water Systems: Circulate cleaning chemicals for 48 hours, then drain. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
3. After the system (or portion thereof) has been leak tested, thoroughly flush with clean water. During the clean water flush, all valves shall be full open, the flow rate for flush shall be at least 4 ft./sec., and the total flow shall equal at least five times the total piping system volume. Flushing shall continue until water runs clear.
4. After clear water flushing is complete, a chemical flushing solution, shall be utilized to remove oil, grease, piping compounds, etc. After the system is filled with this solution, the system shall be brought up to temperature and allowed to circulate for at least eight hours. The system shall then be drained completely and reflushed with fresh water.
5. After the system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side (pH = 7.5+). If the system is found to be still on the acid side, the chemical flush shall be repeated as necessary.
6. The Owner's representative shall be given notice of this cleaning operation. If the Owner's representative deems it necessary, the cleaning operation shall be repeated.

7. "Stop-Leak" compounds shall not be added to the system at any time.
8. Immediately after clear water flushing is complete, a chemical corrosion inhibitor solution, as furnished by the Division 23, Section "Water Treatment," Vendor/Contractor, shall be utilized to initially treat the system.
9. Clean exterior of piping prior to application of coatings.

B. Cleanup:

1. Clean under, in and around equipment.
2. Clean exposed surfaces of ducts, piping, and equipment.
3. Clean equipment cabinets and enclosures.
4. Provide all new filters for equipment.

END OF SECTION 23 0500

SECTION 23 0529 – HANGERS AND SUPPORTS FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Contractor shall design and select supports and upper attachments for all suspended mechanical systems. Contractor shall design and select trapeze pipe hangers and equipment supports using performance requirements and design criteria indicated. Trapeze hangars and equipment supports may be designed using recognized, catalogued, pre-engineered methods. Follow all means and methods identified on the support system product data. Comply with all requirements of the structural drawings and specifications.
- B. Hangers and supports for equipment and distribution systems shall withstand the effects of gravity loads and stresses within limits and under conditions indicated.
 - 1. Supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Hangers and supports shall withstand the effects of Wind and Seismic forces as required in Division 23, Section "Wind, Seismic, and Vibration Controls for Mechanical Systems".

1.4 SUBMITTALS

- A. Product Data: Provide sufficient information to show the hangars and supports are suitable for the intended purpose, including design loads and actual loads. Provide submittal data for:
 - 1. Mechanical systems and equipment hangers and supports
 - 2. Thermal-hanger shield inserts
 - 3. Devices for attachment to the structure
 - 4. Powder-actuated fastener systems
 - 5. Recognized, catalogued, pre-engineered hangar and support systems.
 - a. Identify typical assemblies used for this project
- B. Seismic Control Data: Submit all required information by the Delegated Design Professional in responsible charge of design for Seismic Controls for this project. Where Division 23, Section "Wind, Seismic, and Vibration Controls for Mechanical Systems" does not indicate any required seismic controls, no such submittal is required.

- C. Wind Resistance Data: For all systems and equipment installed outdoors, submit shop drawings indicating the design of the supports and curbs, the attachments to supports and curbs, and the attachment of the support and curbs to the structure, slab, or grade as required to provide resistance to the wind forces identified in Division 23, Section "Wind, Seismic, and Vibration Controls for Mechanical Systems." Where there is no product of this section installed outdoors, no such submittal is required.
- D. Shop Drawings: Provide fabrication and installation details, and calculations for the following systems:
 - 1. Trapeze pipe and duct hangers, multi-trade support racks, and equipment supports not addressed by recognized, catalogued, pre-engineered methods.
 - 2. Architect/Engineer Responsibilities: The Architect/Engineer shall review delegated design submittals for compliance with specification requirements. Design and analysis performed for the delegated design submittal will not be reviewed.
- E. Welding Certificates.

1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code.

PART 2 - PRODUCTS

2.1 METAL FRAMING SYSTEMS

- A. Description: Shop- or field-fabricated, support assembly made of steel channels, accessories, fittings, and other components for supporting equipment, duct, or multiple parallel pipes. Manufacturer's data shall include selection and load support information for standard, pre-engineered installations.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Channels: Continuous slotted carbon-steel, channel with inturned lips.
 - 3. Channel Width: Selected for applicable load criteria.
 - 4. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel stainless steel
 - 6. Paint Coating for indoor, standard applications: Rust inhibiting thermoset acrylic enamel paint applied by electrodeposition after cleaning and phosphating, and thoroughly baked. Manufacturer's standard color
 - 7. Metallic Coating for outdoor or mild corrosion resistance: hot-dipped galvanized per ASTM A123 or A153. Zinc coated after all manufacturing operations are complete Zinc coating thickness shall be G65.
- B. Manufacturers:
 - 1. B-Line Systems, Inc.; a division of Cooper Industries
 - 2. nVent Caddy
 - 3. PHD Manufacturing, Inc
 - 4. Power-Strut Div.; Tyco International, Ltd.
 - 5. Tolco/Eaton
 - 6. Unistrut

2.2 THERMAL-HANGER SHIELD INSERTS

- A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.
- B. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.3 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
 - 1. Manufacturers:
 - a. Hilti, Inc.
 - b. ITW Ramset/Red Head
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC
 - e. Powers Fasteners
 - f. PHD Manufacturing, Inc.

2.4 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and non-metallic grout; suitable for interior and exterior applications.
 - 1. Properties: Non-staining, non-corrosive, and non-gaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-58 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.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-58 and MSS SP-89 for the installation of hangers, supports, clamps, and attachments to properly support piping from building structure.
- B. Hanger Spacing:
 - 1. Hanger spacing and sizing shall per MSS SP-58 or applicable codes, whichever is more stringent.
 - 2. Hanger spacing must be reduced to compensate for any valves and/or fittings installed in the pipe run.
 - 3. Alternate span calculations may be used with a maximum deflection of 0.1 inch between hangers.
 - 4. Hanger spacing must be reduced if thermal hanger shield insert cannot support full span.
- C. Channel Support or Steel Trapeze System Installation:
 - 1. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems. Use clamping systems to prevent excessive displacement, while allowing for free movement for thermal expansion.
 - 2. Multiple pipe runs may be supported on channel/steel trapeze support systems with rollers. Support systems shall be individually designed by a structural engineer with the exception of the following:
 - a. For pipe configurations specified in Table 1, channel support system hangers shall be as described below. Channel support shall be Unistrut P-1000. Hanger rods shall be one size larger than MSS SP-58 requires for largest pipe on support. Where support length exceeds 42 inches, additional hanger rod shall be installed at mid-span and pipe quantities in Table 1 may be placed on each side. Rollers shall be Unistrut P2474 through 6 inches, or P2475 through 16 inches; equal by Anvil or B-Line. Maximum number of pipes on one 42-inch P-1000 channel support is:

Table 1	
Largest Pipe Size	Maximum No. Pipes
NPS 5 and larger	0
NPS 4	2
NPS 3	3
NPS 2-1/2	5
NPS 2	8
NPS 1-1/2	12
NPS 1-1/4 and smaller	16

D. Hanger and Support Installation:

1. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
2. 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.
3. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
4. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31 is not exceeded.
5. Comply with the following for insulated piping:
 - a. Attach clamps and spacers to piping.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Generator exhaust piping: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - d. Do not exceed pipe stress limits according to ASME B31.1.
 - e. Provide protection shields at all pipe supports. Metal shield lengths shall be as required by MSS-SP58 for the compressive strength and support span. Manufactured units shall include certification of compliance with MSS-SP58 for intended use. Requirements shall be as follows:
 - 1) Insulated piping up to NPS 1-1/2 - MSS Type 40 insulation protection shields without high-density inserts.
 - 2) Insulated piping NPS 2 and larger - MSS Type 40 thermal-hanger shield assemblies with the high-density inserts having the same thickness as piping insulation.

E. Building Attachments:

1. Review structural drawings for details of methods of attachment. Coordinate support requirements with project structural engineer.
2. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length specified herein or as indicated in MSS SP 58. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.
3. Powder-actuated fasteners are not permitted.
4. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

5. Attachments to bar joists shall be at panel points and shall comply with load limits and other requirements of the Structural Engineer.

3.3 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 smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes and equipment supports.
- B. Fit exposed connections together to form hairline joints. Connections shall be welded.

3.5 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.6 PAINTING

- A. Touching Up: 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.
- B. Apply paint by brush or spray to provide a minimum dry film thickness of **2.0 mils** .
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.3.1.

END OF SECTION 23 0529

SECTION 23 0548 – WIND, SEISMIC, AND VIBRATION CONTROLS FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.
- B. Work of this section shall be applied to all Division 21, 22, and 23 specifications and drawings. Additional seismic criteria may be specified in individual sections.

1.2 SUMMARY

- A. This project requires vibration and acoustic isolation of mechanical systems. If this project has no exterior equipment duct or pipe delete the next paragraph and edit following paragraphs as appropriate
- B. This project requires designated mechanical systems and equipment to resist design seismic forces.
- C. The work in this section includes Delegated Design for the following:
 - 1. Delegated design for wind resistance
 - 2. Delegated design for Seismic Control.
 - 3. All inspection and test procedures for systems and components requiring International Building Code compliance.
 - 4. Include the costs of engaging inspectors to perform code mandated special inspections.

1.3 DEFINITIONS

- A. Essential Facilities: Buildings and other structures classified as Risk Category IV.
- B. Hazardous Material: Those chemicals that are physical hazards or health hazards as defined in International Building Code, , the International Fire Code, and 29 CFR 1910.1200, Appendix A, whether the materials are in usable or waste condition.
- C. Highly Toxic Material: A material which produces a lethal dose or lethal concentration that falls within any of the highly toxic materials categories defined in the International Fire Code, and 29 CFR 1910.1200, Appendix A.
- D. Life Safety: All systems involved with, but not limited to, fire protection including sprinkler piping, jockey pumps, fire pumps, control panels, service water supply piping, fire service water tanks, smoke management systems, and communications and fire alarm systems intended for the prevention of loss of life.
- E. Licensed Professional Engineer: The individual(s) providing the delegated design licensed by the state in which the project is to be constructed to practice engineering within that state.

1.4 GENERAL DESIGN AND PERFORMANCE REQUIREMENTS

- A. Wind Design and Performance Requirements:
1. Building Risk Category: I II III IV
 2. Wind Design Criteria:
 - a. See Structural drawings.
 - b. Basic wind speed: ____ mph
 - c. Exposure Category: BCD
 3. Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the International Building Code.
 4. Where lateral and vertical uplift forces are identified on the structural drawings for exterior mounted equipment, piping, ductwork, and appurtenances, provide certification that all components will withstand those forces, and design all supports and attachments to resist those forces.
 5. Where lateral and vertical uplift forces are not identified on the structural drawings for exterior mounted equipment, piping, ductwork, and appurtenances, determine those forces using the wind design criteria above using the methods of the International Building Code and ASCE-7, then provide certification that all components will withstand those forces, and design all supports and attachments to resist those forces.
- B. Seismic Design and Performance Requirements
1. Building Risk Category: I II III IV
 2. Seismic Design Category: CDEF.
 3. Mechanical Systems and Components Importance Factor: Components of the following systems specified in Division 21, 22, and 23 have a Component Importance Factor $I_p=1.5$. All other Division 22 and 23 systems and components are considered Importance Factor $I_p=1.0$.
 - a. Life Safety:
 - 1) Automatic Sprinkler and Standpipe Systems
 - 2) Smoke Management Systems
 - 3) _____
 - b. Systems Containing Hazardous Materials or Highly Toxic Materials:
 - 1) Fuel oil systems
 - 2) Fuel gas piping systems
 - c. Essential Systems These systems shall remain in-place, structurally intact, and operational after a design seismic event. Certificates of compliance are required for operating equipment in designated Essential Systems.
 - 1) All Division 22 and 23 systems.
 - 2) _____ systems
 - 3) _____ systems serving _____
 4. Equipment, ductwork, piping, and appurtenances shall be designed and constructed to resist the effects of earthquake motions in accordance with the International Building Code and ASCE-7.
 5. Seismic Load Certification and Analysis:
 - a. Calculations by the qualified licensed professional engineer substantiating the mounting system, seismic restraints and recommended anchor bolts shall be submitted with the shop drawings as a part of the required submittals. Seismic loads shall have their calculations based on criteria as established in this specification. All analysis shall be sealed by a licensed professional engineer.

- b. Restraints devices shall be designed and selected to meet seismic requirements as defined in the International Building Code and ASCE-7.
 - c. For systems designated Importance Factor $I_p=1.5$, provide and submit special inspections reports as required by the International Building Code.
 - d. The manufacturer of equipment for systems designated Importance Factor $I_p=1.5$ shall submit a Certificate of Compliance.
 - 1) These components shall be certified that the mounting system will remain intact, the component shall remain structurally intact and the component shall remain operable following a design seismic event.
 - 2) Components containing hazardous or flammable materials shall be certified that the component will maintain containment following a design seismic event.
 - e. For all components requiring anchorage compliance only, the licensed professional engineer shall submit a calculation package demonstrating that the project specific equipment will accept anchorage through the component's load path to structure at its center of gravity at the designated anchorage locations.
6. Seismic Anchorage:
- a. Analysis for anchorage must indicate calculated dead loads and seismic loads. Analysis must detail anchoring methods, bolt diameter, embedment and/or welded length. All seismic restraint devices shall be designed to accept, without failure, the force criteria in this section, acting through the equipment center of gravity.
 - b. In the event that the equipment is internally isolated and restrained, the entire unit assembly must be attached to the structure to withstand wind and seismic loads. Curb or roof rail mounted equipment must not only have wind and seismic attachment of the equipment to the roof but also to the curb or rails. The method of attachment shall not violate the NRCA rating of the curb by violating the roof's member waterproofing.

1.5 SUBMITTALS

A. Product Data:

- 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device. Indicate actual weight and actual deflection at the point of attachment to equipment. Tag each vibration isolation device with the equipment it is associated with.
- 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of device used.
- 3. Include pre-engineered manufactured wind restraint devices or components used for compliance with the wind resistance requirements. Tag devices indicating the associated restrained mechanical equipment.
- 4. 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. Tag each device to indicate associated system or equipment.
- 5. Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

- 1. 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.
- 2. Wind restraint shop drawings: Where manufactured, pre-engineered equipment or components indicating compliance with the wind resistance requirements is not available, submit shop drawings indicating support, anchorage, and attachment.

3. Seismic control shop drawings: Submit floor plans indicating arrangement and location of seismic control devices in relation to the mechanical systems being protected. Include attachment methods for ducts, pipe, conduits and raceways to floors, slabs or structural steel. Include spacing, and maximum static loads and seismic loads at all attachment and support points. Include details for project-specific fabricated components.
- C. Delegated Design Submittal for Wind Restraint:
1. Design Calculations: Where structural drawings do not indicate wind loads on mechanical equipment, calculate static and dynamic loading due to equipment weight, operation, and wind forces required to select wind restraints.
 2. Design Analysis: To support selection and arrangement of wind and seismic restraints based on design wind related forces.
 3. 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 wind events. Indicate association with vibration isolation devices.
 4. Where catalogued and pre-engineered manufactured equipment, components, or restraint systems meet wind the forces determined through the design analysis, documentation from the manufacturer will be acceptable. Otherwise, analysis data and shop drawings shall be signed and sealed by the qualified licensed professional engineer responsible for their preparation.
- D. Delegated-Design Submittal For Seismic Controls: Analysis data and shop drawings shall be signed and sealed by the qualified licensed professional engineer responsible for their preparation.
1. Design Calculations: Calculate static and dynamic loading due to equipment weight, operation, and seismic forces.
 2. Design Analysis: To support selection and arrangement of seismic restraints. Analyze all requirements of the International Building Code and ASCE-7.
 3. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. 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.
 4. Preapproval and Evaluation Documentation by an evaluation service member of ICC-ES, OSHPD, or an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations) shall be submitted.
 5. Architect/Engineer Responsibilities: The Architect/Engineer shall review delegated design submittals for compliance with specification requirements. Design and analysis performed by the Engineer-in-Responsible Charge of the delegated design submittal will not be reviewed.
- E. Quality Assurance/Control Submittals:
1. "Seismic Qualification of HVAC Equipment" (Example Form 1 located at end of section).
 2. "Statement of Contractor Responsibility for Designated Seismic Systems and HVAC Components Requiring Special Inspection" (Example Form 2 located at end of section).
 3. "Quality Assurance Plan for Seismic Resistance" (Example Form 3 located at end of section).
- F. Certification: Certificates of Compliance for all Designated Seismic Systems.

1.6 QUALITY ASSURANCE

- A. All equipment of a particular category (i.e., seismic restraints, vibration isolators, flexible connectors) shall be of the same manufacturer and shall be selected using published or certified data.
- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel" for all non-ASME Code welding.
- C. Contractor Responsibilities and Approvals: Each contractor responsible for the installation of seismic components requiring special inspection shall be responsible for submitting a written contractor's Statement of Responsibility to the Authority Having Jurisdiction and the Architect/ Engineer. (Refer to Example Form 2, "Statement of Contractor Responsibility for Designated Seismic Systems and Mechanical Components Requiring Special Inspection" at end of specification.)
- D. Periodic and Component Special and Inspection
 - 1. Mechanical systems designated with an Importance Factor $I_p = 1.5$ shall require Periodic Special Inspection or Component Periodic Special Inspection for seismic installation and anchorage during the course of construction.
 - 2. The Engineer in Responsible Charge of the Delegated Design of each of the components and systems shall prepare a "Statement of Special Inspections" (refer to example form 3 at end of specification) per the International Building Code Section 1705 and submit to the Authorities Having Jurisdiction and Architect/Engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control
 - 2. Mason Industries
 - 3. Vibration Mounting Systems (VMC, Amber/Booth Company, and Korfund Dynamics)
- C. Specification A - Pads:
 - 1. Mountings:
 - a. Amber/Booth model NR/NRC/SP-NR, SP-NRC
 - b. Mason Super W
- D. Specification B – Elastomeric Mounts:
 - 1. Mountings:
 - a. Amber/Booth model RVD (rail optional)
 - b. Mason ND or rails type DNR
 - c. VMC Group model RD (rail optional)
 - 2. Bridge bearing Neoprene mountings shall have a minimum deflection of 0.35 inch. All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. On equipment such as small

vent sets and close coupled pumps, steel rails shall be used above the mounting to compensate for the overhang. Color-code or otherwise identify to indicate capacity range.

- E. Specification C - Restrained Elastomeric Mounts: All-directional mountings with seismic restraint.
1. Mountings:
 - a. Amber/Booth: SRVD
 - b. Mason: BR
 - c. VMC: RSM
 2. Bridge-bearing elastomeric mountings shall have a minimum static deflection of 0.2 inch and all directional seismic capability. The mount shall consist of a ductile iron or aluminum casting containing two separated and opposing molded elastomeric elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock-absorbing elastomeric materials shall be compounded to bridge-bearing specification.
- F. Specification D - Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Isolators:
 - a. Amber Booth SW
 - b. Mason: SLF
 - c. VMC: ASC, ALC, AWC
 2. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded elastomeric cup or 1/4-inch elastomeric acoustical friction pad between the bottom of isolator and the support.
 3. All mountings shall have leveling bolts that must be rigidly bolted to the equipment.
 4. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
 5. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.
 6. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height
- G. Specification E - Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Isolators:
 - a. Amber/Booth: CT-ER (ER for non-seismic)
 - b. Mason type SLR or SLRS
 - c. VMC: MS, MSS
 2. Restrained spring mountings shall have a spring isolator within a rigid housing that includes vertical limit stops to prevent spring extension with weight is removed. A minimum clearance of 1/4 inch shall be maintained around restraining bolts and internal elastomeric deceleration bushings so as not to interfere with the spring action. Limit stops shall be out of contact during normal operation. Since housings may be bolted or welded in position there must be an internal isolation pad. Housing shall be designed to resist all seismic forces.
 3. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded elastomeric cup or 1/4 inch elastomeric acoustical friction pad between the bottom of isolator and the support.
 4. All mountings shall have leveling bolts that must be rigidly bolted to the equipment.
 5. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
 6. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.
 7. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height, seismic certification and seismic load capability.

- H. Specification F - Seismically-Restrained Spring Isolators: Freestanding, steel, open spring isolators with ductile-iron or steel housing to provide all-directional seismic restraint
1. Isolators:
 - a. Amber Booth: SWSR
 - b. Mason: SSLFH
 - c. VMC: AEQM
 2. Housing: A unitized adjustable open spring isolator and a welded steel housing designed to resist seismic forces in all directions
 3. Base: Factory drilled for bolting to structure.
 4. Restraint surfaces which engage under seismic motion shall be cushioned with a resilient elastomer to protect equipment. Restraints shall allow a maximum of 1/4-inch movement before engaging and shall allow for the spring to be changed if required.
 5. Isolator shall be a stable spring with a minimum k_y/k_x of 1.0. The spring package shall include an elastomeric pad for high frequency absorption at the base of the spring. Nuts and bolts shall be zinc-electroplated to prevent corrosion.
- I. Specification G - Spring and Elastomeric Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Isolators:
 - a. Amber Booth: BSRA
 - b. Mason: 30N
 - c. VMC: RSH30
 2. Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch-thick elastomeric elements at the top and a steel spring. The neoprene element shall have resilient bushings projecting through the steel box.
 3. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
 4. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.
 5. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short circuiting the spring.
 6. Submittals shall include a hanger-drawing showing the 30° capability.
- J. Specification H – Pre-compressed Spring and Elastomeric Hangers: Pre-compressed combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Isolators:
 - a. Amber Booth: PBSRA
 - b. Mason: PC30N
 - c. VMC: RSHPR
 2. Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch-thick elastomeric elements at the top and a steel spring. The neoprene element shall have resilient bushings projecting through the steel box.
 3. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
 4. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.
 5. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short circuiting the spring.
 6. Hangers shall be pre-compressed and locked at the rated deflection by means of a resilient upstop to keep the piping or equipment at a fixed elevation during installation.
 7. Submittals shall include a hanger-drawing showing the 30° capability.

- K. Specification I - Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.
1. Isolators: Mason: RW30N.
 2. Hangers shall consist of rigid steel frames containing minimum 1-1/4-inch-thick elastomeric elements at the top and a steel spring. The neoprene element shall have resilient bushings projecting through the steel box.
 3. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load.
 4. Springs shall have a minimum additional travel to solid equal to 50% of the operating deflection.
 5. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the rod bushing and short circuiting the spring.
 6. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 7. Submittals shall include a hanger-drawing showing the 30° capability.
 8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- L. Specification R - Pipe Riser Resilient Anchor:
1. Anchors:
 - a. Amber Booth: AB, AG
 - b. Mason: ADA
 - c. VMC: MDPA
 2. All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum of 1/2-inch-thick neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- M. Specification S - Resilient Pipe Guides:
1. Anchors:
 - a. Amber Booth: PG
 - b. Mason: VSG
 - c. VMC: PG
 2. Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch-thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 AIR-MOUNTING SYSTEMS

- A. Specification J - Air Mounts: Freestanding, single or multiple, compressed-air bellows.
1. Air Mounts:
 - a. Amber Booth: CTAS
 - b. Mason: MT
 - c. VMC: Airspring
 2. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows.
 3. Maximum Natural Frequency: 3 Hz.
 4. Operating Pressure Range: 25 to 100 psig.
 5. Burst Pressure: At least three times manufacturer's published maximum operating pressure.

6. Leveling Valves: Provide leveling valves on all but one air mount to maintain leveling within plus or minus 1/8 inch.

B. Specification K - Restrained Air Mounts: Housed compressed-air bellows.

1. Air Mounts:
 - a. Amber Booth: CTAS-ER
 - b. Mason: SLR-MT
2. Assembly: Upper and lower steel sections connected by a replaceable, flexible, nylon-reinforced neoprene bellows and spring, with angle-iron frame having vertical-limit stops and channel-section top with leveling adjustment and attachment screws.
3. Maximum Natural Frequency: 3 Hz.
4. Operating Pressure Range: 25 to 100 psig.
5. Burst Pressure: At least three times manufacturer's published maximum operating pressure.

C. Leveling Valves: Provide leveling valves on all but one air mount to maintain leveling within plus or minus 1/8 inch.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control
3. Mason Industries

B. Specification L - Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
2. Include supports for suction and discharge elbows for pumps.
3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
4. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings.

C. Specification M - Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
2. Include supports for suction and discharge elbows for pumps.
3. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
4. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings.
5. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. Kinetics Noise Control

3. Mason Industries
- B. Specification N – Restrained Vibration Isolation Roof Curb Rails:
1. General Requirements for Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand wind and seismic forces.
 2. Lower Support Assembly: Formed sheet-metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly.
 3. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch-thick elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.
 - a. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with wind and seismic restraint.
 - 1) Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - 2) Outside Spring Diameter: Not less than 80% of the compressed height of the spring at rated load.
 - 3) Minimum Additional Travel: 50% of the required deflection at rated load.
 - 4) Lateral Stiffness: More than 80% of rated vertical stiffness.
 - 5) Overload Capacity: Support 200% of rated load, fully compressed, without deformation or failure.
 - b. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1) Resilient Material: Oil- and water-resistant standard neoprene, natural rubber, or hermetically sealed compressed fiberglass.
 4. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.
 5. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.
- 2.5 ACOUSTICAL FLOOR, CEILING, AND WALL SEALS:
- A. Manufacturer and Model: Mason SWS
 - B. The seal shall consist of two pipe halves with 3/4-inch or thicker packing bonded to the inner faces.
 - C. Packing shall be neoprene sponge for pipe temperatures below 250°For 10 lb/cf density fiberglass for higher temperatures.
 - D. Provide a bolting arrangement to fix the seal around the pipe and eliminate clearance between the inner sponge face and the piping.

2.6 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kinetics Noise Control
 - 2. Mason Industries
 - 3. Vibration Mounting Systems (VMC, Amber/Booth Company, and Korfund Dynamics)
- 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. Snubbers: All-directional seismic snubbers shall consist of interlocking steel members restrained by an elastomeric bushing of Durulene^(TM) Bushing shall be replaceable and a minimum of 1/4 inch thick.
 - 1. Rated loading shall not exceed 1000 psi. A minimum air gap of 1/8 inch shall be incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances.
 - 2. Elastomeric bushings shall be rotated to insure no short circuits exist before systems are activated.
 - 3. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in and stud-wedge or female-wedge type.
- D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- E. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- F. Rigid Braces: Seismic rigid braces shall consist of ASTM A-36 steel angles or channels to resist seismic loads. Seismic solid brace end connectors shall be steel assemblies that swivel to the final attachment angle and utilize two through bolts to provide proper attachment, spaced to IBC standards for attachment to concrete or steel.
- G. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- H. 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.
- I. 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.
- J. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

- K. 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. Minimum length of eight times diameter.
- L. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl 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 wind and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on installation Shop Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.
- D. Select restrained isolators for equipment with large changes in weight between installed weight and operating weight. Select isolators to resist wind forces on exposed equipment.
- E. Vibration Isolator Schedule:

Application	Isolator Specification and Deflection/Structural Base Specification				
	Slab-on-Grade	Structural Span			
		20 feet	30 feet	40 feet	50 feet
Axial Fans, Fan Heads, Cabinet Fans, Fan Sections					
22 in. dia. and less	B, C 0.35"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"
24 in. dia. and larger Less than 2 in sp					

Application	Isolator Specification and Deflection/Structural Base Specification				
	Slab-on-Grade	Structural Span			
		20 feet	30 feet	40 feet	50 feet
Up to 300 rpm	D, E, F, L G, H, I 2.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"
300 to 500 rpm	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 1.5"	D, E, F, M 2.5"	D, E, F, M 2.5"	D, E, F, M 2.5"
501 rpm and up	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 1.5"	D, E, F, L G, H, I 1.5"	D, E, F, M 1.5"	D, E, F, M 2.5"
2.1 in and up					
Up to 300 rpm	D, E, F, M 2.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"
300 to 500 rpm	D, E, F, M 1.5"	D, E, F, M 1.5"	D, E, F, M 2.5"	D, E, F, M 2.5"	D, E, F, M 2.5"
501 rpm and up	D, E, F, M 0.75"	D, E, F, M 1.5"	D, E, F, M 1.5"	D, E, F, M 2.5"	D, E, F, M 2.5"
Centrifugal Fans					
22 in. dia. and less	B, C, L 0.35"	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 0.75"	D, E, F, M 1.5"	D, E, F, M 1.5"
24 in. dia. and larger	D, E, F, L G, H, I	D, E, F, L G, H, I	D, E, F, L G, H, I	D, E, F, L G, H, I	D, E, F, L G, H, I
40 hp and less					
Up to 300 rpm	D, E, F, L G, H, I 2.5"	D, E, F, L G, H, I 3.5"	D, E, F, L G, H, I 3.5"	D, E, F, L G, H, I 3.5"	D, E, F, M 3.5"
300 to 500 rpm	D, E, F, L G, H, I 1.5"	D, E, F, L G, H, I 1.5"	D, E, F, L G, H, I 2.5"	D, E, F, L G, H, I 2.5"	D, E, F, M 3.5"
501 rpm and up	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 0.75"	D, E, F, L G, H, I 1.5"	D, E, F, M 1.5"
Greater than 50 hp					
Up to 300 rpm	D, E, F, M 2.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"	D, E, F, M 3.5"
300 to 500 rpm	D, E, F, M 1.5"	D, E, F, M 1.5"	D, E, F, M 2.5"	D, E, F, M 2.5"	D, E, F, M 3.5"
501 rpm and up	D, E, F, M 1.00	D, E, F, M 1.5"	D, E, F, M 1.5"	D, E, F, M 2.5"	D, E, F, M 2.5"
Propeller Fans					
Wall-Mounted	A 0.12"	A 0.12"	A 0.12"	A 0.12"	A 0.12"
Roof Mounted	A 0.12"	A 0.12"	D, E, F, N 1.5"	D, E, F, N 1.5"	D, E, F, N 1.5"
Heat Pumps	B, C	D, E, F	D, E, F	D, E, F	D, E, F

Application	Isolator Specification and Deflection/Structural Base Specification				
	Slab-on-Grade	Structural Span			
		20 feet	30 feet	40 feet	50 feet
	0.35"	G, H, I 0.75"	G, H, I 0.75"	G, H, I 1.5"	G, H, I 1.5"
Condensing Units	B, C 0.35"	D, E, F G, H, I 0.75"	D, E, F G, H, I 1.5"	D, E, F G, H, I 1.5"	D, E, F G, H, I 1.5"
Ducted rotating equipment small fans, fan powered boxes					
600 rpm or less	B, C 0.35"	D, E, F G, H, I 0.5"	D, E, F G, H, I 0.5"	D, E, F G, H, I 0.5"	D, E, F G, H, I 0.5"
Greater than 600 rpm	B, C 0.35"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"	D, E, F G, H, I 0.75"
Transformers	B, C 0.35"	B, C 0.35"	B, C 0.35"	B, C 0.35"	B, C 0.35"

¹ Suspended support should be avoided when concrete-filled base is specified. If suspension is necessary, contact vibration isolator manufacturer for recommendation on alternate isolation.

3.3 FLEXIBLE PIPE CONNECTORS

- A. Specification "P": Flexible connectors shall be stainless steel hose and braid. Fittings shall be carbon steel. Flexible connectors shall be installed with no bends and not be used to adjust piping misalignment. Hoses shall be equal to Mason BSS, Metraflex.

Minimum Hose Size	
Male Nipples	Flanged
1/2" x 9"	3" x 14"
3/4" x 10"	4" x 15"
1" x 11"	6" x 20"
1-1/4" x 12"	8" x 22"
1-1/2" x 13"	10" x 26"
2" x 14"	12" x 28"
2-1/2" x 18"	14" x 30"
	16" x 32"

- B. Specification "O" - Flexible connections in equipment rooms connected to pumps and chillers 3/4 inches through 12 inches shall be neoprene twin-sphere type units complete with 150 lb-ASA steel floating flanges and EPDM body with Kelvar reinforcing. A rigid-steel reinforcing ring shall be provided at the flange. The design pressure shall be 200 psi at 220°F. Higher temperature pressure ratings may be used if documented temperature and pressure rating is 110% of required limits. Allowable movement limits shall be a min. of 1-inch axial compression, 3/4-inch axial elongation, 3/4-inch lateral movement, and 30-degree angular movement through 3 inches, 20-degree through 8 inches, and 10-degree on 10 inches and larger. Flexible connectors shall be installed with no bends and not be used to adjust piping misalignment. Connections shall be equal to Mason type Safeflex.

- C. Specification “R” - On-line sizes 2-1/2 inches or greater where operating temperature is not more than 230°F, the vibration isolation method of using flexible grooved couplings, installed per manufacturer’s recommendations.

Application	Flexible Connector
Pumps and Chillers in Equipment Rooms 220°F/200 psi and Lower	P O R
Pumps and Chillers All Other Applications	P R
Coils on Isolated Equipment (except equipment with only internally isolated fans)	P R
Air Compressors	P

3.4 ACOUSTICAL FLOOR, CEILING, AND WALL SEALS

- A. Provide acoustical floor, ceiling and wall seals where piping passes through equipment room walls, floors, and ceilings.
- B. Pack concrete around the seal to make it integral with the floor, wall, or ceiling if the seal is not already in place around the pipe prior to the construction or pour of the building members.
- C. Seals shall project a minimum of 1 inch past either face of the wall. Where penetrating fire rated walls, provide recessed seals to allow installation of fire stopping per listing.

3.5 VIBRATION-CONTROL WIND AND SEISMIC -RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 3. Install seismic-restraint devices using methods approved by an agency acceptable to Authorities Having Jurisdiction and in accordance with delegated design submittals.
- C. Piping Restraints:
 1. Comply with requirements in MSS SP-127 and NFPA 13.
 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c..
 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between mounting holes and anchor bolts in concrete base.
- G. 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.
- H. 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 as approved by structural engineer.
- I. 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 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. 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.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.

3.7 FIELD QUALITY CONTROL

- A. Inspections:
 - 1. Measure isolator restraint clearance.
 - 2. Measure isolator deflection.
 - 3. Verify snubber minimum clearances.
 - 4. Engage the services of a Special Inspector qualified under Chapter 17 of the International Building Code to perform the special inspections related to seismic and wind as required in Chapter 17 of the IBC for mechanical systems.
 - 5. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 6. Air-Mounting System Operational Test: Test the compressed-air leveling system.
 - 7. Test and adjust air-mounting system controls and safeties.
- B. Adjusting:
 - 1. Adjust isolators after piping system is at operating weight.

2. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
3. Adjust active height of spring isolators.
4. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 23 0548

FORM 2
STATEMENT OF CONTRACTOR RESPONSIBILITY
FOR DESIGNATED SEISMIC SYSTEMS AND
PLUMBING COMPONENTS REQUIRING SPECIAL INSPECTION

CONTRACTOR NAME: _____

DATE: _____

PROJECT: _____

SPECIFICATION SECTIONS: _____

Attached is our Statement of Responsibility containing the following information required by the International Building Code, Section 1706.

1. Acknowledgment of awareness of the special requirements contained in the statement of special inspections;
2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official;
3. Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of the reports; and
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

Signature: _____

Date: _____



**FORM 3
STATEMENT OF SPECIAL INSPECTIONS**

LICENSED PROFESSIONAL ENGINEER: _____

DATE: _____

PROJECT: _____

The quality assurance plan below lists the designated seismic systems or other qualifying mechanical systems stated in the International Building Code section 1705 requiring special inspections.

SEISMIC SYSTEM	REQUIRED VERIFICATION AND INSPECTION	FREQUENCY OF SPECIAL INSPECTION	FREQUENCY AND DISTRIBUTION OF SPECIAL INSPECTION REPORTS	APPLICABLE REFERENCE STANDARDS

Signature



SECTION 23 0593 – 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 Specifications, apply to this Section.

1.2 SUBMITTALS

- A. Samples: Submit proposed test and balance forms and report formats at least 120 days prior to commencing field work.
- B. Quality Assurance/Control Submittals: Qualifications - Within 30 days after contract award, submit the name(s) of the professional engineer and/or the TABB, NEBB, or AABC certified supervisor who will be supervising this work. Submit the name(s) of the test and balance technician(s) who will be performing the work.
- C. Close-out Submittals:
 - 1. Test and Balance Report: After all balancing is complete, and all coordination with the Owner or his representative is complete, the balancing firm shall furnish digital reports that shall contain the test data information as detailed in Part 3 and as follows:
 - a. Results of dynamic balance testing:
 - 1) Baseline amplitude, velocity, and acceleration frequency spectrum printouts for all devices.
 - 2) All test values exceeding manufacturer's standards shall be identified with recommendations for corrective action.
 - 3) Retest results for rejected devices after corrective action.
 - b. A reduced set of drawings (11" x 17") shall be included in the report with all terminals (VAV boxes, air outlets, inlets, coils, unit heaters, fin tube loops, radiant panel loops, etc.) clearly marked, all equipment designated, and all referenced to the device test reports. The contract drawings may be reduced and used for this purpose, if they remain legible.
 - c. The test and balance Contractor shall submit bound copies of the final testing and balancing report to the Owner or his representative at least 15 days prior to the Mechanical Contractor's request for final inspection. All data shall be recorded on applicable reporting forms. The report shall include all operating data as required in Part 3, a list of all equipment used in the testing and balancing work, and shall be signed by the supervising registered engineer or certified test and balance supervisor and certified test and balance technician, and affixed with his certification seal. Final acceptance of this project will not take place until a satisfactory report is received.
 - 2. Balance report shall not be submitted until all improperly configured or installed systems are corrected and improperly installed or missing balance devices are corrected and tested reports submitted with incomplete information will be returned unreviewed.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Qualified firms desiring to furnish services for this project shall submit for written approval, during bid time, a brochure listing the qualifications of personnel in the organization, instruments available to be used, an outline of system balancing procedures that is intended to be followed, and a list of projects successfully balanced within the last two years. Information regarding additional qualifications listed below must be in the office of the Engineer at least 14 calendar days prior to the date set for receiving bids.
2. The balancing work, including air and hydronic portions, shall be performed by the same firm having total professional responsibility for the final testing, adjusting, and balancing of the entire system.
3. Test and balance firm shall:
 - a. Have had previous experience with at least three projects of similar type and size in the State Utah. Provide the project(s) name, owner, general contractor, mechanical contractor, and references with phone numbers for each.
 - b. Have a permanent place of business and phone number within a 200-mile radius of the job site.
 - c. Have been actively engaged in balancing work within the State of Utah for at least three of the past five years. Provide at least three project references with phone numbers.
 - d. Have a minimum of two permanent employees who have been actively engaged in balancing work for a minimum of 3 years. Provide names, certifications, and experience resumes.
4. The test and balance field work shall be performed under the direct supervision a TABB, NEBB or AABC certified test and balance supervisor. The certified supervisor shall:
 - a. Perform the test and balance work or be on-site at least 33% of the total time the test and balance work is in progress, or
 - b. Be on site a minimum of 10% of the total time the test and balance work is in progress with the work performed by a full-time certified TABB, NEBB or AABC test and balance technician.
5. The vibration testing firm shall be an independent test and balance firm or vibration testing firm, not associated with equipment suppliers or installers, specializing in dynamic vibration measurement and balance. The agency shall be TABB, NEBB or AABC certified in sound and vibration testing and shall have been actively engaged in vibration testing and balancing work for a minimum of three years. Firms not certified by TABB, NEBB or AABC shall have been actively engaged in sound and vibration testing work for a minimum of five years and shall provide three references including project name, owner, general contractor, mechanical contractor, and references with phone numbers for each.

B. Certifications:

1. Testing, adjusting, and balancing shall be done by a firm using TABB, NEBB, or AABC certified supervisors, or by an independent firm specializing in this work. A definition of independent shall mean the firm is not associated with the contractor performing work under Division 23; the firm derives its income solely from testing, adjusting, and balancing and/or commissioning mechanical systems; and the work is performed in a professional manner.
2. Test and balance firm shall own or rent and have available for this project all necessary balancing instruments as required to maintain TABB, NEBB, or AABC certification. Instrument calibration shall have been checked and verified as per TABB, NEBB or AABC requirements. Provide instrument list with calibration date for each instrument listed.

C. Regulatory Requirements:

1. Refer to Division 23 Section "Common Work Results for HVAC," for general code, standard and regulatory requirements.
2. Comply with procedural standards for testing, adjusting, and balancing of environmental systems as outlined in the latest edition of SMACNA, NEBB, and/or AABC procedural manuals.
3. ASHRAE Compliance:
 - a. Applicable sections and paragraphs as published in ASHRAE 2011 Applications Handbook, Chapter 38, Testing, Adjusting, and Balancing, and Standard 111.
 - b. Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
4. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1-2007-, Section 6.7.2.3 - "System Balancing."

1.4 SCHEDULING

- A. Coordinate scheduling of work with the General Contractor, the appropriate subcontractors. Schedule test and balance work to coincide with testing and verification of control systems where practical.
- B. Provide written notification (within 24 hours) to General Contractor, =, Engineer, and Owner or his representative of any component and/or system deficiencies.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Provide all necessary tools, scaffolding, and ladders.
- B. Provide all necessary instruments. Calibration and maintenance of instruments shall be in accordance with TABB, NEBB or AABC. Calibration histories for each instrument shall be available for examination.
- C. When DDC terminal unit controls are used, appropriate temperature control application software and hardware shall be used for proper interface with the terminal unit DDC controls.
- D. Provide all sheaves necessary to obtain design airflow from fans.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Air and water testing and balancing shall not begin until the system to be tested has been cleaned and flushed, and is in full working order. Where glycol is used, it shall be installed prior to hydronic balancing.
- B. Preliminary test and balance requirements shall be ascertained prior to the commencement of work through a review of available plans and specifications for the project. In addition, visual observations at the site during construction shall have been made to determine the location of required balancing devices; that they are being installed properly; and that proper access has been provided.

- C. Prior to and during testing and balancing, the testing and balancing technician shall immediately notify the Contractor of all balancing devices not yet installed and those portions of the system unable to be balanced. The Contractor shall correct the deficiencies and shall notify the Engineer of situations requiring additional instruction.
- D. Before any air balance work is done, the system shall be checked for:
 1. Excessive duct, plenum, and equipment leakage
 2. Dirt and debris in ducts and/or AHUs
 3. Filters are installed (and changed if they are dirty)
 4. Coil fins are clean and combed where needed
 5. Correct motor rotation
 6. Excessive vibration
 7. Equipment lubrication
 8. Proper operation of automatic control and smoke dampers
 9. Manual control dampers, fire dampers, and air outlet dampers are wide open
 10. Duct end caps installed and access doors closed
 11. Grilles, registers, and diffusers are properly installed
- E. Put heating, ventilating, and air conditioning systems and equipment into full operation and continue operation of same during each working day of testing and balancing.

3.2 REQUIREMENTS OF WORK

- A. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Ducts and Accessories."
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Division 23 Section "Mechanical Insulation."
- B. 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.
- C. Take and report testing and balancing measurements in inch-pound (IP) units.
- D. All equipment, provide the following included with the equipment test data. Underlined items require other equipment test data sections be included within specified test data section:

Electric Motor, Drive, VFD Test Data			
Item	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
Motor			
Motor HP	X	X	
Motor type (ODP, TEFC, etc.)	X	X	
Motor RPM	X	X	X
Voltage per phase	X	X	X

Electric Motor, Drive, VFD Test Data			
Item	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
Motor amperage per phase	X	X	X
Motor service factor	X	X	
Motor efficiency class (EPACT, NEMA Premium, etc.)	X	X	
Belt Drive			
Motor sheave OD (Belt Drive)		X	X
Fan sheave ID (Belt Drive)		X	X
Sheave centerline distance (Belt Drive)			
Number/size belts (Belt Drive)		X	X
Driven RPM Initial (Fan, etc.)			X
Driven RPM Final (Fan, etc.)			X
Motor Starter			
Manufacturer	X	X	
Model	X	X	
Size	X	X	
Overload size/ Electronic overload set point	X	X	
Trip class set point	X	X	
VFD			
Manufacturer	X	X	
Model	X	X	
Main fuse size	X	X	
VFD fuse size	X	X	
Bypass fuse size (when equipped)	X	X	
Maximum frequency set point			X
Minimum frequency set point			X
Final frequency set point			X
Resonant/vibration frequency lock-out bands			X

E. Air Balance, provide the following:

Fan Test Data (125 W or 1/6 hp and larger)			
Item*	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
Unit designation	X		
Type of Service	X		
Manufacturer	X	X	
Model number	X	X	
Total airflow	X		X
External SP	X		X
Fan discharge SP			X

Fan Test Data (125 W or 1/6 hp and larger)			
Item*	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
Fan Suction SP			X
Include Motor, Drive, VFD Test Data*			
Air Outlet Test Data			
Item	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
Unit designation	X		
Type of service	X		
Area served	X		
Final velocity (when $A_k \neq 1.0$)			X
A_k factor (when $A_k \neq 1.0$)	X		
Final airflow			X
First test reading			X
Instrument used for testing			X

Duct Traverse Test Data			
Item	Tabulate Design/Submittal Data	Confirm Actual Installation	Test
System designation	X		
Traverse designation	X		
Location	X		
Airflow	X		X
Duct size, I. D.	X		X
Duct area	X		X
Average velocity			X
Static pressure at traverse			X
Instrument used for testing			X

- F. Adjust air handling systems to the following tolerances:
1. Supply systems shall be balanced so that:
 - a. The total quantity to each space is within -5% to +10% of design values.
 - b. If two outlets in space, each outlet is within -10% to +10% of design value.
 - c. If three or more outlets in space, each outlet is within -15% to +15% of design value.
 2. Exhaust and return systems shall be balanced so the total quantity from each space is -10% to +10% of design values.
 3. Air diffuser patterns shall be set to minimize objectionable drafts and noise.

4. The supply, return, and exhaust fan static pressure controls shall be set by the balancing firm (and the Controls Contractor if the systems have fan volume control).
 - a. The pitot tube traverse method for determining main duct cfm shall be used and recorded wherever possible; flow hood measurements at registers and diffusers may be totaled for branch duct quantities.
 - b. The supply air system shall be tested in all operating modes (full return air, full outside air, full cooling with the design diversity, and full cooling with no diversity).
 - c. After balancing is completed, check fan motor amperage with the filters clean.
 - d. System static pressure profiles and fan motor amperages shall be recorded in all modes.
 - e. The lowest fan speed resulting in satisfactory system performance shall be determined at full design airflow. Any inlet or outlet fan volume (balancing) dampers shall be in the wide-open position and one path presenting the greatest resistance to flow shall be fully open and unobstructed.
5. Final adjustments shall include but not be limited to the following:
 - a. Fans:
 - 1) Belt Drive: RPM - Include sheave and belt exchange as required to deliver airflow within limits of installed motor horsepower and mechanical stress limits of the fan. Determine the limiting fan tip speed before increasing rpm. Final fan speed setting shall allow for predicted filter loading and shall provide proper duct pressures for operation of zone terminal units where used.
Note: Fan rpm shall not be increased more than 10% from the factory setting without prior authorization by the Engineer.
 - 2) Direct Drive:
 - a) RPM with Speed Taps: Set fan speed on tap that most closely approaches design cfm. Report tap setting on equipment data sheet.
 - b) RPM with Speed Control Rheostat: Set output of fan to design cfm by adjusting the SCR. After adjustment, check fan's ability to restart after powering down. Increase SCR setting if required for proper starting.
 - c) CFM with Variable Pitch Blades: Variable fixed pitch fan blades and variable in-motion pitch fan blades shall be adjusted initially by the manufacturer at pitch required to provide design output. Check and readjust if necessary to obtain design cfm. Pitch angle adjustment shall not exceed recommended maximum to prevent "stall."
 - b. Registers and Diffusers: Registers, diffusers, etc., are to be adjusted to deliver design air quantities per the "Requirements of Work" paragraph in this specification.
6. When air balancing is done and manual dampers are set, all test holes shall be plugged and all manual damper positions shall be marked. The following information shall be recorded in the final report: Design inlet or outlet size, actual inlet or outlet size, and design cfm (velocity) through the orifice for each terminal in the system.

- G. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.3 FIELD QUALITY CONTROL

- A. Upon request of the Engineer, a representative of the balancing firm performing the work shall demonstrate fluid flow quantities shown in the report by reading back outlets or terminals selected at random by the Engineer. It is understood that the operating mode of the system shall be the same for

read back as it was during balancing, and the number of readings verified will not exceed 10% of the total in the report. If rechecks fail, test and balance report will be rejected.

- B. Equipment non-performance not resolvable by the Contractor shall be reported to the Engineer. Balancer shall assist the Engineer, when requested, by providing field temperature, pressure and flow information at specific locations.
- C. When deemed necessary by the Owner or Engineer, the balancing firm shall run temperature, pressure, and/or humidity recordings, and shall be prepared to verify any of the report test results in the presence of the Owner and/or Engineer.
- D. When deemed necessary by the Engineer, a 24-hour space temperature recording shall be taken and any required partial rebalance of the system shall be performed without any additional cost.

END OF SECTION 23 0593

SECTION 23 0801 – START-UP, TESTING, AND COMMISSIONING OF HVAC WITHOUT Cx AGENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section covers the general requirements for the Division 23 responsibilities for start-up, testing, and commissioning.
 - 1. Mechanical system installation, start-up, testing, balancing, commissioning, preparation of O&M manuals, and operator training are the responsibility of the Contractor. Absence of a separate commissioning agent on this project does not relieve Division 23 from the obligations to complete all portions of the work in a satisfactory and fully operational manner.
 - 2. Work of Division 23 includes:
 - a. Testing and start-up of the equipment.
 - b. Testing, adjusting, and balancing of hydronic and air systems.
 - c. Providing qualified personnel for performance of start-up, testing, and commissioning tests.
 - d. Providing equipment, materials, and labor as necessary to correct construction and/or equipment deficiencies found during the start-up, testing, and commissioning process.
 - e. Providing operation and maintenance manuals and as-built drawings to the Owner.
 - f. Providing system operating and maintenance procedure narratives.
 - g. Providing training and demonstrations for the systems specified in this Division.

1.3 TRAINING

- A. In addition to the requirements of Division 01, schedule and perform the training of the Owner's engineering and maintenance staff on each system and related components. Training will be conducted in a classroom setting, with field demonstrations as appropriate, with system and component documentation and suitable classroom training aids.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

- A. Provide test equipment as necessary for testing and start-up of the mechanical equipment and systems.

2.2 TEST EQUIPMENT - PROPRIETARY

- A. Proprietary test equipment, hardware, and software required by the equipment manufacturer for programming and/or start-up, whether specified or not, shall be provided at no cost. Manufacturer shall provide the test equipment, demonstrate its use, and assist the Contractor in the start-up, testing,

and commissioning process as needed. Proprietary test equipment (and software) shall become the property of the Owner upon completion of the start-up, testing, and commissioning process.

- B. Controls installer/manufacturer shall provide a printout of:
 - 1. All software code
 - 2. All user interface screens

PART 3 - EXECUTION

3.1 WORK PRIOR TO DEMONSTRATION

- A. Complete all phases of work so the systems can be started, tested, balanced, and commissioned. Contractor has primary start-up responsibilities for all mechanical systems so they are functional. This includes the complete installation of all equipment, materials, pipe, duct, wire, insulation, controls, etc.
- B. A start-up, testing, and commissioning plan will be developed by the Contractor and submitted to the Owner. Owner or his representative may elect to observe start-up testing and commissioning.
- C. Responsibilities of Contractor are as follows:
 - 1. Factory start-up services for the following items of equipment:
 - a. Controls, fans
 - 2. Normal start-up services required to bring each system into a fully operational state. Provide skilled technicians to start up and debug all systems within Division 23. This includes motor rotational check, belt and alignment checks, cleaning, filling, purging, leak testing, testing control sequences of operation, full-load and part-load performance, etc. The demonstration and training is not to be performed until each system is complete, including normal start-up and testing.
- D. Prepare, complete and sign start-up and test forms for each piece of equipment and system. Contractor is responsible for assuring the items checked off as complete are ready for demonstration.

3.2 DEMONSTRATIONS

- A. The same technicians that performed start-up and testing shall demonstrate the systems. Work schedules, time required for testing, etc., will be coordinated by the Contractor and submitted to the Owner. Contractor will ensure that the qualified technician(s) are available and present during the agreed-upon schedules and of sufficient duration to complete the necessary demonstrations.
- B. The Owner or his representative reserves the right to question the appropriateness and qualifications of the technicians relative to each item of equipment, system, and/or subsystem. Qualifications of technicians will include expert knowledge relative to the specific equipment involved. Contractor shall also provide adequate documentation and tools as necessary to start up and test the equipment, system, and/or subsystem.

3.3 WORK TO RESOLVE DEFICIENCIES

- A. In some systems misapplied equipment, and/or deficient performance under varying loads will result in additional work being required to start-up, test, and commission the systems. This work will be

completed under the direction of the Owner's representative. Whereas all members will have input and the opportunity to discuss, debate, and work out problems, the Owner will have final jurisdiction over any additional work done to achieve performance.

- B. Division 23 corrective work must be completed in a timely fashion to permit the timely completion of the start-up, testing, and commissioning process. Experimentation to demonstrate system performance may be permitted.

3.4 ADDITIONAL COMMISSIONING

- A. Additional start-up, testing, and commissioning activities may be required after system adjustments, replacements, etc., are completed. The Contractor shall complete this work as part of the Contractor's basic contractual obligations.

3.5 SEASONAL COMMISSIONING

- A. Seasonal commissioning pertains to testing under full-load conditions during peak heating and cooling seasons, as well as part-load conditions in the spring and fall. Initial commissioning will be done as soon as contract work is completed, regardless of season. Subsequent commissioning shall be undertaken at appropriate times thereafter to ascertain adequate performance during the different seasons.
- B. Cooling equipment will be tested as close to summer design extremes as possible (subject to Owner's schedule limitations) with a fully occupied building. Contractor shall perform the initial and the alternate peak season tests of the systems as required to demonstrate performance.
- C. Training will be conducted by the Contractor and vendors. The Contractor will be responsible for highlighting system peculiarities specific to this project. .

END OF SECTION 23 0801

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SECTION 23 0993 – SEQUENCE OF OPERATION

PART 1 – GENERAL

1.1 DEFINITIONS

- A. DDC: Direct digital controls
- B. VAV: Variable air volume

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CONTROL EXECUTION - GENERAL

- A. All trend logs and test data required by Section 23 0913, Part 3, shall be provided.
- B. All set points, operating points, sequencing ratios, PID tuning parameters, and all other numeric and digital constants shall be adjustable by the user (only with a high-level password) from the graphic. To change these values, the user shall not be required to modify program code, recompile, or download. All points and virtual points shall be capable of being overridden or having a specified value “fixed” from the central workstation to facilitate software testing. To override such a point, the user shall not be required to modify program code, recompile, or download.
- C. Provide independently adjustable, minimum 'on' and 'off' timers for each start/stop point. Initially set times so as not to exceed six starts per hour. On two-speed motors, provide a 20-second adjustable time delay when transferring from high-speed to low-speed to allow the load to decelerate.
- D. System logs, trend logs, and event-initiated logs shall be set up to provide historical and real-time monitoring of system operation. Logs shall include all points associated with the equipment group. Logs shall be grouped by equipment.
- E. Every digital and analog input shall have an alarm assigned to it. Alarm points shall be locked out when equipment is not in use. Provide time delays to prevent false alarms during equipment startup. When a set point is reset, the alarm limits shall be reset. These alarm limits shall be a constant offset from the set point. The alarm set points shall be initially set by this contractor in conjunction with the Owner.

3.2 SEQUENCE OF OPERATIONS AND CONTROL DIAGRAMS.

- A. See drawings for sequence of operations and control diagrams.

END OF SECTION 23 0993

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SECTION 23 3100 – DUCTS AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

- A. Product Data for all items in this section.
 - 1. Performance and construction data including leakage, pressure drop, chemical resistance, and temperature range as appropriate.
 - 2. Cable support systems shall include listings showing equivalency to SMACNA prescribed hangers.
 - 3. Include acoustical data for flexible duct, attenuators, and double wall duct
- B. Shop Drawings: Shop Fabrication Standards listing system type, pressure class, seal class, material, sheet metal gage, reinforcement, seam and joint construction, and type and spacing of hangers and supports including methods for duct and building attachment for all duct systems of this project.
- C. Delegated-Design Submittal: Custom Supports: Details, signed and sealed by the qualified professional engineer responsible for their preparation for hangers and supports not addressed in SMACNA standards or cataloged, pre-engineered product data.
- D. Coordination Drawings: 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. Duct installation indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
 - 2. Duct Fittings
 - 3. Elevation of top or bottom of ducts
 - 4. Dimensions of main duct runs from building grid lines
 - 5. Locations for duct accessories, including dampers, turning vanes, and access doors and panels
 - 6. Suspended ceiling components.
 - 7. Structural members to which duct will be attached.
 - 8. Penetrations of smoke barriers and fire-rated construction.
 - 9. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures
 - b. Air outlets and inlets
 - c. Speakers
 - d. Sprinklers
 - e. Access panels
- E. Welding certificates.
- F. Seismic Control Data: Submit all required information by the Delegated Design Professional in responsible charge of design for Seismic Controls for this project. Where Division 23, Section “Wind,

Seismic, and Vibration Controls for Mechanical Systems” does not indicate any required seismic controls, no such submittal is required.

- G. Wind Resistance Data: For all systems and equipment installed outdoors, submit shop drawings indicating the design of the supports and curbs, the attachments to supports and curbs, and the attachment of the support and curbs to the structure, slab, or grade as required to provide resistance to the wind forces identified in Division 23, Section 23 0548 “Wind, Seismic, and Vibration Controls for Mechanical Systems.” Where there is no product of this section installed outdoors, no such submittal is required.
- H. Field quality-control reports.
 - 1. Duct System Cleanliness Test Report
 - 2. Duct Leakage Test Report
 - 3. Photographs described in PART 3
- I. Close-Out Submittals: Operating test of Fire, smoke, and combination fire/smoke dampers.

1.3 QUALITY ASSURANCE

- A. Comply with AMCA 500-D testing for damper rating.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code - Steel," for hangers and supports
 - 2. AWS D1.2, "Structural Welding Code - Aluminum," for aluminum supports
 - 3. AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.
- D. SMACNA Compliance: Applicable requirements of the current edition of:
 - 1. HVAC Duct Construction Standards - Metal and Flexible
 - 2. Rectangular Industrial Duct Construction Standards
 - 3. Round Industrial Duct Construction Standards
 - 4. System Air Leakage Test Standard

1.4 PERFORMANCE REQUIREMENTS

- A. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.
- B. Contractor shall furnish and install ductwork and accessories, including offsets and size transitions, which may become evident during the course of construction, to avoid building construction and other considerations, to provide a complete and operational system. Make any adjustments in dimensions required to maintain the interior free area shown on the drawings where such adjustments are made or where duct is lined.
- C. Airstream Surfaces: Surfaces in contact with the air stream shall comply with requirements in ASHRAE 62.1.

- D. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements specified design criteria.

PART 2 - PRODUCTS

2.1 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.
 - 1. Galvanized Coating Designation: G90.
 - 2. Finishes for Surfaces Exposed to View or Weather: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts.
- D. Reinforcement Shapes and Plates: ASTM A 36, steel plates, shapes, and bars; black and galvanized.
 - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- E. Tie Rods: Same materials as duct, size per the appropriate SMACNA standard.
- F. Intermediate Reinforcement: Match duct material.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the duct airway size.
- B. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 2, "Rectangular Duct Construction" based on indicated 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 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."
 - a. Where specified for specific applications, all joints shall be welded.
 - 2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal 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." Button punch lock, detail L-2, is not acceptable.
 - a. Where specified for specific applications, all joints shall be welded.
 - 3. 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."

4. Reinforcement Comply with SMACNA "HVAC Duct Construction Standards - Metal and Flexible," based on indicated static-pressure class unless otherwise indicated.
 - a. Internal reinforcement is prohibited in duct with design velocity over 2250 fpm, or on any grease exhaust duct, or any material handling duct.

2.3 DUCT LINER

- A. Do not use duct liner.

2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723 certified by a nationally recognized testing laboratory.

- B. 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-inch .
2. Manufacturer: Carlisle Hardcast DT-5300-Tape with RTA-50 coating or approved equal.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10" w.g., positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to 200°F.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
10. For indoor applications, use sealant that has 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. Manufacturer: Carlisle Hardcast DS-321 coating or approved equal.
2. Application Method: Brush on.
3. Solids Content: Minimum 65%.
4. Shore A Hardness: Minimum 20.
5. Water resistant.
6. Mold and mildew resistant.
7. VOC: Maximum 75 g/L (less water).
8. Maximum Static-Pressure Class: 10" w.g., positive and negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
11. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
12. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- D. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. Description: Extruded butyl/EPDM proprietary copolymer sealant on a siliconized release paper.
 - 2. Manufacturer: Carlisle Hardcast GT-1902, or approved equal.
 - 3. Dimensions: 3/16 inch x 5/8 inch
 - 4. Resistant to mold, mildew, and water:
 - 5. Service temperature: Minus 65 to plus 200°F
 - 6. VOC: 0 g/l.
 - 7. Maximum Static-Pressure Class: 10" w.g., positive and negative.
 - 8. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 9. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals: Seal shall provide maximum leakage class of 3 cfm/100 sq ft at 1" w.g. and shall be rated for 10" w.g. static-pressure class, positive or negative.
 - 1. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 - 2. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5 FABRICATED HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- E. 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.

2.6 STEEL CABLE SYSTEMS FOR DUCT SUPPORT

- A. Manufacturers:
 - 1. Gripple
 - 2. CEAS Wedgy

- B. Manufactured and engineered specifically for duct supports. Listed as an acceptable alternative to the duct hanger systems prescribed in the SMACNA HVAC Duct Construction Standards through the SMACNA Testing & Research Institute (STRI) or the International Code Service Evaluation Service.
- C. Cables for Galvanized Duct: Galvanized steel complying with ASTM A 603.
- D. Cables for Stainless steel Ducts: Stainless steel complying with ASTM A 492.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Contractor shall select, apply, and install hanging and support components in complete compliance with manufacturer's requirements and recommendations.

2.7 DUCT TAKE OFF WITH MANUAL VOLUME DAMPERS

- A. Conical Spin In Fitting With Damper
 1. Type: Single blade up to 20-inch diameter.
 2. Maximum Velocity: (2,000 fpm) or less.
 3. Sleeve: 20-gauge galvanized steel or stainless steel.
 4. Blades: 20-gauge galvanized steel or stainless steel.
 5. Shafts: 0.375-inch square.
 6. Bearings: Synthetic, on each side of damper shaft.
 7. Insulation Stand Off To Accommodate Insulation Thickness.
 8. Locking quadrant with locking wing nut on each side of damper shaft.
- B. Rectangular To Round 45 Degree Shoe Tap Fitting With Damper
 1. Type: Single blade up to 20-inch diameter.
 2. Maximum Velocity: (2,000 fpm) or less.
 3. Sleeve: 20-gauge galvanized steel or stainless steel.
 4. Blades: 20-gauge galvanized steel or stainless steel.
 5. Shafts: 0.375-inch square.
 6. Bearings: Synthetic, on each side of damper shaft.
 7. Insulation Stand Off To Accommodate Insulation Thickness.
 8. Locking quadrant with locking wing nut on each side of damper shaft.
- C. Round To Round 45 Degree Saddle Tap Fitting With Damper
 1. Type: Single blade up to 20-inch diameter.
 2. Maximum Velocity: (2,000 fpm) or less.
 3. Sleeve: 20-gauge galvanized steel or stainless steel.
 4. Blades: 20-gauge galvanized steel or stainless steel.
 5. Shafts: 0.375-inch square.
 6. Bearings: Synthetic, on each side of damper shaft.
 7. Insulation Stand Off To Accommodate Insulation Thickness.
 8. Locking quadrant with locking wing nut on each side of damper shaft.
- D. Round To Round 90 Degree Saddle Tap Fitting With Damper
 1. Type: Single blade up to 20-inch diameter.
 2. Maximum Velocity: (2,000 fpm) or less.

3. Sleeve: 20-gauge galvanized steel or stainless steel.
4. Blades: 20-gauge galvanized steel or stainless steel.
5. Shafts: 0.375-inch square.
6. Bearings: Synthetic, on each side of damper shaft.
7. Insulation Stand Off To Accommodate Insulation Thickness.
8. Locking quadrant with locking wing nut on each side of damper shaft.

E. Damper Actuators: Provide locking quadrant operators on all dampers unless otherwise noted on plans

2.8 MANUAL VOLUME DAMPERS

A. Manufacturers:

1. Air Balance
2. American Warming and Ventilating
3. Arrow
4. Greenheck
5. Louvers & Dampers
6. Nailor
7. Pottorff
8. Ruskin
9. Vent Products
10. Venco

B. Rectangular, Steel, Low Velocity

1. Manufacturer: Ruskin MD35, Greenheck MBD-15 or equal
2. Type: Parallel blade or opposed blade with concealed or exposed linkage, all galvanized steel or all stainless steel
3. Maximum Velocity: (1,500 fpm) or less
4. Frame: 16-gauge, roll formed channel
5. Blades: 16-gauge
6. Maximum Blade Width: 8 inches, exception: single blade up to 12 inches
7. Blades 36 inches and longer and driven blade shall be furnished with reinforcing cone. Maximum blade length is 48 inches
8. Shafts: 1/2-inch
9. Bearings: Synthetic
10. Insulation Stand Off To Accommodate Insulation Thickness.

C. Rectangular, Steel, Medium Velocity

1. Manufacturer: Ruskin CD60 or equal
2. Type: Parallel blade or opposed blade with concealed or exposed linkage, all galvanized steel or all stainless steel
3. Maximum Velocity: (4000 fpm) or less
4. Frame: 16-gauge 1, roll formed channel
5. Blades: 16-gauge
6. Maximum Blade Width: 8 inches
Exception: single blade up to 12 inches
7. Blades 36 inches and longer and driven blade shall be furnished with reinforcing cone. Maximum blade length is 48 inches
8. Shafts: 1/2-inch

9. Bearings: Synthetic or stainless steel sleeve
10. Insulation Stand Off To Accommodate Insulation Thickness.

D. Round, Steel

1. Manufacturer: Ruskin MDRS25, Greenheck MBDR-50 or equal.
2. Type: Single blade up to 20-inch diameter; use rectangular steel with round adapter above 20-inch diameter.
3. Maximum Velocity: (2,000 fpm) or less.
4. Frame: 20-gauge galvanized steel or stainless steel.
5. Blades: 20-gauge galvanized steel or stainless steel.
6. Shafts: 0.375-inch square.
7. Bearings: Synthetic.
8. Insulation Stand Off To Accommodate Insulation Thickness.

E. Rectangular, Aluminum

1. Manufacturer: Ruskin CD-51, Greenheck VCD-43 or equal.
2. Type: Parallel blade or opposed blade with concealed or exposed linkage.
3. Maximum Velocity: (2,000 fpm) or less.
4. Frame: 16-gauge 6063T5 aluminum channel.
5. Blades: 16-gauge 6063T5 aluminum.
6. Maximum Blade Width: 8 inches.
Exception: single blade up to 12 inches.
7. Shafts: 1/2-inch (13-mm), plated or stainless steel.
8. Insulation Stand Off To Accommodate Insulation Thickness.

- F. Damper Actuators: Provide locking quadrant operators on all dampers unless otherwise noted on plans

2.9 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Cesco Products; a division of Mestek, Inc.
3. Ductmate Industries, Inc.
4. Flexmaster U.S.A., Inc.
5. Greenheck Fan Corporation
6. McGill AirFlow LLC
7. Nailor Industries Inc.
8. Pottorff; a division of PCI Industries, Inc.
9. Ventfabrics, Inc.
10. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors. Fabricate and install access panels according to the duct pressure classifications requirement's for each system, and to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

1. Low pressure duct-mounted access doors, for rectangular ducts, with a pressure classification below 3"wc:
 - a. Doors shall have minimal to no leakage while tested below 3"wc:
 - b. Door: Double wall galvanized steel panels.
 - c. Frame: Galvanized steel, dovetail, spin, or press on frames is acceptable.

- d. Insulation: High density insulation fill, with UL classification FHC25/50.
- e. Vision panel at humidifiers or as otherwise noted.
- f. Hinge: Full length galvanized steel piano hinge secured to both frame and door.
- g. Cam and Latches: The cam shall be manufactured from no less than 16 gauge galvanized steel, secured to the door. The latches shall be manufactured from no less than 20 gauge galvanized steel, secured to the frame.
- h. Gasket: Service temperature range of -20 ° F to 150 ° F.
2. Low pressure duct-mounted access doors, for round ducts, with a pressure classification below 3"wc.
 - a. Minimal to no leakage while tested bellow 3"wc:
 - b. Door: Galvanized steel panels.
 - c. Insulation: High density insulation fill, with UL classification FHC25/50.
 - d. Vision panel at humidifiers or as otherwise noted.
 - e. Hinged Type: Full length galvanized steel piano hinge, with no less than 2 latches secured to both panel, and duct on all hinged doors.
 - f. Sandwich Type: Door consists of multiple layers of stamped steel. With molded knobs that have threaded metal inserts to eliminate thread stripping, carriage bolts are secured to inner door with springs to allow for the panel to be easily removed.
 - g. Gasket: Service temperature range of -20 ° F to 150 ° F.
3. Medium pressure hinged duct-mounted access doors, for rectangular ducts, with a pressure classification 3"wc up to 10"wc.
 - a. Doors shall not exceed a leakage rate of more than 2 cfm while testing at 10"wc:
 - b. Door: Double wall galvanized steel panels.
 - c. Frame: Galvanized steel, dovetail, or spin-in
 - d. Insulation: High density insulation fill, with UL classification FHC25/50.
 - e. Double Wall Vision panel at humidifiers or as otherwise noted.
 - f. Hinge: Full length galvanized steel piano hinge secured to both frame and door.
 - g. Cam and Latches: Diecast galvanized steel, secured to the door.
 - h. Gasket: Service temperature range of -20 ° F to 150 ° F.
4. Medium pressure duct-mounted "sandwich type" access doors for round and rectangular ducts, with a pressure classification 3"wc up to 10"wc. Doors shall not exceed a leakage rate of more than 2 cfm while testing at 10"wc:
 - a. Door: Double wall galvanized steel panels.
 - b. Insulation: High density insulation fill, with UL classification FHC25/50.
 - c. Double Pane Vision panel at humidifiers or as otherwise noted.
 - d. Sandwich Type: Door consists of multiple layers of stamped steel. With molded knobs that have threaded metal inserts to eliminate thread stripping, carriage bolts are secured to inner door with springs to allow for the panel to be easily removed.
 - e. Gasket: Service temperature range of -20 ° F to 150 ° F.
5. Medium pressure spin-in type duct-mounted access doors for rectangular ducts, with a pressure classification 3"wc up to 10"wc.
 - a. Doors shall not exceed a leakage rate of more than .5 cfm while testing at 6"wc:
 - b. Door: Double wall, insulated galvanized steel panels.
 - c. Insulation: High density insulation fill, with UL classification FHC25/50.
 - d. Double Pane Vision panel at humidifiers or as otherwise noted.
 - e. Frame: Round spin-in 22 ga galvanized steel.
 - f. Cam and Latches: Diecast galvanized steel, secured to the door.
 - g. Gasket: Service temperature range of -20 ° F to 150 ° F.

2.10 FLEXIBLE DUCTS

- A. Do not use flexible ducts

2.11 MANUFACTURED DUCT CONNECTORS

- A. For rectangular duct, Ductmate WDCI J & H or Ductmate 25/35/45 duct connection systems. Connectors shall be installed in strict accordance with the manufacturer's instructions. Connector material shall be the same as the ductwork material. Or Engineer-approved equivalent.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Duct Installation:
 1. 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 ductwork systems including field identified offsets and adjustments required to avoid conflict with building construction and other conditions. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings, Coordination Drawings, or Requests for Information.
 2. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
 3. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
 4. 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.
 5. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
 6. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
 7. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
 8. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
 9. 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.
 10. All ductwork shall be fabricated and installed so that no undue vibration or noise results. Joints per seal class shall be sealed airtight with additional taping and caulking provided if necessary.
 11. Provide all necessary manual, backdraft, and relief dampers as required for proper adjustment and control of air distribution.
 - a. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts.
 - b. Install steel volume dampers in steel ducts.

- c. Install aluminum volume dampers in aluminum ducts.
 - d. Set dampers to fully open position before testing, adjusting, and balancing.
 - e. Install fire and smoke dampers according to listing and manufacturer's recommendations.
 - f. Backdraft and relief dampers shall be installed per the manufacturer's recommendations.
12. Install duct access doors in the most practical location to gain access to the interior of the duct to allow for inspecting, adjusting, and maintaining accessories and equipment. Duct access doors shall be no less than 1/3 of the duct width/height dimension and no smaller than 12" x 12". If ductwork dimension is smaller than 12" provide access door the same size as duct. Duct access doors are required at the following locations:
- a. Upstream of duct coils.
 - b. Upstream from duct filters.
 - c. At outdoor-air intakes and mixed-air plenums.
 - d. At intake and exhaust louvers.
 - e. At drain pans and seals.
 - f. Upstream from backdraft dampers.
 - g. Upstream from equipment.
 - h. Upstream of control dampers.
 - i. Upstream security bars.
 - j. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Paint access doors red. Provide min 12" x 12" door.
 - k. Upstream from turning vanes in ducts 3" pressure class and over
 - l. Upstream from duct silencers.
 - m. Control devices requiring inspection.
 - n. Elsewhere as indicated.
13. Install flexible connectors to connect ducts to equipment.
14. For fans developing static pressures of 5" w.g. and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
15. 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 movement during start and stop of fans.
16. Transitions in ductwork, in changing shapes and sizes, shall be made with angles not exceeding 15 degrees (diverging) or 30 degrees (converging) wherever possible.
17. Flexible duct shall be used on supply diffuser run outs only, and only where indicated. Flexible ducts shall be installed using lengths not exceeding 5 feet to make the connection. Flexible duct shall be suspended at the manufacturer's recommended intervals, but not exceeding 4 feet, with a minimum 1 1/2" wide 26-gauge steel band to support flex. Maximum allowable sag is 1/2" per foot of spacing between supports.
18. Flexible duct shall be installed such that obstructions do not crush, distort or otherwise intrude on the flexible duct.
19. Flexible duct shall be connected to a beaded end of the runout duct or a take-off fitting. Fasten core of flex duct to runout and diffuser with stainless steel worm-gear drive clamp, plus UL-181 listed tape. Fasten outer jacket with UL-181 listed tape, leaving no exposed insulation.
20. Contractor shall not provide holes in the duct systems for the installation of hangers for other equipment. Work of all other trades shall be so coordinated as to render this unnecessary.
21. At ends of ducts that are not connected to equipment, ductwork, or air distribution devices at time of ductwork installation, provide a temporary closure of plywood or corrugated cardboard backed polyethylene film or other covering that will prevent entrance of moisture, dust, and debris and duct leakage until time connections are to be completed.

22. Manufactured duct connectors shall be installed in strict accordance with the manufacturer's instructions. Material of duct connector shall match ductwork material.

B. Installation of Exposed Ductwork:

1. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
2. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
3. 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.
4. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
5. Provide wire mesh over open ducts that do not receive grills, registers or diffusers.
6. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.2 DUCT PROTECTION

- A. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction."
- B. Store duct sections on jobsite in clean, dry area, on pallets or otherwise elevated from floor or grade. Duct ends and openings shall be covered and protected from dirt and moisture.
- C. Cover and protect duct openings from dirt and moisture during and after erection.
- D. Cover return ducts openings with MERV 8 filters whenever air handlers are operated during construction.

3.3 SEALING OF HVAC DUCTS

- A. Seal ducts to the Seal Class described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" as follows:
 1. Exterior, Supply, Return, or Exhaust Air Ducts, all pressure classes: Seal Class A.
 2. Interior, Supply, Return, Outside, or Exhaust Air Ducts 2" w.g. and Lower: Seal Class B.
 3. Interior, Supply, Return, Outside, or Exhaust Air Ducts. greater than 2" w.g.: Seal Class A.
 4. Other environmental air and comfort conditioning ductwork: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Install hangers and supports for metal ducts and fittings to comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Attachments and Spacing:
 1. Building Attachments: Verify attachment methods with structural drawings. Use concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 2. Where practical, install concrete inserts before placing concrete.
 3. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

4. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
6. Do not use powder-actuated concrete fasteners for seismic restraints.
7. Hanger Spacing: Comply with SMACNA for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection unless more restrictive by SMACNA.
8. Hangers Exposed to View: Threaded rod and angle or channel supports.
9. 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 max. intervals of 16 feet.
10. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Provide flexible and fabric connections at inlet and discharge duct connections to in-line fans, fan coil units and air handling equipment, except when fans are internally isolated. Flexible connections shall be securely fastened to the duct and equipment per SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." Allow at least 1 inch of slack.
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

- A. Paint materials and application requirements are specified in Division 09 painting sections.
- B. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 1. Flat Paints and Coatings: 50 g/L
 2. Nonflat Paints and Coatings: 150 g/L
- C. Low-Emitting Materials: Interior paints and coatings 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."

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. 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. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
 4. Inspect turning vanes for proper and secure installation.
 5. Operate remote damper operators to verify full range of movement of operator and damper.

3.8 DUCT CLEANING

- A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances. Where ductwork is to be painted clean and prepare surface for painting.
- B. Ductwork contaminated or damaged above "shop" or "mill" conditions shall be cleaned, repaired or replaced to the Engineer's satisfaction.
- C. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- B. Supply Ducts: Ducts Connected to single zone Air Handling and Rooftop Units
 - 1. Pressure Class: Positive 2" w.g.
- C. Return and Outdoor Air Ducts: Ducts Connected to Air Handling Units and Rooftop Units
 - 1. Pressure Class: Negative 2" w.g.
- D. Intermediate Reinforcement:
 - 1. Galvanized-Steel Ducts: Galvanized steel
 - 2. PVC-Coated Ducts: Match duct material
 - 3. Stainless steel Ducts: Match duct material
 - 4. Aluminum Ducts: Aluminum
 - 5. Internal reinforcement is prohibited in duct with design velocity over 2250 fpm, or on any grease exhaust duct, or any material handling duct.
- E. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," for general construction requirements. Use radius elbows unless specifically shown otherwise. Offsets shall be radius ogee fittings unless shown otherwise, mitered offsets shall not exceed 30 deg, and shall be without vanes.
 - a. Radius - minimum 1.5 centerline radius-to-width ratio.
 - 1) Smaller radius may be used with splitter vanes and where approved by the Engineer.
 - 2) Radius elbows may incorporate size transition from inlet to outlet
 - 3) Radius elbows may be used for any change of direction angle.
 - b. Mitered Type shall have equal inlet and outlet, and shall have vanes for 90 deg elbows. Elbows 30 deg and less shall have no turning vanes. Mitered elbows shall not be used for changes of direction between 90 deg and 30 deg unless specifically shown or approved by the Engineer.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," for general construction requirements.
 - a. Minimum radius-to-diameter ratio shall be 1.5 and elbow segments shall be 5: Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - b. Radius-to Diameter Ratio: 1.5.
 - c. Round Elbows, 12 inches and Smaller in Diameter: Stamped or pleated.
 - d. Round Elbows, 14 inches and Larger in Diameter: Standing seam or Welded.

F. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," for general construction requirements.
 - a. Rectangular Main to Rectangular Branch: 45-degree entry, or pyramidal where flow is from/to more than one direction.
 - b. Rectangular Main to Round Branch: Conical spin-in.
 - c. Branch to Run Out: Conical spin-in with damper.
 - 1) No dampers on air terminal inlet duct.
 - 2) Locate damper downstream in branch duct where spin-in is not accessible.

END OF SECTION 23 3100

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SECTION 23 3400 – FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUBMITTALS

- A. Product Data: Product data for selected models, including specialties, accessories, certified fan performance curves, certified fan sound power ratings, motor ratings, and electrical characteristics.
- B. Shop Drawings: Shop drawings from manufacturer detailing equipment assemblies and indicating dimensions, weights, required clearances, components, and location and size of field connections.
- C. Wiring Diagrams: Wiring diagrams that detail power, signal, and control wiring. Differentiate between manufacturer-installed wiring and field-installed wiring.
- D. Seismic Control Data: Submit all required information by the Delegated Design Professional in responsible charge of design for Seismic Controls for this project. Where specification section 23 05 48, “Wind, Seismic, and Vibration Controls for Mechanical Systems” does not indicate any required seismic controls, no such submittal is required.
- E. Wind Resistance Data: For all systems and equipment installed outdoors, submit shop drawings indicating the design of the supports and curbs, the attachments to supports and curbs, and the attachment of the support and curbs to the structure, slab, or grade as required to provide resistance to the wind forces identified in specification section 23 05 48, “Wind, Seismic, and Vibration Controls for Mechanical Systems”. Where there is no product of this section installed outdoors, no such submittal is required.

1.3 QUALITY CONTROL

- A. Certificates: Fans shall bear the AMCA Certified Sound Ratings Seal.

PART 2 - PRODUCTS

2.1 FANS (GENERAL)

- A. Provide fans that are factory fabricated and assembled, factory tested, and factory finished, with indicated capacities and characteristics.
- B. Fans and shafts designed for continuous operation at the maximum rated fan speed and motor horsepower. The fan shaft shall be turned, ground, and polished steel designed to operate at no more than 70% of the first critical speed at the top of the speed range of the fan's class.

- C. Provide type of shaft bearings indicated, having a median life "Rating Life" (AFBMA L10) of 200,000 hours, calculated in accordance with Anti-Friction Bearing Manufacturer's Association (AFBMA) Standard 9 for ball bearings and AFBMA Standard 11 for roller bearings.
- D. All 3-phase fan motors 1 hp through 200 hp shall be NEMA Premium. Reference Division 23 Section, "Common Work Results For Mechanical Systems" for additional motor requirements. Fan motors shall be selected so that they do not operate in the service factor at total pressures $\pm 20\%$ from selection point.

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Acme, Carnes, Greenheck, Jenn Fan, Loren Cook, Penn Ventilator, and Twin City Fan and Blower.
- B. Belt-drive or direct-drive, as indicated, centrifugal shall consist of housing, wheel, fan shaft, bearings, motor, drive assembly, curb base, and accessories.
- C. Housings shall be heavy-gauge, removable, spun-aluminum, dome top with outlet baffle; base shall be square, one-piece, hinged, aluminum with venturi design fan inlet cone.
 - 1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains. Upblast units used for kitchen/grease hood exhaust shall be UL 762 listed for application with approved grease reservoir and drain.
- D. The fan wheel shall be aluminum hub and wheel with backward-inclined blades.
- E. Belt-driven drive assembly shall be resiliently mounted to the housing, with the following features:
 - 1. Pulleys: Cast iron, adjustable pitch.
 - 2. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
 - 3. Fan Shaft: Turned, ground, and polished steel drive shaft keyed to wheel hub.
 - 4. Fan and Motor: Isolated from exhaust airstream.
- F. Provide the following accessories where scheduled on the drawings.
 - 1. Disconnect Switch: Non-fusible type, with thermal overload protection, factory-wired through an internal conduit.
 - 2. Bird Screens: Removable 1/2-inch mesh, 16-gauge, aluminum or brass wire.
 - 3. Dampers: Counter-balanced, parallel-blade, backdraft dampers with blade seals mounted in curb base, factory-set to close when fan stops.
 - 4. Roof Curbs: Prefabricated, heavy-gauge, galvanized steel; mitered and welded corners; 2-inch-thick, rigid, fiberglass insulation adhered to inside walls; built-in cant and mounting flange for flat roof decks with 2-inch wood nailer. Size as required to suit roof opening and fan base.
 - a. Coordinate curb materials and construction with roof deck materials. Other curb heights or curbs for sloped roofs may be required.
 - b. Overall curb height shall be a minimum of 12 inches.

2.3 FINISHES

- A. The following factory finishes are required:
 - 1. Sheet Metal Parts: Prime coating prior to final assembly.
 - 2. Exterior Surfaces: Baked-enamel finish coat after assembly.

2.4 SOURCE QUALITY CONTROL

- A. Test fans in accordance with AMCA Standard 300, "Test Code for Sound Rating."
- B. Fans and shafts shall be statically and dynamically balanced.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install fans level and plumb in accordance with manufacturer's written instructions.
- B. Arrange installation of units to provide access space around fan for service and maintenance.
- C. Mount or suspend units on vibration isolators and secure to withstand overturning and seismic forces.
- D. High-Volume-Low-Speed Fans: The fan shall be mounted to the structure. Entire installation shall comply with the manufacturer's recommendations. Consult the manufacturer's installation guide for acceptable I-beam width and proper sizing and placement of angle iron for a span mount. Consult with the Structural Engineer, and provide certification prior to installation that the Structural Engineer has approved the means of attachment to the structure.
- E. The design criteria for the fan-mounting system shall be capable of handling not less than 300 ft-lbs of torque. The fan shall be installed so that the fan blades are at least 10 feet above the floor or as shown. The fan installation area must be free of obstructions such as lights, cables, sprinklers, or other building components; with the blades at least 2 feet clear of all obstructions. The fan shall not be installed where it will be continuously subjected to wind gusts or in close proximity to the outputs of HVAC systems or radiant heaters.
- F. If guy wires are needed, review structural attachments for the guy wires with the Structural Engineer. Provide factory authorized representative for startup and to assist the Balancing Contractor and the Commissioning Agent.

3.2 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.

3.3 CLEANING

- A. Adjusting, Cleaning, and Protecting: Adjust damper linkages for proper damper operation. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheel and cabinet.

END OF SECTION 23 34 00

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SECTION 26 0500 - BASIC ELECTRICAL MATERIALS-METHODS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all items, articles, materials, equipment, operations and/or methods listed, mentioned, shown and/or scheduled on the drawings and/or in these specifications, including all labor, services, permits, fees, utility charges, and incidentals necessary and required to perform and complete the electrical work described in this Division. Apply for all permits early in the project to avoid problems due to code revisions.
- B. See the contract conditions (general and supplementary) and Division 1 for requirements concerning this Division including, but not limited to, submittals, shop drawings, substitution requests, change orders, maintenance manuals, record drawings, coordination, permits, record documents and guarantees.
- C. Division 26 Contractor shall be responsible for all work indicated by Divisions 26, 27, 28, and the electrical portions of Division 33 within the drawings and specifications. Any work indicated by Division 16 shall be provided and installed by the Division 26 Contractor.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Mechanical equipment motors to be furnished under another Division but connected under this Division. Verify and coordinate all equipment locations and electrical characteristics with other trades involved in the work. Coordination shall be done prior to rough-in or ordering equipment.
- B. Control wiring for mechanical equipment beyond provisions shown on the Electrical Drawings shall be performed under another Division of the work.

1.3 QUALITY ASSURANCE

- A. Do all work in accordance with regulations and design and construction standards of the University of Utah, National Electrical Code, state and local codes and amendments, National Fire Codes, and all other applicable codes.

1.4 PROJECT CONDITIONS

- A. The Contractor shall inspect the job site prior to bidding and familiarize himself with existing conditions which will affect the work. Prior to start of work, obtain "As built", "Record", or other Drawings showing existing underground utilities.
- B. Electrical drawings are diagrammatic indicating approximate location of outlets, lighting fixtures, electrical equipment, etc. Consult the Architectural, Structural, and Mechanical Drawings to avoid conflicts with equipment, structural members, etc. When required make all deviations from Drawings to make the work conform to the building as constructed, and to related work of others. Minor relocations ordered prior to installation may be made without added cost to Owner.

- C. Call to the attention of the Engineer any error, omission, conflict or discrepancy in Drawings and/or Specifications. Do not proceed with any questionable items of work until clarification of same has been made.
- D. Under no conditions are beams, girders, footings or columns to be cut for electrical items unless so shown on Drawings or written approval obtained from the Engineer.
- E. Verify the physical dimensions of each item of electrical equipment to fit the available space and promptly notify the Engineer prior to roughing-in if conflicts appear. Coordination of equipment to the available space and to the access routes through the construction shall be the Contractor's responsibility.

1.5 SHOP DRAWINGS

- A. Prior to ordering equipment, and prior to Contractor's first application for payment, the Contractor shall, within 14 days after award of this work, submit complete shop drawings to the Architect, of materials and equipment he proposes to furnish. It is preferred that all sections be submitted at once, however, in the event that one or more sections need approvals quickly and others are not prepared yet, the Engineer will agree to review the individual section submittals needing immediate approval. However, each individual submittal section must be complete and remaining submittals that are not a rush shall be submitted all in one package as quickly as possible. Submitting individual sections over many weeks/months will not be tolerated.
- B. List shall bear Contractor's stamp, signature or other means to show that he has inspected same and certified that submitted material is correct in regard to quantity, size, dimension, quality and is coordinated with the Contract Documents.
- C. See individual sections within this Division for products requiring submittal.
- D. Each shop drawing submittal shall be prepared by the manufacturer, and shall clearly show manufacturer's name, catalog numbers, pictures, details, layout, type, size, rating, style, and all options identified in a permanent fashion. Specific items or options shall be permanently marked on sheets containing more than one option – do not rely on the Engineer to mark options. Yellow highlight will not be an acceptable means of marking.
- E. Some sections of this Division may require shop drawings prepared on full size floor plans in AutoCAD or other CAD software. Where required, contact the Architect for the latest version of the floorplans and match the size and scale of the construction drawings. Drawings delivered to the contractor from the Architect/Engineer may not include addenda changes. Contractor shall only use floor plans for purposes of the construction on this job, and not for any other use or reuse. Add any required addenda items prior to finishing submittals.
- F. Provide complete materials (all materials) list at the beginning of each tabbed section showing "Specification Section", "Material Item," "Manufacturer's Name and Catalog Number," and all pertinent data.
- G. Contractor agrees that Shop Drawing Submittals processed by the Engineer are not Change Orders; that the purpose of Shop Drawing Submittals by the Contractor is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating

which equipment and material he intends to furnish and install and by detailing the fabrication and installation methods he intends to use.

- H. Contractor further agrees that if deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing Submittals are processed by the Engineer, the design Drawings and Specifications shall control and shall be followed.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials shall be new and bear manufacturer's name, model number, electrical characteristics and other identification. All equipment to be U.L. approved or listed by another testing agency approved by authorities having jurisdiction.
- B. Material and equipment shall be standard product of manufacturer regularly engaged in production of similar material for at least five years (unless specifically exempted) and shall be manufacturer's latest design.
- C. If the description of a product is in conflict with the product as specified in the catalog number, the description shall generally take precedence. Contact the Engineer for clarification if this occurs.
- D. All equipment for essential or life safety systems must be rated and certified for the appropriate seismic design category or seismic use group for the installed location.

2.2 DISCONNECTS

- A. Safety and disconnect switches to be Heavy duty quick-make, quick-break, dual rated, lockable, and of such electrical characteristics as required for the load served. Switches to have defeatable cover interlock.
- B. Fuse clips shall accept Class L fuses if required. Motor rated toggle switches equal to Square D Class 2510, type F with thermal overloads may be used as motor disconnects in dry locations.
- C. Disconnect switches required by code shall be installed whether or not specifically shown on the Drawings. Disconnect switches for refrigeration equipment and multiple motor HVAC equipment shall be fusible type.
- D. Safety and disconnect switches (fuse, non-fuse or circuit-breaker type) to be of same manufacturer as switchgear and panelboards.

2.3 FUSES

- A. Provide fuses as indicated on the drawings, sized per NEC, or as required by the equipment manufacturer, whichever provides maximum protection, for a fully operational system.
- B. All fuses shall be furnished of the same manufacturer.

- C. All fuses shall be installed by the electrical contractor at job-site and only when equipment is to be energized. Fuses shall not be installed during shipment.
- D. All fuses to be 200,000 AIC, Current-limiting, U.L., Time Delay, Dual-element Type as follows:

For feeders 600 Amps and less:

Class Rk-1 for 600 volt; LPS-RK, LLS-RK, & A6D-R
Class RK-1 for 250 volt; LPN-RK, LLN-RK, & A2D-R
Class J; JHC, JTD, & AJT

For motor circuits beyond the main and sub distribution boards, 600 volt and below:

Class RK-5 for 600 volt; FRS-R, FLS-R, & TRS-R
Class RK-5 for 250 volt; FRN-R, FLN-R, & TR-R

- E. SPARE PARTS: Provide 10% spare fuses, but not less than 3 of any one size and type.
- F. Approved Manufacturers, with catalog numbers listed in order: Bussman, Littelfuse, Mersen.
- G. If the electrical contractor wishes to furnish materials other than those specified, a written request, along with a complete short circuit and selective coordination study, shall be submitted to the engineer for evaluation at least 8 days prior to the bid date. If the engineer's evaluation indicates acceptance, a written addendum will be issued listing the other acceptable manufacturer.

2.4 BOXES

- A. Outlet and junction boxes shall be sized in accordance with code requirements or as noted on the drawings.
- B. Unless otherwise specified or shown on the drawings, all outlet boxes for new work shall be galvanized steel knockout, outlet boxes. Gangable boxes are not acceptable. Outlet boxes shall not be smaller than 4 inch square and 1-1/2 inches in depth, unless otherwise noted. All outlet box covers, rings, or other fittings shall be galvanized. Boxes which are exposed to the weather shall be cast metal. Outlet boxes for phone and data outlets shall be 2.5-inch-deep boxes.
- C. Outlet boxes shall be designed for the intended use, and shall be installed flush with finish surface lines or not more than 1/8 inch back and shall be level and plumb. Long screws with spaces or shims for mounting devices are not acceptable. No combustible materials shall be exposed to wiring at outlets.
- D. Outlet boxes on opposite sides of fire or sound isolating partitions shall have a minimum horizontal separation of 24 inches. Back to back boxes are not permitted in any walls.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION METHODS

- A. All items, articles, materials, and equipment specified under this Division shall be installed per the manufacturer's installation instructions. Where the manufacturer's instructions are in conflict with

the directions provided elsewhere in this Contract, the Engineer shall be notified prior to beginning rough-in.

- B. Cutting or notching shall be kept to an absolute minimum and done when, and in a method approved by the Engineer. Patch and correct finished surfaces damaged by electrical work.
- C. Relays, panels, cabinets and equipment shall be level and plumb and installed parallel with structural building lines. All equipment and enclosures shall fit neatly without gaps, openings, or distortions. Provide approved devices for closing all unused openings.
- D. Arrange circuit wiring as shown on the Drawings and do not alter or combine runs or homeruns without the specific approval of the Engineer. Feeder runs shall not be recombined or altered.
- E. Contactors, transformers, starters and similar noise producing devices shall not be placed on walls which are common to occupied space.
- F. Ballasts, contactors, starters, transformers and like equipment which are found to be noticeably noisier than other similar equipment on the project will be deemed defective and shall be replaced.
- G. In general, the mounting heights shall be as noted on the Drawings, or as listed below, the Interior Elevations and drawing notes taking precedence. Where no heights are indicated, request clarification from the Engineer. Consult the Architectural, Mechanical and Structural drawings to avoid conflicts prior to roughing-in and for exact locations. All dimensions are to the top of the back box or device whichever is higher. Lighting dimensions are to the bottom of suspended fixtures and center of wall mounted fixtures unless otherwise noted.

Light Switches	48 inches to top
Convenience Receptacles	20 inches to top
Data/Telephone Outlets	20 inches to top
Disconnects and Motor Controllers	72 inches to top
Fire Alarm Signals	96 inches to top (but at least 6 inches below ceiling)
Fire Call Stations	48 inches to top
- H. Where raceways penetrate floors, ceilings, ducts, chases, and fire walls, provide fire stopping to maintain integrity of the fire assembly. Firestopping method shall be approved by the Code Authority having jurisdiction.
- I. All materials and equipment installed under this work shall be properly and adequately supported from the building structure except where ceiling construction or other provisions are specifically designed to support them. Support systems shall provide a safety factor of four. This shall apply to chains, hangers, anchors, clamps, screws, structural iron, and all other hardware and appurtenances associated with the support system.
- J. Rough-in for communications outlets for phone and data systems shall consist of a 4" square deep (4SD) box with a single gang mud ring. Provide a .75-inch conduit for wall phones and a 1-inch conduit for combination voice and data outlets to an accessible ceiling space. Conduit shall be terminated above the ceiling in a bushing and a pull string installed.
- K. Maintain the following minimum separations from voice and data cables:

1. Power conduit – 12 inches
2. Transformers and motors – 40-inches
3. Fluorescent lighting – 12 inches.

Coordinate with the voice and data installer to assure these separations are met.

3.2 LOW VOLTAGE WIRING METHODS

- A. Provide Conduit homeruns complete for all low-voltage systems. Plenum cabling will not be acceptable.
- B. Conductors shall be concealed by conduit in all spaces and shall be run parallel to structural lines and supported at minimum 10' intervals from structure.
- C. All low voltage cable must be suitable for the conditions in which it will be used. Prior to purchasing or installing any cable, confirm with the Mechanical Contractor which areas, if any, require plenum rated cable.
- D. Provide a box, plaster ring, and conduit with insulated bushing from each wall or floor outlet to an accessible ceiling or crawl space. Conduit shall be minimum 3/4" for telephone, minimum 1" combined voice and data outlets, and sized as needed for other systems. Drawings notes shall take precedence. Raceways for phone and data cable shall be sized based on the number of cables in accordance with the following guidelines.

3/4 inch conduit	max 4 cables
1 inch conduit	max 8 cables
1.25 inch conduit	max 14 cables
1.5 inch conduit	max 19 cables
2 inch conduit	max 32 cables

- E. Furnish and install all necessary sleeves and raceways to permit the installation of signal cables (specific attention is called to non-contiguous ceiling spaces) to the appropriate equipment termination point. Provide sleeves through all fire-rated walls and partitions. No outlets of any type shall be left without a raceway system or accessible ceiling path to their termination point. Verify that raceway sizes and quantities are appropriate and will have at least 50% spare capacity after all cables are initially installed. Provide at least one empty spare conduit to each area, sized to handle future needs.

3.3 LABELING

- A. Clearly and properly label the complete electrical system to indicate the loads served or the function of each item of equipment provided under this work.
- B. Permanent Engraved nameplates: shall be 1/16 inch thick, laminated three-ply plastic, center-ply white, outer-ply black (for normal power) or red (for emergency power) or orange (for UPS power) "Lamicoid" or equal. Letters shall be formed by engraving outer colored ply, exposing white center-ply, and shall be a minimum of 5/8 inch high. Nameplates shall be secured with screws or pop rivets.

- C. Provide permanent engraved nameplates for the equipment listed below as well as all other similar equipment; refer to each section for specific labeling requirements:
 - 1. Switchboards and Panelboards
 - 2. Motor Controllers, Variable Frequency Drives (VFD), Safety Disconnects
 - 3. Electrical Contactors and Relays
 - 4. Other similar electrical devices and equipment
- D. Self-Adhesive Labels: shall have self-adhesive “P-Touch” or equivalent sticky backs, black lettering with a clear (see through) background.
- E. Provide self-adhesive labels for the devices and equipment listed below as well as all other similar equipment; each label shall list the applicable circuit number feeding the device and devices fed from Emergency or UPS power shall also list “EMERGENCY” or “UPS” as applicable next to the circuit number (for example, a receptacle fed from circuit 2 in panel 1P1 would read “1P1-2” on the label):
 - 1. Thermal Switches and Manual Starters
 - 2. Power outlet receptacles
 - 3. Light Switches, and Wall Mount timeswitches
 - 4. Fire alarm initiation devices (smoke detectors, heat detectors, pull stations, etc.)
 - 5. Fire alarm notification devices (horn/strobes, etc.)
- F. For Service switchboards, panelboards, and/or disconnecting means, provide a permanent engraved label indicating maximum available fault current as calculated by the Engineer. Include the date calculation was made.
- G. Where existing service entrance components are modified, including where conductors are increased in size, or the service transformer or service disconnecting means is replaced or increased in size, provide a new permanent engraved label on each service switchboard, panelboard, and/or disconnecting means with required information as indicated by the National Electrical Code.
- H. Provide neat and clearly legible handwritten labeling using a permanent “Sharpie” or equivalent chisel tip black marker for all junction boxes containing power and fire alarm wiring. Label each junction box with the applicable circuit number(s) for the cables contained within each junction box in a location and large enough to be clearly visible from the floor.
- I. Provide a laminated copy of the electrical one line diagram(s), size of sheets as required to be clearly visible. Permanently mount within main electrical room, coordinate final location with architect.
- J. Where changes are made in existing panels, distribution boards, etc., provide new labeling and schedules to accurately reflect the changes.

3.4 SAFETY

- A. The Engineer has not been retained or compensated to provide design and construction review services relating to the Contractor's safety precautions or to means, methods, techniques, sequences or procedures required for the contractor to perform the work.

3.5 DEMOLITION

- A. It is the intent of these specifications to require the contractor to make all necessary adjustments to the electrical system, required to meet code, and accommodate installation of the new and remodeled work.
- B. Remove all existing fixtures, clocks, switches, receptacles, raceways, and other electrical equipment and devices and associated wiring from walls, ceilings, floors, and other surfaces scheduled for remodeling, relocation, or demolition unless specifically shown as retained or relocated on the drawings. If existing walls, ceiling, floors, etc. are moved, extend existing devices, fixtures, and circuiting to the new location.
- C. Disconnect all existing mechanical equipment scheduled for removal or relocation. See mechanical drawings for scope of work. Remove abandoned raceways and cables. Relabel panels and motor control centers to reflect changes.
- D. If existing junction boxes will be made inaccessible, or if abandoned outlets serve as feed through boxes for other existing electrical equipment which is being retained, new conduit and wire shall be provided to bypass the abandoned outlets. If existing conduits pass through or are mounted on partitions or ceilings which are being removed or remodeled, new conduit and wire shall be provided to route around the ceiling or wall and maintain service to the existing load.
- E. Extend circuiting and devices in all existing walls to be furred out.
- F. Locations of items shown on the drawings as existing are partially based on as-built and other drawings which may contain errors. Contractor shall verify the correctness of the information shown prior to bidding and provide such labor and material as is necessary to accomplish the intent of the contract documents. The plans may show some demolition conditions, but are not intended to show all of them.
- G. All materials accumulated during the demolition process are the Owners property and shall be removed from the job site as directed by the Owner. If Owner does not wish to salvage materials, contractor shall remove from jobsite and dispose, or recycle materials at contractor's discretion, in a lawful manner.
- H. Where changes are made in existing panels, distribution boards, etc., provide new labeling and schedules to accurately reflect the changes.
- I. Demolish and dispose of hazardous materials in a lawful manner, such as PCB containing transformers or ballasts, mercury containing lamps, or materials containing lead. All costs for proper disposal shall be paid by the contractor unless specified elsewhere in the general conditions.

3.6 POWER INTERRUPTIONS

- A. Keep outages to occupied areas to a minimum and prearrange all outages with the Owner's representative and utilities involved. Requests for outages shall state the specific dates and hours and the maximum durations, with the outages kept to these specified times. When power interruptions will last longer than 5 minutes and cover more than 10% of the building, or affect public areas, they shall be performed on the weekends between 1 and 5 a.m.

- B. Contractor shall coordinate with the Owner so that work can be scheduled not to interrupt operations, normal activities, building access, etc. Coordinate work with other crafts for proper scheduling.
- C. No circuits shall be turned off without prior approval from owner. Coordinate with the Owner any interruptions which affect the operation of the remaining portions of the facility.
- D. This contractor will be liable for any damages resulting from unscheduled outages or for those not confined to the preapproved times. Include all costs for overtime labor as necessary to maintain electrical services in the initial bid proposal. Temporary wiring and facilities, if used, shall be removed and the site left clean before final acceptance. Requests for outages must be submitted at least 5 days prior to intended shutdown time.
- E. Include in bid cost of minimum temporary power for Fire Alarm System, Security, Telephone/Data equipment and any other equipment designated by Owner, during time when primary building power has been interrupted.

3.7 GROUNDING

- A. Ground all electric equipment, raceways and enclosures in accordance with code rules and established safety practices. Provide a single main grounding point where grounding conductors from the Grounding Electrode System ground rods, ground grids, water pipes, main switchgear, etc. may be terminated.
- B. Grounds shall be installed where accessible for future inspection and servicing. Where ground connections are made underground or in inaccessible locations, they shall be made using an exothermic weld process, Cadweld or equivalent or Ampact pressure connectors.
- C. Install grounding conductors in approved metallic raceways unless specifically shown or specified otherwise. Bond at each end and at all intervening boxes and enclosures between the service equipment and grounding electrode.
- D. No. 8 and smaller grounding conductors shall have green insulation. No. 6 and larger shall be marked with green colored tape at each end and at every box, panel, switchboard, or point where conductor is accessible.
- E. All isolated ground buses shall be used only for conductors from isolated ground receptacles. Do not bond conduit or enclosures to isolated ground buses. All isolated ground conductors shall be run back to the main ground point for the separately derived system which serves them.

3.8 EQUIPMENT CONNECTIONS

- A. The location and method for connecting to each item of equipment shall be verified prior to roughing-in. The voltage and phase of each item of equipment shall be checked before connecting. Motor rotations shall be made in the proper direction. Pump motors are not to be test run until liquid is in the system and proper lubrication to all bearings in unit is checked.
- B. Conduit, wire and circuit breaker sizes for mechanical, elevator and similar equipment are based on the equipment ratings of one manufacturer. The equipment actually furnished may have entirely different electrical characteristics. Conduit, wire, circuit breakers, disconnects, etc. shall not be

ordered or installed until exact electrical requirements are obtained. Responsibility for this coordination rests with the Contractor.

3.9 SEISMIC BRACING

- A. Furnish and install all seismic bracing of equipment, feeders, lighting fixtures, and other electrical items in accordance with prevailing codes. Refer to ASCE 7-05, section 13.6 for calculation methods. Provide and submit the required designs, calculations, certifications, and stamped drawings to the authority having jurisdiction and obtain their approval prior to installation or fabrication.
- B. Where conduit, cable trays, or busducts are attached to structures where they cross a seismic isolation interface, the electrical components shall be designed to accommodate the seismic relative displacement.

3.10 PAINTING

- A. All electrical equipment and conduit exposed in finished areas and on exterior walls are to be painted to match surrounding surfaces.
- B. Contractor shall coordinate the timing of painting requirements.
- C. Refer to Architectural specifications for methods and materials.

3.11 PROJECT RECORD DOCUMENTS

- A. Maintenance of Documents:
 - 1. Maintain at Jobsite, One Record Copy of: Contract Drawings, Specifications, Addenda, Reviewed Shop Drawings, Change Orders, Other Modifications to Contract and Field Test Records.
 - 2. Keep apart from documents used for construction.
 - 3. Keep documents available at all times for inspection by Architect.
- B. Recording:
 - 1. Label each document "PROJECT RECORD."
 - 2. Keep record documents current. Do not permanently conceal any work until required information has been recorded.
 - 3. Contract Drawings, legibly mark to record actual construction; including but not limited to the following:
 - a. Depths of various elements; locations of underground items, with dimensions to building walls and corners; changes of dimensions and details; changes made by Addendum, Field Orders or Change Order.
 - b. Specifications and Addenda; legibly mark each Section to record changes made by Addendum, Field Order or Change Order.
- C. As-Built Submittals: At completion of project, transfer changes, addenda items, variations from drawings, exact routes of all feeders and service conduits, and locations of stubbed conduits to clean new prints and specifications which will be supplied by the Architect and deliver to the Architect as

"As-reported Record" drawings. Include dimensions to all buried or concealed conduits to permanent structures.

D. Operation and Maintenance Manuals

1. At completion of project, prepare Operation and Maintenance Manuals with operation and Maintenance Data, contractors warranties, and copies of approved electrical permits. Include corrected copies of original submittals and shop drawings.
2. See Division 01 for additional requirements.

3.12 WARRANTIES

- A. Provide a minimum 1 year warranty on all electrical equipment, devices, labor, and work by Division 26 whether specified or not.
- B. Provide warranties greater than 1 year as specified in other sections where stated. The warranty requirement most stringent shall be used where conflicts arise.
- C. Provide copies of all warranties to the owner upon completion of the project.

3.13 COMPLETION

- A. Complete each system as shown or specified herein and place in operation except where only roughing-in or partial systems are called for. Each system shall be tested and left in proper operation free of faults, shorts or unintentional grounds. Demonstrate system in the presence of the Architect, the Owner or their representative when requested.

3.14 FINAL OBSERVATION

- A. Contractor shall submit written certification that:
 1. Contract Documents have been reviewed.
 2. Contractor has inspected Project for compliance with Contract Documents.
 3. Work has been completed in accordance with Contract Documents.
 4. Equipment and Systems have been tested and are operational.
 5. Project is completed and ready for final inspection.
- B. Engineer will make final inspection as soon as possible after receipt of Certification.
- C. Should Engineer consider that work is finally complete in accordance with Contract Document requirements, Contractor shall make Contract Closeout submittals.
- D. Should Engineer consider that work is not finally complete:
 1. He will so notify Contractor, stating reasons.
 2. Contractor shall take immediate steps to remedy deficiencies, and send second written notice to Engineer certifying that work is complete.
 3. Engineer will re-inspect work.

- E. The Engineer will make two final inspections. The first will determine deficiencies and errors in the work and the second will determine whether or not the noted deficiencies and errors have been satisfactorily corrected.
- F. If additional inspections are required because of the Contractor's failure to complete the deficiencies and errors prior to the second inspection, costs for the successive inspections will be back-charged to the Contractor by the Owner, who, in turn, will reimburse the Engineer. Charges will be based as follows:
 - 1. Engineer time at current billing rates.
 - 2. Travel time, and all other expenses incurred in making inspections.
- G. Contractor to provide one (1) journeyman, tools, meters, instruments and other test equipment required by Engineer. Contractor to remove and replace trims, covers, fixtures, etc., for Engineer to review and test materials, systems, methods and workmanship. (Example: Removing switchboard and panel covers to take voltage/amp readings, review connections and wire size, etc.)

END OF SECTION 26 0500

SECTION 26 0519 - WIRES AND CABLES (600V)

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all wires and cables as herein specified and shown on the associated drawings for service conductors, feeder conductors and branch circuit conductors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Basic Electrical Material & Methods – Section 26 0500.
- B. Raceways – Section 26 0533.

1.3 QUALITY ASSURANCE:

- A. All wire and cable shall meet or exceed the following standards:
 - 1. ASTM-B series specifications
 - 2. ICEA S-61-402/NEMA WC 5 - Thermoplastic insulated cables 0-2000 volt
 - 3. UL Standard 62 and 83 – Thermoplastic insulated cable
 - 4. UL VW-1 Flame Test for sizes #12 through #1
 - 5. National Electric Code (NFPA 70) – Latest edition
- B. Manufacturer's shall be engaged in the manufacturing of industry accepted quality wires and cables for a period of no less than 5 years for all types and sizes required.

1.4 SUBMITTALS (NOT USED)

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of Southwire, Houston Wire, Rome Cable, or similar manufacturer located within the continental North American market. Cables made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.
- B. Substitutions: Equivalent manufacturers are allowed at contractors option, no submittals or prior approvals are necessary if cable meets specifications.

2.2 MATERIALS

- A. Application: For use in general wiring applications for lighting and power in ducts, conduits, wireways and other approved raceways with a maximum conductor temperature of 90 degrees C in dry locations and 75 degrees C in wet locations.
- B. Provide wires and cables that are chemical, gasoline, and oil resistant.

- C. Minimum conductor size shall be No. 12 AWG unless otherwise noted.
- D. Where adverse conductor exposure exists, code approved insulation suitable for the conditions encountered shall be used unless shown otherwise on the Drawings.
- E. Wire and cable shall be new, shall have grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals and shall be delivered in complete coils or reels with identifying size and insulation tags.

2.3 COPPER CONDUCTORS

- A. For No. 10 AWG and smaller, provide soft-drawn stranded copper conductors with type THHN/THWN insulation.
- B. For No. 8 AWG and larger, provide soft drawn stranded, Class B stranded copper conductors with type THHN/THWN insulation.

2.4 ALUMINUM AND/OR METAL CLAD (MC) CABLING OPTIONS

- A. Aluminum and MC Cabling not acceptable – Provide copper only conductors.

2.5 COLOR CODE

- A. All wire shall be fully colored in sizes 12 and 10 AWG, and color banded at each end and at all junction and pull boxes for size 8 AWG and larger.
- B. Color Code throughout the project shall be:

1. 480Y/277V System

Phase A	Brown
Phase B	Orange
Phase C	Yellow
Neutral	Grey
Neutral A (dedicated)	Grey w/black stripe #12 & #10
Neutral B (dedicated)	Grey w/orange stripe #12 & #10
Neutral C (dedicated)	Grey w/yellow stripe #12 & #10
Equipment Ground	Green

2. 208Y/120V System

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Neutral A (dedicated)	White w/black stripe #12 & #10
Neutral B (dedicated)	White w/red stripe #12 & #10
Neutral C (dedicated)	White w/blue stripe #12 & #10
Equipment Ground	Green
Isolated Ground	Green w/yellow stripe #12 & #10 Green and Yellow bands #8 and up

- C. Provide a permanent, plastic engraved label on the inside of each branch-circuit panelboard throughout the project identifying the Color Code used throughout the project. Refer to NEC 200.6 (D).

2.6 SPLICES AND TERMINATIONS

- A. Splices shall utilize Scotch "Hyflex" or "Ideal" wing nut connector installed properly. Crimp on splices designed to be used without wire stripping are not acceptable.
- B. Splices for No. 8 and larger wires shall be made with mechanically applied pressure type connectors.
- C. All taped joints shall be with "Scotch 33+" or equal, applied in half-lap layers without stretching to deform.
- D. Where splice box is subject to rain, weather, or moisture, provide "Rain Tight" termination device.
- E. Terminations of conductors passing through "high heat zones", shown on the drawings, shall be 90°C rated lugs.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Inspect exposed cables for physical damage and remove as length allows.
- B. Utilize pulling compound on long pulls.
- C. Do not exceed manufacturer's minimum bending radius or tension during installation.
- D. Provide dedicated neutrals on all branch power receptacle circuits of 120/208 volt.

3.2 BRANCH CIRCUIT GROUNDED CONDUCTOR (NEUTRAL) WIRING METHODS

- A. Dedicated (separate) neutral wiring methods
 - 1. Provide dedicated neutral wiring for the following system(s):
 - a. Lighting
 - b. Receptacles
 - c. Other than lighting and receptacle branch circuits
 - 2. Provide dedicated (separate) neutral for each branch circuit; shared/common neutral wiring is not allowed.
 - 3. For dedicated neutral branch wiring, there shall be no more than six (6) current-carrying conductors allowed within a single raceway unless specifically allowed otherwise in the drawings. All neutral conductors shall be considered current carrying. Provide all required wire size increases to account for the applicable NEC wire ampacity deratings.
 - 4. Provide dedicated neutral cables with colored stripe as required in wire color coding section for identification.

3.3 SPLICES AND TERMINATIONS

- A. Splices are to be made up complete promptly after wire installation.
- B. Single wire pigtails shall be provided for fixture and device connections. Wirenuts may be used for fixture wire connections to single wire circuit conductor pigtails.
- C. Install wing nut connector properly, according to manufacturers written instructions. Crimp on splices designed to be used without wire stripping are not acceptable.
- D. Torque bolted connections to manufacturers recommendations.
- E. Insulation shall be removed with a stripping tool designed specifically for that purpose. A pocket knife is not an acceptable tool. All conductors shall be left nick-free.
- F. Thermoplastic insulated wire and cable shall not be installed or handled in temperatures below +14°F (-10°C). Cross-linked polyethylene insulated wire and cable may be installed to -°F (-40°C).

3.4 LABELING

- A. Service Cables - Provide an engraved laminated 3-ply plastic “Lamicoid” or equal label which designated as “SERVICE CABLE(S)” attached with a nylon wire tie to the cables at each entry and exit from pullboxes, wireways and any other similar locations.
- B. Feeders – Provide an engraved laminated 3-ply plastic “Lamicoid” or equal label with feeder name attached with a nylon wire tie to the feeder at each entry and exit from pullboxes, wireways and any other similar locations.
- C. Branch Circuits – Clearly mark and identify the circuit number(s) at each junction box and similar location with a permanent black marker or equivalent that is clearly visible. For concealed junction boxes the marking shall be made on the outside coverplate; for exposed boxes or boxes with finished coverplates marking shall be made on the interior of the box where visible when removing the coverplate.

3.5 COMMISSIONING AND TESTING

- A. Contractor shall provide for access and inspection of installed wires and cables by the Architect/Engineer, owner and commissioning agent.
- B. Document all tests and provide written copies in the O&M manuals.
- C. Perform continuity tests and resistance measurements through bolted connections to ensure correct cable connections.
- D. Perform insulation resistance test on all feeder conductors exceeding 100 amps, size #2 and larger. Values shall not be less than 50 megaohms.

END OF SECTION 26 0519

SECTION 26 0526 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all grounding and bonding as code required and as herein specified and shown on the associated drawings.

1.2 APPLICATION

- A. All grounding and bonding shall be by copper only connectors, copper cable and wire, and/or copper braids.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Basic Electrical Material & Methods – Section 26 0500.
- B. Wires & Cables – Section 26 0519.

1.4 QUALITY ASSURANCE

- A. All installation of grounding and bonding conductors shall meet or exceed the following standards:
 - 1. Exceeds ANSI/IEEE 142 for service ground electrode resistance (2.5 ohms rather than 5 ohms).
 - 2. ASTM B 8 stranded conductors
 - 3. ICEA S-61-402/NEMA WC 5 - Thermoplastic insulated cables 0-2000 volt
 - 4. UL Standard 62 and 83 – Thermoplastic insulated cable
 - 5. 4.UL VW-1 Flame Test for sizes #12 through #1
 - 6. National Electric Code (NFPA 70) – Latest edition
 - 7. UL listing is required
- B. Manufacturers shall be engaged in the manufacturing of industry accepted quality grounding connectors for a period of no less than 5 years for all types and sizes required.

1.5 SUBMITTALS (NOT USED)

PART 2 - PRODUCTS

2.1 GROUNDING CONNECTORS AND GROUND RODS

- A. Acceptable Manufacturers: Subject to compliance with all requirements, provide products of one of the following manufacturers for grounding connectors or ground rods:
 - 1. Chance/Hubbell
 - 2. Copperweld Corporation
 - 3. Erico Inc., Electrical Products Group

4. Burndy Electrical
 5. Kearney/Cooper Power Systems
 6. O-Z/Gedney Co
 7. Raco/Hubbell
 8. Thomas & Betts Electrical
- B. Provide products of a quality manufacturer located within the continental North American market. Grounding connectors made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.
- C. Provide products that are listed and labeled by UL for all applications used, and for specific types, sizes and combinations of conductors and other items connected.
- D. For buried connections, provide crimp style connections or welded type connections. For accessible connections, provide bolted pressure-type, torque as per manufacturers recommendations.
- E. Substitutions: Equivalent manufacturers are allowed at contractor's option, no submittals or prior approvals are necessary if ground connectors and rods meet specifications.

2.2 CONDUCTORS

- A. Provide copper or tinned-copper wire and cable insulated for 600 volt unless otherwise required by applicable code or authorities with jurisdiction.
- B. Provide No. 4 and/or No. 6 AWG stranded conductor for bonding conductors.
- C. Bonding Jumper: Provide copper tape, braided copper conductors, terminated with copper ferrules, 1-5/8" wide x 1/16" thick.

PART 3 - EXECUTION

3.1 GROUNDING INSTALLATION

- A. Ground all electrical equipment, raceways and enclosures in accordance with code rules and established safety practices. All grounding systems inside the building must be bonded to the main power service ground, including telecom closets, TV cabling entrances, lightning protection systems, and computer data center grounds. es
- B. Install insulated equipment grounding conductors in all types of raceways for all power feeders and branch circuits
- C. Route grounding electrode conductors along the shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subject to strain, impact, or damage.
- D. Grounding electrode conductors and bonding jumper connections to grounding electrodes shall be accessible (unless allowed by NEC 250.68(A) exceptions) and provide a continuous effective grounding path.

- E. Where ground connections are made underground or in inaccessible locations, they shall be made using an exothermic weld process, Cadweld or equivalent, or Ampact pressure connectors.
- F. Install main grounding electrode conductors in approved metallic raceways unless specifically shown or specified otherwise. Bond at each end and at all intervening boxes and enclosures between the service equipment and grounding electrode.
- G. No. 8 and smaller grounding conductors shall have green insulation. No. 6 and larger shall be marked with green colored tape at each end and at every box, panel, switchboard, or point where conductor is accessible.
- H. Provide bonding jumpers to steel structure as indicated on the plans. Use exothermic welded connectors for steel connections below slab, and/or bolted clamp connections where accessible above slab.
- I. For equipment subject to vibration, install bonding jumper so that vibration is not transmitted through the grounding connection.

3.2 CONNECTIONS

- A. For equipment grounding connections #10 and smaller, grounding conductors may be terminated with appropriate winged pressure type connectors (wirenuts). For #8 and larger, use pressure-type grounding lugs.
- B. Where metallic raceways terminate at metal housings without appropriate electrical connection to housing, terminate each conduit with an insulated throat grounding bushing. Connect grounding bushing with a bare copper grounding conductor to grounding bus and/or grounding terminal electrically bonded to housing.
- C. For all main telephone/data conduits and sleeves exceeding 1-1/2 inches, where serving telephone/data closets and data rooms, provide insulated throat grounding bushings. Connect grounding bushing with a bare copper grounding conductor to grounding bus inside telecom room.
- D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers published torque-tightening values. If manufacturers data is not available, tighten according to UL468A.
- E. For compression type connections, use hydraulic compression tools and dies to provide the correct circumferential pressure for all connectors. Use only tools and dies as recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible, permanent indication that a connector has been adequately compressed onto the grounding conductor.

3.3 COMMISSIONING AND TESTING

- A. Contractor shall provide a time for access and inspection of grounding system for the Architect/Engineer, telecommunications installer and the commissioning agent. Correct all defects and flaws found prior to testing.

END OF SECTION 26 0526

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SECTION 26 0533 – RACEWAY

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all raceways, wireways, and associated fittings as herein specified and shown on the associated drawings.

1.2 APPLICATION

- A. Electric metallic tubing (EMT), galvanized rigid conduit (GRC), intermediate metal conduit (IMC), flexible metal conduit, and PVC conduit may be used.
- B. Schedule 40 PVC conduit may only be used below grade and below slabs on grade. PVC shall not be used above grade. PVC shall not be used in masonry walls and shall not be used in suspended slabs. Conduits larger than 1 inch may be run below the slab. Type EB and DB utility duct shall not be substituted for Schedule 40 PVC.
- C. GRC and IMC shall be used in locations subject to mechanical injury, for penetrations of building and manhole walls, and for service conduit under concrete slabs. GRC and IMC may be used: outside, where exposed to weather, in wet locations, in hazardous locations (as approved by code). Schedule 80 PVC may not be substituted for GRC and IMC.
- D. EMT may be used only in dry and protected locations and in suspended slabs. EMT may not be used: outside, where exposed to weather, in hazardous locations or where subject to mechanical injury.
- E. Flexible metal conduit (FMC) will be permitted only where flexibility is necessary. FMC may be used only where flexibility is necessary in dry protected locations, such as: connections to recessed light fixtures, work fished into existing concealed dry locations, wood frame construction. Flexible metal conduit shall be used for connection to all equipment subject to movement or vibration such as motors and transformers. Length shall not exceed 6 feet unless specified otherwise.
- F. Liquid-Tight Flexible Metal Conduit (LFMC) shall substitute only in those locations where flexible metal conduit is required and additional moisture protection is desired or needed. LFMC may be used: for connections to motors or fixed equipment where subject to moisture or weather and subject to movement or vibration. Length shall not exceed 6 feet unless specified otherwise.
- G. Drawing notes requiring a specific type of raceway shall take precedence over the specifications.
- H. Surface metal or Plastic raceways (Wiremold) shall not be used.
- I. Electrical wiring shall be in U.L. approved raceways and enclosures throughout.
- J. Conduits 4 inch and larger intended for use on primary services and communications services shall have minimum 48-inch radius sweep on all bends.

1.3 RELATED WORK SPECIFIED ELSEWHERE

- A. Basic Material & Methods – Section 26 0500.
- B. Wires and cables (600V) – Section 26 0519.

1.4 QUALITY ASSURANCE

- A. All installation of conduits and raceways shall meet or exceed the following standards:
 - 1. Polyvinyl Chloride (PVC): in accordance with ANSI C80.1 and NEMA Std. Pub. No. RN 1.
 - 2. Rigid Metal Conduit (RMC): in accordance with ANSI C80.1.
 - 3. Electric Metallic Tubing (EMT): in accordance with ANSI C80.3.
 - 4. Seismic Bracing: ASCE 7-05, Section 13.6, latest edition
 - 5. National Electric Code (NFPA 70) – Latest edition
 - 6. UL listing is required
- B. Manufacturer's shall be engaged in the manufacturing of industry accepted quality raceway for a period of no less than 5 years for all types and sizes required.

1.5 SUBMITTALS (NOT USED)

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide products of a quality manufacturer located within the continental North American market. Conduit and Raceways made in Europe, Asia, South America, Africa, or other overseas markets are not acceptable.
- B. Substitutions: Equivalent manufacturers are allowed at contractor's option, no submittals or prior approvals are necessary if conduit and fittings meet specifications.

2.2 RACEWAYS

- A. Galvanized Rigid Metal Conduit (GRC): Provide zinc-coated, hot-dipped galvanized, rigid metallic conduit in sizes indicated on the drawings. Provide RMC in 3/4 inch minimum size.
- B. Intermediate Metal Conduit (IMC): Provide hot-dipped galvanized, intermediate metal conduit in sizes indicated on the drawings. Provide IMC in 3/4 inch minimum size.
- C. Electric Metallic Tubing (EMT): Provide electric metal tubing in sizes indicated on the drawings. Provide EMT in 3/4 inch minimum size.
- D. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight, flexible metal conduit, constructed of single strip, flexible continuous, interlocked, and double-wrapped steel, galvanized inside and outside, coated with liquid-tight jacket of flexible Polyvinyl Chloride (PVC). Provide Liquid-Tight Flexible conduit in 3/4 inch minimum size.

- E. Provide Schedule 40 PVC conduit (where installed below grade or below slab on grade) in one inch minimum size.
- F. Surface metal raceways equal to Wiremold (700 series unless noted otherwise) may be used only where specifically called for on the drawings or in the specifications. Such installation shall be directed and approved by the Architect prior to ordering raceway.
- G. Surface plastic raceways are not acceptable.
- H. Aluminum conduit is not acceptable.
- I. Provide EMT in 3/4 inch minimum size; EMT in 1/2 inch minimum size may be used for fire alarm and low voltage (< 30 volts) control wiring only.
- J. Provide PVC conduit in one inch minimum size.

2.3 FITTINGS

- A. EMT Connectors and couplings shall be steel concrete tight set screw type with insulated throats on connectors. Die-cast fittings or fittings made from pot metal shall not be allowed. Indenter type fittings are not acceptable
- B. Connectors larger than 1-1/4 inch shall utilize equivalent of O-Z/Gedney type SBT/SB insulated bushings.
- C. GRC and IMC shall be coupled and terminated with threaded fittings. Provide fully-threaded, malleable steel fittings, rain-tight and concrete-tight as applicable. Provide double locknuts and metal bushings at all conduit terminations. Ends shall be bushed with insulating bushings (OZ Gedney type B or equal).
- D. PVC shall be provided with matching schedule 40 fittings.
- E. FMC and LFMC fittings shall be in accordance to industry standards.
- F. Sealing bushings are to be provided equal to O-Z/Gedney Type FSK, WSK or CSMI as required by application. Provide equal to O-Z/Gedney Type CSB for internal sealing bushings.
- G. Expansion fittings shall be equal to O-Z/Gedey AXDX.
- H. Cable Supports: Provide OZ Gedney, or equivalent cable supports for vertical risers, type as required by application.
- I. Aluminum conduit fittings are not acceptable.

2.4 SEISMIC BRACING COMPONENTS

- A. Provide the following components for vertical support and lateral/longitudinal seismic bracing:
 - 1. Strut: Unistrut (or equal) P1000 Metal Framing Channel
 - 2. Allthread: Stainless Steel, 3/8 minimum size
 - 3. Angles/Hinges: Bline B335-2 or Mason Industries SCB Swivel Anchor

4. Expansion Anchors: Hilti Kwik Bolt II (or equal) minimum 3/8" x 2-1/4" depth.
5. Hardware: Miscellaneous cap screw/spring nuts and other hardware required for a complete system.

2.5 BOXES

- A. Refer to section 26 0500 for appropriate boxes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Provide pull boxes where shown or required to limit the number of bends in any run to not more than three 90 degree bends. Use code gauge galvanized sheet steel boxes of code required size with removable covers, installed so that covers will be accessible after work is completed. Verify with the Architect any locations in finished areas.
- B. Exposed raceways shall be parallel to structural lines and location must be approved by Architect/Engineer prior to installation. Where exiting from masonry walls in exposed rooms, particular attention and detail should be taken to exit in a neat and orderly fashion, at the correct elevation to hit structural steel roof supports.
- C. Avoid placing conduits within 1-1/2 inches of the upper flutes of roof decking.
- D. Maintain a minimum of 6 inches spacing from Hot water and/or steam lines, and 2 inches from Chilled Water and Culinary Water lines. Do not support conduit from other utility services.
- E. Conduits 4 inch and larger intended for use on primary services and communications services shall have minimum 48-inch radius sweep on all bends.
- F. Conceal all raceways and wiring in finished spaces.
- G. All conduit leaving building envelope (e.g., site lighting, roof mounted HVAC requirement, etc.) to be 0.75 inch minimum.
- H. Field bends and offsets shall be made without flattening, kinking, rippling or destroying the smooth internal bore or surface of the conduit and to not less than NEC minimum radius. Conduit that shows signs of rippling or kinking shall not be installed. Any conduits installed with wrinkles or kinks or otherwise in an unworkmanlike manner shall be replaced at no additional cost to owner.
- I. Precaution shall be exercised to prevent accumulation of water, dirt, concrete, or other foreign matter in the conduits during the execution of the project. Conduits in which water or foreign matter has been permitted to accumulate shall be thoroughly cleaned or the conduits runs replaced where such accumulation cannot be removed by methods approved the engineer.
- J. Permanently cap all spare conduits. Cap or plug conduit ends during construction to prevent entrance of foreign material.
- K. For metal conduit systems, provide electrically continuous conduit systems throughout.

- L. Conduit stubbed from a concrete slab or wall to serve an outlet under a table or to supply a machine shall have a rigid conduit coupling flush with the surface of the slab. Provide plug where conduit is to be used in future.
- M. Conduits in above grade suspended slabs, where written approval is obtained from the Structural Engineer of Record, shall be located in the middle of the slab and spaced according to the minimum recommendations of the ACSE 9-91. There shall be no crossovers, and conduit must be spaced a minimum of 18 inches on center. Conduits larger than one inch shall not be run in suspended slabs.
- N. If work in suspended slabs is approved, EMT must be placed on stands and tied down to prevent floating prior to concrete pour. A minimum of 1-1/2 inch of concrete cover below the conduit and above the conduit is required. The Architect/Engineer must be invited to review and approve the installation prior to the concrete pour. Contractor shall rework any conduit rough that is disapproved.
- O. Avoid placing conduits in pre or post tensioned slabs. The maximum size, spacing, and location of conduits in pre or post-tensioned slabs shall be subject to approval by the Structural Engineer.
- P. Provide ground wire within all conduits sized per NEC code.

3.2 SUPPORT AND SEISMIC BRACING INSTALLATION

- A. Conduit racks shall be adequately braced for Seismic Restraint, as required per ASCE 7-05, Section 13.6, latest edition.
- B. For 3 or more conduits install conduit racks with trapeze style hanging system, with stainless steel 3/8 inch all-threads hanging down to a Galvanized steel strut assembly. Provide conduit clips to rigidly clip conduit to strut.
- C. Provide a diagonal lateral seismic restraint braces at maximum 10 foot intervals (alternating directions), and a longitudinal brace (alternating directions) at maximum 30 foot intervals. Braces must be made of strut or similar rigid material, and will be tied directly to trapeze strut with hinges or rigid angles. Wire ties for bracing will not be acceptable. All hardware made for bracing shall be seismically rated.
- D. If a large number of suspended conduit feeders (more than 12 each exceeding 2-1/2 inches in size) are grouped together, the contractor shall review the layout with the structural engineer, provide estimated weights, and obtain approval for the proposed layout.
- E. Hanger rods shall be fastened to structure in an approved manner. Pullout resistance shall have a safety factor of 4.
- F. Support individual suspended feeder conduits by metal ring or trapeze hangers with threaded steel rods.
- G. Support spacing shall be in accordance with the following table, in addition to these maximum spacing requirements the seismic support and bracing may require additional support and/or spacing supports less than the maximum distance indicated below; the most stringent requirement and shortest spacing distances shall be enforced.

Conduit Type	Conduit Size	Max. Distance Between Conduit Supports	Max. Distance from Outlet Box, Junction Box, Cabinet, Fitting, Conduit Termination or Bends Larger Than 22 Degrees
IMC/GRC	½" to ¾"	10 feet	3 feet for all sizes
	1"	12 feet	
	1.25" to 1.5"	14 feet	
	2" to 2.5"	16 feet	
	3" and larger	20 feet	
EMT	All Sizes	10 feet	3 feet
FMC	All Sizes	4.5 feet	1 foot
LFMC	All Sizes	4.5 feet	1 foot

3.3 FIELD CUTS AND THREADS

- A. Cut all conduits perpendicular and square. Remove all sharp or rough edges and ream all burrs, inside and outside.
- B. Provide clean sharp threads on RMC and IMC. Engage at least five full threads on all RMC and IMC fittings.
- C. Before couplings or fittings are attached, apply one coat of red lead or zinc chromate to male threads of RMC or IMC.
- D. Apply coat of red lead, zinc chromate or special compound recommended by manufacture to conduit where conduit protective coating is damaged.

3.4 EXPANSION AND SEISMIC JOINTS

- A. Expansion Joints:
 - 1. All conduits crossing expansion joints where cast in concrete shall be provided with expansion-deflection fittings, equivalent to O-Z/Gedney AXDX, installed per manufacturers recommendations.
 - 2. All conduits three inches and larger where not cast in concrete shall be rigidly secured to the building structure on opposite sides of a building expansion joint with an expansion-deflection fitting across the joint, equivalent to O-Z/Gedney AXDX, installed per manufacturer's recommendations.
 - 3. All conduits less than three inches where not cast in concrete shall be provided with junction boxes securely fastened on both sides of the expansion joint, connected together with 15 inches of slack (a minimum of 15 inches longer than the straight line length) flexible conduit and copper green ground bonding jumper. In lieu of this flexible conduit, an expansion-deflection fitting, as indicated for conduits three inch and larger, may be installed.
- B. Seismic Joints:
 - 1. No conduits cast in concrete shall be allowed to cross a seismic joint.
 - 2. All conduits shall be provided with junction boxes securely fastened on both sides of the seismic joint, connected together with 15 inches of slack (a minimum of 15 inches longer than

the straight line length) flexible conduit and copper green ground bonding jumper. Prior to installation, verify with Architect that the 15 inches is adequate for the designed movement, and if not, increase this length as required.

3.5 CLEANING

- A. Pull a mandril and swab through all conduits before installing conductors. Raceways shall be left clean and free of debris.
- B. Provide a pull string in all empty conduits.

3.6 COMMISSIONING AND FINAL INSPECTION

- A. Contractor shall provide a time for access and inspection of raceway system for the Architect/Engineer, telecommunications installer and the owner. Correct all defects and flaws found prior to wall and ceiling installation and prior to cabling installation.
- B. Demonstrate rigid seismic bracing to ensure minimal movement of the raceways on suspended racks in a seismic event. Demonstration shall be by pushing with at least 25 pounds force laterally and longitudinally at selected (mid-span) locations along the length of the suspended raceway rack. Rack shall not move more than 2 inches during these demonstrations.

END OF SECTION 26 0533

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SECTION 26 0526 – CABLE TRAY 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 Specifications, apply to this Section.
- B. Refer to Division 26, Section "Common Work Results for Electrical Systems."

1.2 ACTION SUBMITTALS

- A. Product Data: Submit for each type of product. Include data indicating dimensions and finishes for each type of cable tray indicated.
- B. Shop Drawings: For each type of cable tray.
 - 1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
 - 2. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to sides of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.
- C. Delegated-Design Submittal: For seismic restraints.
 - 1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer who is licensed in the state where Project is located and who is responsible for their preparation.
 - 2. Design Calculations: Calculate requirements for selecting seismic restraints.
 - 3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 - 2. Vertical and horizontal offsets and transitions.
 - 3. Clearances for access above and to side of cable trays.
 - 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
- B. Field quality-control reports.

1.4 COORDINATION

- A. Coordinate layout and installation of cable trays and suspension system with other construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 1. Allied Tube & Conduit; a division of Atkore International
 2. B-Line Systems, Inc.
 3. Chalfant Cable Trays
 4. Cope, a division of Atkore International, Inc.
 5. Enduro Composites Inc.
 6. GS Metals Corp.
 7. Legrand North America, LLC
 8. MP Husky USA Cable Tray
 9. Thomas & Betts Corporation
 10. Engineer-approved equal

2.2 GENERAL REQUIREMENTS FOR CABLE TRAY

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.
 1. Source Limitations: Obtain cable trays and components from single manufacturer.
- B. Structural Performance: See articles on individual cable tray types for specific values for the following parameters:
 1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
 2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
 3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.3 WIRE-MESH CABLE TRAY

- A. Description:
 1. Configuration: Galvanized- steel wire mesh, complying with NEMA VE 1.
 2. Width: 12 inches (300 mm) unless otherwise indicated on Drawings.
 3. Minimum Usable Load Depth: 4 inches (100 mm) or as indicated on Drawings.
 4. Straight Section Lengths: 12 feet (3.7 m), except where shorter lengths are required to facilitate tray assembly.
 5. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
 6. Maximum uniform load and support span are indicated by cable tray class.
 7. Class Designation: Comply with NEMA VE 1, Class 12A or as indicated on the Drawings.
 8. Splicing Assemblies: Bolted type using serrated flange locknuts.
 9. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

B. Materials and Finishes:

1. Steel:
 - a. Straight Sections and Fittings: Steel complies with the minimum mechanical properties of ASTM A1008/A1008M, Grade 33, Type 2.
 - b. Steel Tray Splice Plates: ASTM A1011/A1011M, HSLAS, Grade 50, Class 1.
 - c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A510/A510M, Grade 1008.
 - d. Finish: Hot-dipped galvanized after fabrication, complying with ASTM A123/A123M, Class B2.
 - e. Hardware: Galvanized, ASTM B633.

2.4 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.5 WARNING SIGNS

- A. Lettering: 1-1/2-inch-(40-mm-)high, black letters on yellow background, with legend "WARNING! NOT TO BE USED AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL."
- B. Comply with Division 26, Section "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA FG 1 and NEMA VE 2.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable tray and support systems according to NEMA FG 1 and NEMA VE 2.
- B. Install cable tray as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable tray, so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square-neck carriage bolts and locknuts.

- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Provide fasteners and supports to carry cable tray, cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Division 26, Section "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Division 26, Section "Vibration and Seismic Restraints for Electrical Systems."
- H. Place supports, so that spans do not exceed maximum spans on schedules, and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support assembly to prevent twisting from eccentric loading.
- K. Do not install more than one cable tray splice between supports.
- L. Make connections to equipment with flanged fittings fastened to cable trays and to equipment. Support cable trays independent of fittings. Do not carry weight of cable trays on equipment enclosure.
- M. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed recommended dimensions. Space connectors and set gaps according to applicable standard.
- N. Make changes in direction and elevation using manufacturer's recommended fittings.
- O. Make cable tray connections using manufacturer's recommended fittings.
- P. Seal penetrations through fire and smoke barriers.
- Q. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- R. Install cable trays with enough workspace to permit access for installing cables.
- S. Install barriers to separate cables of different systems, such as power, communications, and data processing, or of different insulation levels, such as 600, 5000, and 15,000 V.
- T. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Division 26, Section "Grounding and Bonding for Electrical Systems."
- B. Bond cable trays with electrical power conductors together with splice plates listed for grounding purposes or with listed bonding jumpers.

- C. Bond cable trays with single-conductor power conductors together with a grounding conductor run in the tray along with the power conductors and bonded to the tray at 72-inch (1800-mm) intervals. Size the grounding conductor according to NFPA 70.
- D. When using epoxy- or powder-coat painted cable trays as a grounding conductor, completely remove coating at all splice contact points or ground connector attachment. After completing splice-to-grounding-bolt attachment, repair the coated surfaces with coating materials recommended by cable tray manufacturer.
- E. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

3.4 CONNECTIONS

- A. Remove paint from all connection points before making connections. Repair paint after the connections are completed.
- B. Connect raceways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 1. After installing cable trays survey for compliance with requirements.
 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 4. Verify that there are no intruding items, such as pipes, hangers, or other equipment, in the cable tray.
 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.

7. Check for improperly sized or installed bonding jumpers.
8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 Ohm.

B. Prepare test and inspection reports.

3.6 PROTECTION

A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.
3. Repair damage to paint finishes with matching touchup coating recommended by cable tray manufacturer.

END OF SECTION 26 0536

SECTION 26 0553 – 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 Specifications, apply to this Section.
- B. Refer to Division 26, Common Work Results for Electrical Systems.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate color, lettering style, and graphic features of identification products.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.

PART 2 - PRODUCTS

2.1 RACEWAY AND CABLE LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
 - 1. Color: Black letters on orange field.
 - 2. Legend: Indicates voltage.
- B. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
- C. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape.
 - 1. Not less than 6 inches wide x 4 mil thick (152 mm wide x 0.102 mm thick).
 - 2. Compounded for permanent direct-burial service.
 - 3. Embedded continuous metallic strip or core.
 - 4. Printed legend indicating type of underground line.

- D. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch-thick (0.4 mm) aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
- E. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, unless otherwise indicated, with eyelet for fastener.
- F. Aluminum-Faced, Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002-inch-thick (0.05-mm), laminated with moisture-resistant acrylic adhesive, punched for fasteners, and preprinted with legends to suit each application.
- G. Brass or Aluminum Tags: 2 inch x 2 inch x 0.05 inch (51 mm x 51 mm x 1.3 mm) metal tags with stamped legend, punched for fastener.

2.2 NAMEPLATES AND SIGNS

- A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.
- B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, a minimum of 1/16 inch thick (1.6 mm) for signs up to 20 square inches (129 square cm) and 1/8 inch (3.2 mm) thick for larger sizes.
 - 1. Engraved legend with white letters on black face.
 - 2. Punched or drilled for mechanical fasteners.
- C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch (6.4 mm) grommets in corners for mounting.
- D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch (1 mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4 inch (6.4 mm) grommets in corners for mounting.
- E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

2.3 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
 - 1. Minimum Width: 3/16 inch (5 mm)
 - 2. Tensile Strength: 50 lb (22.3 kg) minimum
 - 3. Temperature Range: Minus 40 to plus 185°F (Minus 40 to plus 85°C)
 - 4. Color: According to color-coding
- B. Paint: Formulated for the type of surface and intended use.
 - 1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
 - 2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
 - 3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
 - 4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.
- C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.
- D. Circuits with more than 600 volts: Identify raceway and cable with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint over a continuous, painted orange background; place warning signs at 10 foot (3 m) intervals. Identify the following:
 - 1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
 - 2. Wall surfaces directly external to conduits concealed within wall.
 - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
 - 4. Entire surface of exposed conduits.
- E. Install painted identification according to manufacturer's written instructions and as follows:
 - 1. Clean surfaces of dust, loose material, and oily films before painting.
 - 2. Prime surfaces using type of primer specified for surface.
 - 3. Apply one intermediate and one finish coat of enamel.
- F. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
 - 1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches wide (51 mm), completely encircling conduit, and place adjacent bands of two-color markings in contact, side-by-side.
 - 2. Band Locations: 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.
 - 3. Apply the following colors to the systems listed below:
 - a. Fire Alarm System: Red
 - b. Fire-Suppression Supervisory and Control System: Red and yellow
 - c. Combined Fire Alarm and Security System: Red and blue
 - d. Security System: Blue and yellow
 - e. Mechanical and Electrical Supervisory System: Green and blue
 - f. Telecommunication System: Green and yellow
- G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

- H. Circuit Identification Labels on Boxes: Install labels externally.
 - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover
 - 2. Concealed Boxes: Plasticized card-stock tags
 - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent

- I. Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches (400 mm) overall, use a single line marker. Install line marker for underground wiring, both direct-buried cables and cables in raceway.

- J. Secondary Service, Feeder, and Branch-Circuit Conductors: Color-code throughout the secondary electrical system.
 - 1. Color-code 208/120-volt system as follows:
 - a. Phase A: Black
 - b. Phase B: Red
 - c. Phase C: Blue
 - d. Neutral: White
 - e. Ground: Green
 - 2. Color-code 480/277-volt system as follows:
 - a. Phase A: Brown
 - b. Phase B: Orange
 - c. Phase C: Yellow
 - d. Neutral: Gray or white with a colored stripe
 - e. Ground: Green with a gray stripe
 - 3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
 - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch-wide (25 mm) tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
 - b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

- K. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
 - 1. Legend: 1/4 inch (6.4 mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations
 - 2. Tag Fasteners: Nylon cable ties
 - 3. Band Fasteners: Integral ears

- L. Apply identification to conductors as follows:
 - 1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

2. **Multiple Power or Lighting Circuits in the Same Enclosure:** Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
 3. **Multiple Control and Communication Circuits in the Same Enclosure:** Identify each conductor by its system and circuit designation. Use a consistent system of tags, color-coding, or cable marking tape.
- M. Apply warning, caution, and instruction signs as follows:
1. **Warnings, Cautions, and Instructions:** Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
 2. **Emergency Operation:** Install engraved laminated signs with white legend on red background with minimum 3/8-inch-high (9 mm) lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- N. **Equipment Identification Labels:** Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch-high (13 mm) lettering on 1-1/2-inch (38 mm) -high label; where two lines of text are required, use labels 2 inches (50 mm) high. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Panelboards, electrical cabinets, and enclosures
 2. Access doors and panels for concealed electrical items
 3. Electrical switchgear and switchboards
 4. Emergency system boxes and enclosures
 5. Motor-control centers
 6. Disconnect switches
 7. Enclosed circuit breakers
 8. Motor starters
 9. Power transfer equipment
 10. Contactors
 11. Control devices
 12. Transformers
 13. Clock/program master equipment
 14. Fire alarm master station or control panel
- O. **Transformer Disconnecting Means Identification:** where transformer disconnecting means is not in sight of transformer, or located in a remote location, the disconnecting means shall be lockable and its location shall be indicated on the transformer. Provide engraved-plastic labels to indicate location of transformer disconnecting means.

END OF SECTION 26 0553

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SECTION 26 0923 – LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.
- B. Refer to Division 26, Common Work Results for Electrical Systems.

1.2 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 specifications. Any submitted device that differs in any manner from that specified must be marked "exception." Clearly indicate exact differences and include all manufacturers' data as indicated.
- B. Product Data: including device operation, warranty period, wiring diagram(s), dimensions, materials, and finishes.

1.3 CLOSE-OUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following: Manufacturers indicated are used to establish a minimum acceptable standard of quality. Similar products by comparable manufacturers may be considered.
 - 1. Indoor Occupancy Sensors:
 - a. Hubbell Building Automation
 - b. Leviton Controls
 - c. Sensor Switch
 - d. Watt-Stopper Inc.
 - e. Or approved equal.

2.2 INDOOR OCCUPANCY SENSORS

- A. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
 4. Power Pack: Dry contacts rated for 20A ballast load at 120 and 277V ac, for 13A tungsten at 120V ac, and for 1 hp at 120V ac. Sensor has 24V dc, 150 mA, Class 2 power source, as defined by NFPA 70.
 5. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
 7. Bypass Switch: Override the "on" function in case of sensor failure.
 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (20 to 2000 lux); turn lights off when selected lighting level is present.
 9. Warranty: 5 years.
- B. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
1. Detector Sensitivity: Detect occurrences of 6-inch-minimum (150 mm) movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
- C. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
- D. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.
 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum (150 mm) movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).

2.3 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application and shall comply with California Title 24.
 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120°F (0 to 49°C).
 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277V, and 1500W incandescent.
 4. Standard Range: 180-degree field of view, with a minimum coverage area capable of sensing occupancy in a room up to 15 feet x 15 feet.
 5. Sensing Technology: Provide PIR or dual-technology sensors to meet space sensing requirements.
 6. Switch Type: selectable for manual 'on' or automatic 'on' at unit.

7. Voltage: match circuit voltage.
8. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 2 to 200 fc (20 to 2000 lux). The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
9. Concealed "off" time-delay selection from 30 seconds to 30 minutes with test mode.
10. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
11. Warranty: 5 years.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install equipment level and plumb and according to manufacturer's written instructions.
- B. Locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have 90 to 100% coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors.
- C. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- D. Set time delay for all occupancy sensors to maximum 30 minutes.
- E. Set Dual-Technology occupancy sensors to be activated by either infrared or ultrasonic technologies.
- F. Mounting heights indicated are to bottom of unit for suspended devices and to center of unit for wall-mounting devices.

3.2 WIRING INSTALLATION

- A. Install wiring between sensing and control devices according to manufacturer's written instructions and as specified in Division 26 Section, "Low-Voltage Electrical Power Conductors and Cables," for low-voltage connections.
- B. Wiring Method: Install all wiring in raceway as specified in Division 26, Section 26 0533, "Raceway."
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions. Bundle, train, and support wiring in enclosures
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Ground equipment Connections
- G. 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.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26, Section 26 0553, "Identification for Electrical Systems."
- B. Label time switches and contactors with a unique designation. Identify controlled circuits in lighting contactors.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections:
 - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Lighting control devices will be considered defective and shall be replaced if they do not pass tests and inspections.
- D. Prepare test and inspection reports and submit to the Owner/Architect for review.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal occupancy hours for this purpose.
 - 1. For occupancy and motion sensors, verify that lighting is controlled to suit the Owner operations. Adjust sensitivity and time delay to suit the Owner's operations.
 - 2. For daylighting controls, adjust set points and deadband controls to suit the Owner's operations.

END OF SECTION 26 0923

SECTION 26 2726 - SWITCHES AND RECEPTACLES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all switches, receptacles, and other devices as herein specified and shown on the associated drawings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Bryant, Arrow-Hart, Eagle, LaGrande, General Electric, Leviton, Hubbell are acceptable.

2.2 MATERIALS

- A. The following list of wiring devices covers the most commonly specified items and establishes the grade of device. Should the Drawings indicate a device other than those listed herein without reference to catalog number, such device shall be of the same grade and manufacturer as like devices.

Single Pole Switches	Hubbell #1221
Duplex Receptacles - 20 amp	Hubbell #5362

All wiring devices and plates to be specification grade. Receptacles shall be mounted vertically with the ground pin down unless otherwise noted.

- B. For normal power, provide white devices as per University standard. Provide stainless steel plates in ALL areas. Receptacles fed by UPS circuits shall have BLUE devices with "UPS POWER" engraved in white letters on a red nylon plate with panel and circuit designation engraved on plate.
- C. Wet location and/or weatherproof receptacles shall be in a weatherproof enclosure, the integrity of which is not affected when the receptacle is in use (attachment plug cap inserted), UL labeled and listed "Suitable For Wet Locations While In Use". Provide enclosure with stainless steel screws, gasket between enclosure and mounting surface and between cover and base, clear impact resistant UV stabilized polycarbonate as manufactured by TayMac Corporation or accepted equivalent.

PART 3 - EXECUTION

3.1 GENERAL

- A. Provide a separate GFI type receptacle for each receptacle noted on plans as GFI. Standard receptacles fed from an up-stream GFI type receptacle are not acceptable.
- B. Install outlets and switches in a neat manner.
- C. Faceplates, devices, and boxes shall be square with floor, and door lines.

- D. Devices to be installed flush with faceplate.

3.2 LABELING

- A. Provide self-adhesive labels for all switches and receptacles in compliance with Section 26 0500.
- B. Where switches control remote lighting or power outlets, or where switches in the same outlet (two or more) serve different purposes, such as light, power, intercom, etc. or different areas, such as corridor and outside, provide self-adhesive labels clearly indicating the function of each switch or outlet.

END OF SECTION 26 2726

SECTION 28 3100 – FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Refer to Division 26 Section, "Common Work Results for Electrical Systems."
- B. Refer to Division 26 Section, "Vibration and Seismic Requirements for Electrical Systems."

1.2 SUMMARY

- A. This project adds two smoke detectors to the existing Honeywell/Gamewell FCI fire alarm system.
- B. The work described in this specification consists of all labor, materials, equipment, and services necessary and required to design, install and test the automatic fire detection and alarm system to the satisfaction of the Authority Having Jurisdiction (AHJ). Any material not specifically mentioned in this specification or not shown on drawings, but required for proper performance and operation as specified, shall be furnished and installed. Device quantities and locations shown on the drawings are diagrammatic only.
- C. The automatic fire detection and alarm system shall meet the requirements of the Owner.
- D. Revised fire detection and alarm system design documents shall be sealed and signed by a Professional Engineer (P.E.), or by a NICET level 3 or 4 Technician and shall include the following:
 - 1. selection of type of system and components
 - 2. identification of fire alarm panel location
 - 3. creation of system concept riser diagram(s)
 - 4. identification of interface(s) required with fire safety functions, other fire alarm systems and other building systems
 - 5. determine average ambient sound level
 - 6. determine minimum candela ratings and placement of strobes
 - 7. identification of all initiating device and notification appliance locations
 - 8. shop drawing preparation, including:
 - a. the layout, the circuiting and placement of initiating devices, notification appliances, and other system components
 - b. preparation of riser diagram(s)
 - c. inclusion of notification appliance circuit voltage drop calculations
 - d. battery calculations for secondary power
 - e. technical data sheets and details for the specific equipment being furnished for installation

1.3 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

- A. This installation shall be made in accordance with the drawings, specifications, and the following:
 - 1. National Electrical Code (NEC)
 - 2. National Fire Alarm Code (NFPA 72)
 - 3. International Building Code (IBC)
 - 4. International Fire Code (IFC)
 - 5. Americans with Disabilities Act (ADA)

6. Underwriters Laboratory (UL)
7. Local codes and Authorities Having Jurisdiction

1.4 SYSTEM DESCRIPTION

- A. General: Non-coded, addressable-analog system with manual and automatic alarm initiation and multiplexed signal transmission dedicated to fire alarm service only. All automatic and manual initiating devices shall be the addressable type.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated. Include annotated catalog data showing manufacturer's name, model, voltage, and catalog numbers for all equipment and components.
- B. Shop Drawings:
 1. Wiring Diagrams: Detail wiring and differentiate between manufacturer-installed and field-installed wiring. Include diagrams for equipment and for systems which are supervised or controlled by the FACP with all terminals and interconnections identified. Diagrams shall show all connections from field devices to the FACP and remote fire alarm control units, initiating circuits, switches, relays, and terminals. Provide point-to-point wiring diagrams showing all internal panel wiring connections and jumper positions.
 2. Power Supply and Battery: Sizing calculations for both the alarm and supervisory power requirements. Ampere-hour requirements for each system component shall be submitted with the calculations.
 3. Voltage drop calculations shall be included.
 4. Provide data on each circuit to indicate that there is at least 25% spare capacity for notification appliances, 25% spare capacity for initiating devices.
 5. Floor Plans: Indicate final quantities and device locations, equipment/enclosure locations, raceway routings,, junction boxes, and other system components required by the AHJ.
 6. System Operation Description: Detailed description for this Project, including method of operation and supervision of each type of circuit and sequence of operations to the satisfaction of the AHJ for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are not acceptable.
 7. Provide a complete list of device addresses and corresponding messages.
 8. Provide detailed drawings of the graphic annunciator construction and wiring connections.
 9. Graphic Panel: Submit full-size drawing at actual production scale.
 10. Provide electronic copy of shop drawings.
- C. Submissions to Authorities Having Jurisdiction (AHJ):
 1. In addition to distribution requirements for Submittals specified in Division 01 Section "Submittals," make an identical submission simultaneously to the AHJ. Provide the number of sets required for plan review by the AHJ. Include copies of annotated Contract Drawings as needed to depict component locations to facilitate review.
 2. Resubmit if required to make clarifications or revisions to obtain approval.
 3. Fire alarm shop drawings shall be sealed and signed by a Professional Engineer (P.E.), or by a NICET level 3 or 4 Technician; both shall be licensed in Utah. By signing and sealing the documents, the Professional Engineer (P.E.), or NICET level 3 or 4 Technician shall certify that the fire alarm installation meets requirements of the local codes and applicable sections of NFPA.

4. On receipt of comments from authorities having jurisdiction, submit these comments to Architect/Engineer for review.
 5. Provide three copies of approved shop drawings, including all AHJ comments at conclusion of review period, to Architect/Engineer.
- D. Coordination Drawings: Plans, sections, and elevations drawn to scale and coordinating installation of smoke detectors in ducts and access to them. Show the following near each duct smoke provision of detector installation:
1. Size and location of ducts, including lining
 2. Size and location of piping
 3. Size and arrangement of structural elements
 4. Size and location of duct smoke detector, including air-sampling elements
- E. Operating Instructions: Specific to the installed system. Provide for permanent mounting at the FACP.
- F. Product Certificates: Signed by manufacturers of system components certifying that products furnished comply with applicable codes, standards, field conditions, and AHJ requirements.
- G. Installer Certificates: Signed by system installer certifying that the system installation and tests comply with applicable codes, standards, field conditions, and AHJ requirements.
- H. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Comply with NFPA 72 and the IFC. Include copy of all test reports with the final Operation & Maintenance manual.
- I. Maintenance Data: Data for fire alarm systems to be included in maintenance manuals specified in Division 01. Comply with NFPA 72 and the IFC.
- J. Certificate of Completion: Comply with NFPA 72 and the IFC.

1.6 QUALITY ASSURANCE

- A. Engineer Qualifications: A Professional Engineer (P.E.), licensed in Utah, with a minimum of 5 years fire alarm design and installation experience who is an authorized representative of the FACP manufacturer for both design and installation of components required for this Project.
- B. NICET Technician Qualifications: A NICET professional, level 3 or 4, with a minimum of 5 years fire alarm design and installation experience who is an authorized representative of the FACP manufacturer for both design and installation of components required for this Project.
- C. Installer Qualifications: An experienced installer with a minimum of 5 years of fire alarm installation experience, who is an authorized representative of the FACP manufacturer for both installation and maintenance of units required for this Project.
- D. Manufacturer Qualifications: A firm with a minimum of five years of experience in manufacturing systems similar to those indicated for this Project and with a record of successful in-service performance.
- E. Source Limitations: Obtain fire alarm system components through one source from a single manufacturer.

- F. Compliance with Local Requirements: Comply with applicable building codes, local ordinances and regulations, and requirements of the AHJ.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Gamewell-FCI, a part of the Honeywell Life Safety Group

2.2 FUNCTIONAL DESCRIPTION OF SYSTEM

- A. Control of System: By the FACP.
- B. System Supervision: Automatically detect and report open circuits, shorts, and grounds of wiring for initiating device, signaling line, and notification-appliance circuits.
- C. Priority of Signals: Automatic alarm response functions resulting from an alarm signal from one zone or device are not altered by subsequent alarm, supervisory, or trouble signals. An alarm signal is the highest priority. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even when the lower-priority condition occurs first. Annunciate and display all alarm, supervisory, and trouble signals regardless of priority or order received.
- D. Noninterference: A signal on one zone shall not prevent the receipt of signals from other zones.
- E. System Reset: All zones are manually resettable from the FACP after initiating devices are restored to normal.
- F. Transmission to Remote Alarm Receiving Station: Automatically route alarm, supervisory, and trouble signals to a remote alarm station by means of a digital alarm communicator transmitter and telephone lines.
- G. System Alarm Capability during Circuit Fault Conditions: System wiring and circuit arrangement prevent alarm capability reduction when a single ground occurs in an initiating device circuit, signal line circuit, or notification-appliance circuit. Refer to Paragraph 2.20 for wiring Class.
- H. Loss of primary power at the FACP initiates a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on the secondary power supply.
- I. Basic Alarm Performance Requirements: Unless otherwise indicated, operation of a manual station, automatic alarm operation of a smoke or flame or heat detector, or operation of a sprinkler flow device initiates the following:
 - 1. Notification-appliance operation.
 - 2. Identification at the FACP and the remote annunciator of the zone originating the alarm.
 - 3. Identification at the FACP and the remote annunciator of the device originating the alarm.
 - 4. Transmission of an alarm signal to the remote alarm receiving station.
 - 5. Unlocking of electric door locks in designated egress paths.
 - 6. Release of fire and smoke doors held open by magnetic door holders.

7. Recall of elevators.
 8. Shutdown of fans and other air-handling equipment associated with the device where the alarm was initiated.
 9. Closing of smoke dampers in air ducts of the system associated with the device where the alarm was initiated.
 10. Recording of the event in the system memory.
 11. Recording of the event by the system printer.
- J. Alarm Silencing, System Reset and Indication: Controlled by switches in the FACP and the remote annunciator.
1. Silencing-switch operation halts both audible and visual notification appliances and activates an "alarm silence" light. Display of identity of the alarm device is retained.
 2. Subsequent alarm signals from other devices or zones reactivate notification appliances until silencing switch is operated again.
 3. When alarm-initiating devices return to normal and system reset switch is operated, notification appliances operate again until alarm silence switch is reset.
- K. Smoke detection initiates the following:
1. Audible and visible indication of an "alarm verification" signal at the FACP.
 2. Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
 3. Recording of the event by the system printer.
 4. General alarm if the alarm is verified.
 5. Cancellation of the FACP indication and system reset if the alarm is not verified.

2.3 SMOKE DETECTORS

- A. General: Include the following features:
1. Operating Voltage: 24V dc, nominal.
 2. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 3. Plug-in Arrangement: Detector and associated electronic components are mounted in a module that connects in a tamper-resistant manner to a fixed base with a twist-locking plug connection. Terminals in the fixed base accept building wiring.
 4. Integral Visual-Indicating Light: LED type. Indicates detector has operated.
 5. Sensitivity: Can be tested and adjusted in-place after installation.
 6. Integral Addressable Module (base-mounted): Arranged to communicate detector status (normal, alarm, or trouble) to the FACP.
 7. Remote Controllability: Unless otherwise indicated, detectors are analog-addressable type, individually monitored at the FACP for calibration, sensitivity, and alarm condition, and individually adjustable for sensitivity from the FACP.
- B. Photoelectric Smoke Detectors: Include the following features:
1. Sensor: LED or infrared light source with matching silicon-cell receiver.
 2. Detector Sensitivity: Between 2.5 and 3.5% per foot (0.008 and 0.011% per mm) smoke obscuration when tested according to UL 268A.
 3. Integral Thermal Detector: Fixed-temperature type with 135°F (57°C) setting.
- C. Ionization Detector: Include the following features:
1. Responsive to both visible and invisible products of combustion.
 2. Self-compensating for changes in environmental conditions.

2.4 WIRE

- A. Non-Power-Limited Circuits: Solid-copper conductors with 600V rated, 75°C, color-coded insulation. Comply with NEC Article 760 (II).
 - 1. Low-Voltage Circuits: No. 16 AWG, minimum.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum.
- B. Power-Limited Circuits: NFPA 70, solid-copper conductors, Types FPL, FPLR, or FPLP, as recommended by manufacturer. Comply with NEC Article 760 (III).
- C. Where required by NFPA 72, provide 2 hour-rated cable for notification appliances.

2.5 CIRCUITS

- A. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B ; Level 1.
 - 1. Initiating Device Circuits: single open (trouble indication); single ground (trouble indication, alarm receipt during abnormal condition).
 - 2. Notification Appliance Circuits: single open (trouble indication); single ground (trouble indication, alarm receipt during abnormal condition); wire-to-wire short (trouble indication)..
 - 3. Install no more than 100 addressable devices on each signaling line circuit.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. 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 in NFPA 72.
 - 5. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- C. Smoke Detectors near air-supply diffuser or return-air opening: Install no closer than 5 feet (1.5 m).

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with NEC Article 760. Unless otherwise indicated, install wiring in metal raceway according to Division 26 Section "Raceways and Boxes for Electrical Systems." Conceal raceway except in unfinished spaces and as indicated. Class A circuits shall be installed such that the outgoing and return conductors are routed separately from the FACP in accordance with NFPA 72, Part 6.4.

- 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.
- E. **Connecting to Existing Equipment:** Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of the building.
 - 2. Connect new equipment to existing monitoring equipment at the supervising station.
 - 3. Expand, modify, and supplement existing control monitoring equipment as necessary to extend existing control monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals according to Division 26 Section "Electrical Identification."

3.4 FIELD QUALITY CONTROL

- A. **Manufacturer's Field Service:** Engage a factory-authorized service representative to inspect field-assembled components and connections and to supervise pretesting, testing, and adjustment of the system. Report results in writing.
- B. **Pretesting:** After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the compliance of the system with requirements of Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones, and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
- C. **Report of Pretesting:** After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of witnesses to preliminary tests.
- D. **Final Test Notice:** Provide a minimum of 10 days' notice in writing when the system is ready for final acceptance testing.
- E. **Minimum System Tests:** Test the system according to procedures outlined in NFPA 72. Minimum required tests are as follows:
 - 1. Verify the absence of unwanted voltages between circuit conductors and ground.

2. Test all conductors for short circuits using an insulation-testing device.
 3. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on record drawings.
 4. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
 5. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10% of initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
 6. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
 7. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.
 8. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
- F. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets Specifications and complies with applicable standards.
- G. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log on the satisfactory completion of tests.
- H. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.

END OF SECTION 28 3100

SECTION 32 3113 - CHAIN LINK FENCES AND GATES

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. Chain-link fence, matching existing.

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. Fence posts, rails, and fittings.
 - b. Chain-link fabric, reinforcements, and attachments.
- B. Shop Drawings: For fence assembly.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For factory-authorized service representative.
- B. Product Certificates: For each type of chain-link fence.
- C. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- D. Field quality-control reports.
- E. Sample Warranty: For special warranty.

1.5 FIELD CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of chain-link fences that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to comply with performance requirements.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Chain-link fence frameworks shall withstand the design wind loads and stresses for fence height(s) and under exposure conditions indicated according to ASCE/SEI 7.
 - 1. Design Wind Load: As indicated on Drawings.
 - a. Minimum Post Size: Determine according to ASTM F 1043 for post spacing not to exceed 10 feet for Material Group IA, ASTM F 1043, Schedule 40 steel pipe.
 - b. Minimum Post Size and Maximum Spacing: Determine according to CLFMI WLG 2445, based on mesh size and pattern specified.

2.2 CHAIN-LINK FENCE FABRIC

- A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist according to "CLFMI Product Manual" and requirements indicated below:
 - 1. Fabric Height: 10 feet.
 - 2. Steel Wire for Fabric: Wire diameter of 0.148 inch.
 - a. Mesh Size: 2 inches (match existing).
 - b. Zinc-Coated Fabric: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied before weaving.
 - c. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.

3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

- A. Posts and Rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on the following:
 1. Fence Height: 120 inches.
 2. Light-Industrial-Strength Material: Group IC-L, round steel pipe, electric-resistance-welded pipe.
 - a. Line Post: 2.375 inches in diameter.
 3. Horizontal Framework Members: Top and bottom rails according to ASTM F 1043.
 - a. Top Rail: 1.66 inches in diameter.
 4. Metallic Coating for Steel Framework:
 - a. Type A: Not less than minimum 2.0-oz./sq. ft. average zinc coating according to ASTM A 123/A 123M or 4.0-oz./sq. ft. zinc coating according to ASTM A 653/A 653M.
 - b. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
 - c. Coatings: Any coating above.

2.4 FITTINGS

- A. Provide fittings according to ASTM F 626.
- B. Post Caps: Provide for each post.
- C. Rail and Brace Ends: For each end post.
- D. Rail Fittings: Provide the following:
 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
 2. Rail Clamps: Line and corner boulevard clamps for connecting bottom rails to posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

H. Finish:

1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.

2.5 GROUT AND ANCHORING CEMENT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout, recommended in writing by manufacturer, for exterior applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
 1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CHAIN-LINK FENCE INSTALLATION

- A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
 1. Installation to match existing.
- B. Post Excavation: Drill holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts with mechanical anchors at indicated spacing into firm, undisturbed soil.
 1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
 2. Mechanically Driven Posts: Drive into soil to depth of 30 inches. Protect post top to prevent distortion.
- D. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

- E. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- F. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.
- G. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
 - 1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 24 inches o.c.
- H. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 32 3113

SECTION 40 9100 – INSTRUMENTATION AND CONTROL DEVICES

PART 1 – GENERAL

1.1 SUMMARY

- A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specifications apply to this section.
- B. Contractor shall provide Instrumentation and Control Devices in accordance with the Contract Documents. Where instrumentation is furnished by the boiler manufacturer it shall also comply with this section unless approved by Engineer prior to bid.

1.2 RELATED SECTIONS

- A. Division 01 Section “General Commissioning Requirements” for responsibilities and procedures of the Commissioning Agent.
- B. Division 23 equipment and system sections with specific control requirements.
- C. Division 23 Section, “Testing, Adjusting, and Balancing for HVAC” for responsibilities and procedures of the TAB Contractor.
- D. Division 26 sections for electrical equipment and wiring and conduit requirements and any electrical interface to the controls and instrumentation.

1.3 WIND AND SEISMIC CRITERIA

- A. All system components must comply with the wind and seismic requirements of Division 23 Section "Wind, Seismic, and Vibration Controls for Mechanical Work." These include requirements for anchorage, internal, and attached/imbedded components. Included are the minimum 2018 IBC requirements plus additional criteria for this project. Systems requiring systems and components to be designated with a Component Importance Factor of 1.5 and requiring certification are tabulated in Division 23 Section "Wind, Seismic, and Vibration Controls for Mechanical Work."
- B. Seismic Performance: Both Mechanical equipment and integrally mounted or separately mounted accessories and components with a component importance factor of 1.5 shall withstand the effects of earthquake motions determined according to ASCE 7 and remain operational.
 - 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."

1.4 PRODUCTS SUPPLIED, BUT NOT INSTALLED UNDER THIS SECTION:

- A. The automatic temperature control valves, separable wells for immersion sensors, shall be provided by the Controls Contractor for installation by the Mechanical Contractor under the Controls Contractor's supervision. Taps for flow and pressure instruments shall be located by the Controls Contractor for installation by the Mechanical Contractor.

- B. The Controls Contractor shall provide all automatic temperature control dampers which are not part of packaged equipment, for installation by the Mechanical Contractor under the Control Contractor's supervision.

1.5 SUBMITTALS

- A. Control Systems Hardware Equipment Submittal: Contractor shall submit a complete, bound package at one time within 60 Days after the commencement date stated in the "Notice to Proceed" including,
 - 1. An index that lists each device by tag number, type, and equipment manufacturer. Tag numbers shall match those shown on the P&ID drawings.
 - 2. A separate technical brochure or bulletin shall be included with each instrument data sheet. The data sheets shall be indexed in the submittal by systems or loops, as a separate group for each system or loop. If, in a single system or loop, a single type of instrument is employed more than once, one data sheet with one brochure or bulletin may cover multiple identical uses of that instrument in that system. Each brochure or bulletin shall include a list of tag numbers for which it applies. System groups shall be separated by labeled tags or colored sheets of paper.
 - 3. Any proposed Contractor substitutions shall be clearly identified in a column on the index. The Contractor is responsible for including adequate information in the submittal to show that the proposed substitution shall satisfy the specification requirements. Those components that the Owner find unsuitable shall be rejected.
- B. Contractor shall complete data sheets according to ISA S20 - Specification Forms for Facility Measurement and Control Instruments, Primary Elements and Control Valves, for each component, with the technical manufacturer's data sheets for that device, including any options. Any manufacturer's technical product brochures used shall be complete enough to verify conformance to Contract Document requirements. The submitted product data sheets, at a minimum, shall show:
 - 1. Each component's functional description as used in the Contract Documents
 - 2. Manufacturer's name and Manufacturer's model number
 - 3. Specific project tag number used in the Contract Documents (if there are multiple similar devices, one manufacturer's product data sheet can be submitted with and index of all the devices that it applies to).
 - 4. Specific project system or loop of which the component is a part
 - 5. Site location or assembly at which the component is to be installed
 - 6. Signal and power input and output characteristics
 - 7. Scale, range, units, and multiplier (if required)
 - 8. Requirements for electric supply (if required)
 - 9. Requirements for air supply (if required)
 - 10. Materials of the component parts that will be exposed to the facility media and corrosive ambient air
 - 11. Any special requirements, options, or features inherent to the components.
 - 12. Any special requirements for mounting of the component in a specific area of the site.
- C. List of spare parts for every device and prices of those devices.
- D. Contractor shall provide sizing calculations for any pressure, temperature, level, or flow meter that they propose to substitute.
 - 1. The calculations shall be submitted on the instrument manufacturer's letterhead.

2. Proposed meters size shall be based upon the minimum, average, and maximum ranges shown in the Contract Documents.
 3. Any applicable permanent head-loss, velocity changes, pressure changes, or temperature changes associated with each meters shall be boldly indicated.
 4. Contractor shall provide flow vs. differential pressure curves for each head-type device. Contractor shall provide pressure and temperature compensation curves for compressible fluids.
- E. Contractor shall provide references to the applicable ASME or ISA standard equations used to calculate the data presented. Contractor shall provide a listing of every constant used in the equations and the units for every parameter used in the calculations.
- F. Provide engineering calculations or laboratory test data to demonstrate that the hardware provided will meet the seismic performance requirements indicated in the Contract Documents. Calculations shall be sealed by a registered professional Engineer. Refer to the Structural drawings for seismic design data.

1.6 REFERENCES

- A. This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.
1. API RP550 – Manual on Installation of Refinery Instruments and Control Systems, Part I – Sections 1 through 13.
 2. ISA S20 – Specification Forms for Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
 3. ISA S51.1 – Process Instrumentation Terminology

PART 2 – PRODUCTS

2.1 GENERAL

- A. Implementation of Current Technology: Meters, gauges, analytical instruments, and other components shall be the most the recent field-proven models marketed by their respective manufacturers at the time of preparation of the Submittal Drawings unless older model components are required to match existing equipment. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.
- B. Equipment installed in hazardous areas shall meet Class, Group, and Division as shown on the Drawings, to comply with the National Electric Code.
- C. All instruments shall return to accurate measurement without manual resetting upon restoration of power after a power failure.
- D. Unless otherwise shown or specified, local indicators shall be provided for all instruments. Where instruments are located in inaccessible locations, local indicators shall be provided and shall be mounted as specified. All indicator readouts shall be linear in process units. Readouts of 0-100%

- shall not be acceptable, except for speed and valve position. Floating outputs shall be provided for all transmitters.
- E. Unless otherwise specified, field instrument and power supply enclosures shall be 316 stainless steel, fiberglass, or PVC coated copper free cast aluminum NEMA 4X construction.
 - F. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted, installed adjacent to the sensor. Special cables or equipment shall be supplied by the associated equipment manufacturer.
 - G. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture, and fungus. Solid-state components shall be conservatively rated for long term performance and dependability over ambient atmospheric fluctuations. Ambient condition tolerance shall be -15 to 50°C and 5 to 95% relative humidity, unless otherwise specified. Field mounted equipment and system components shall be designed for installation in dusty, humid, and corrosive service conditions.
 - H. All devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, insofar as possible, and shall consist of equipment models which are currently in production. All equipment provided, where applicable, shall be of modular construction and shall be capable of field expansion.
 - I. All non-loop powered instruments and equipment shall be designed to operate on a 60 Hz alternating current power source at a nominal 117 V, plus or minus 10%, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided. Where equipment requires voltage reduction, constant voltage transformers shall be supplied.
 - J. All analog transmitter and controller outputs shall be isolated, 4-20 milliamps into a load of 0-750 ohms, unless specifically noted otherwise. All switches shall have double-pole, double-throw contacts rated at a minimum of 600 VA, unless specified otherwise.
 - K. Loop Accuracy: The accuracy of each instrumentation system or loop shall be determined as a probable maximum error; this shall be the square root of the sum of the squares of certified "accuracies" of the designated components in each system, expressed as a percentage of the actual measured range or value of the measured variable. Each individual instrument shall have a minimum accuracy of plus and minus 0.5% of full scale and a minimum repeatability of plus and minus 0.25% of full scale unless otherwise indicated in the specifications. Instruments that do not conform to or surpass these criteria shall not be acceptable. Loop Isolators and Converters: Signal isolators shall be provided as required to confirm component impedance matching in circuits where feedback paths could be generated, or in order to assure loop integrity during the removal of a systems loop component for testing or maintenance procedures. Voltage-dropping precision wire-wound resistors shall be installed at field side terminations within the control panels to ensure the affected loop's integrity. Signal conditioners and/or signal converters shall be provided where required to rectify any signal level incompatibilities or provide required functions.
 - L. Reporting Accuracy
 - 1. The system shall report all values with an end-to-end accuracy as listed, or better, than those listed below:
 - a. Ducted air 1 °F
 - b. Delta-P 1 inch w.g.

Control Stability and Accuracy:

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±0.2 in. w.g. ±0.01 in. w.g.	0-6 in. w.g. -0.1 to 0.1 in. w.g.
Airflow	±10% of full scale	All
Space Temperature	±1.0°F	
Duct Temperature	±2.0°F	
Fluid Pressure	±1.5 psi ±1.0 in. w.g.	1-150 psi 0-50 in. w.g. differential

- M. Signal Levels: Analog measurement and control signals shall be ranged as indicated in the contract documents, and shall vary in direct linear proportion to the measured facility variable. Electrical signals outside control panels shall be 4 to 20 milliamperes dc. Signals within enclosures may be 1 to 5V dc or 0-10V dc. Electric signals shall be electrically or optically isolated from other signals.
- N. Contractor shall furnish a priced list of special tools required to calibrate and maintain the instrumentation provided.
- O. All instruments shown on the drawings shall be provided by the Contractor. Additional instruments may be required to complete the instrument loops because of certain characteristics of the particular equipment selected by the Contractor. Such additional instruments shall be provided at no additional cost even though not specified on any list or on the contract drawings.

2.2 ACCESSORIES

- A. Isolation Valves – Valves shall comply with Section 23 05 23, when specified otherwise shall be full port ball valves with ASTM A276, Type 316 stainless steel trim and body and with Teflon seats and packing. Valves shall be Parker CPI, Whitey, Hoke, or Engineer-approved equal.
- B. Gauge Valves – Gauge valves shall be machined from ASTM A276 bar stock and shall be provided with 1/2-inch NPT connections and integral bleed valve. Valves shall be Anderson, Greenwood & Company M9530, Hoke 6801L8Y, or Engineer-approved equal.
- C. Root Valves – Root valves shall be ASTM A276, Type 316 stainless steel bar stock with 1/2-inch NPT male process connection and three 1/2-inch NPT female instrument connections. One instrument connection shall be provided with an ASTM A276, Type 316 stainless steel bleed valve. ASTM A276, Type 316 stainless steel plugs shall be provided for unused ports. Lagging type units shall be provided for insulated vessels and pipes. Root valves shall be Anderson, Greenwood & Company M5 AVS-44, Hoke 6802L8Y, or Engineer-approved equal.
- D. Manifolds – Manifolds shall be three-valve bar-stock type. Manifold body shall be machined from 316 stainless steel bar stock. Valves shall be globe configuration with 316 stainless steel ball seats and Teflon stem packing. Manifolds shall be designed for direct mounting to differential pressure transmitters in place of the flanges normally furnished. Fabricated manifolds or manifolds employing needle or soft seat valves are not acceptable. Purge taps, 1/8-inch NPT shall be furnished on manifolds where water purge is specified. Manifolds shall be Anderson Greenwood M4TVS, Hoke 8123F8Y, or Engineer-approved equal.

- E. Tubing – Instrument tubing between the process connection and instruments shall be 1/2-inch x 0.065-inch seamless annealed ASTM A269, Type 316 stainless steel. Tubing fittings shall be Type 316 stainless steel. Fittings shall be of the swage ferrule design and shall have components (nut, body and ferrule system) interchangeable with those of at least one other manufacturer. Flare and ball sleeve compression type are not acceptable. Fittings shall be Swagelok, Parker CPI, or Engineer-approved equal.
- F. Chemical Seals
1. Diaphragm – Seal shall be the diaphragm type with flushing connection, Type 316 stainless steel body and Type 316L diaphragm unless otherwise specified. Seal shall be Mansfield and Green Type SG, Ashcroft Type 101, or Engineer-approved equal.
 2. Annular Ring – Seal shall be the in-line full stream captive sensing liquid type. Metallic wetted parts shall be Type 316 stainless steel. Flexible cylinder shall be Buna-N unless otherwise specified. Seals shall be rated 200 psig with not more than 5-inch WC hysteresis. Seals shall be Ronningen-Petter Iso-Ring, Red Valve series 40, or Engineer-approved equal.
 3. Fill Fluid – Chemical seals and associated instruments shall be factory filled as follows: Instrument side of seal, capillary tubing, and instrument shall be evacuated to an absolute pressure of 1.0 Torr or less; filled; and sealed. Unless otherwise specified, fill fluid shall be silicone oil, Dow Corning DC200, Syltherm 800, or Engineer-approved equal.
- G. Bushings and Thermowells – Bushings or thermowells shall comply with SAMA PMC17-10. Temperature taps shall be 1/2-inch NPT, and lagging extensions shall be provided on insulated vessels or pipes. Thermowells and bushings shall be machined from Type 316 stainless steel bar stock unless otherwise specified.
- H. Purge Assemblies
1. Air – Air purge assembly shall consist of a constant-differential relay, needle valve, check valve and 0.2 to 2.0 scfh rotameter. Assembly shall be Moore Products 62VA, Fischer & Porter 10A3137N-3BR2110, or Engineer-approved equal.
 2. Water – Water purge assembly shall consist of a strainer, constant-differential regulator, needle valve, check valve, and 20 to 200 cc/m rotameter. Assembly shall be Moore Products 63BD4A, Fischer & Porter 10A3137N-53BR2110, or Engineer-approved equal. Strainer shall be 155 micron wye-type, ASCO 8600A2, Crane, or Engineer-approved equal.

2.3 POWERED INSTRUMENTS GENERAL REQUIREMENTS

- A. Powered instruments are those instruments which require power (120V ac or 24V dc loop power) to operate. Each instrument includes an element or analyzer and a transmitter/controller.
- B. Transmitters shall be 4 to 20 milliampere output two-wire type with operating power derived from the transmission circuit. Transmitter shall support an external load of 0 to 600 ohms or greater without requiring trimming resistors with a transmission circuit power supply of 24 volts. Transmitter output shall be galvanically isolated from the process and the transmitter case. Time constant of transmitters used for flow or pressure measurement, including level transmitters used for flow measurement, shall be adjustable from 0.5 to 5.0 seconds. Transmitter output shall increase with increasing measurement except where "reverse action" is specified in the instrument schedule.
- C. Electrical parts of transmitter and/or primary element mechanisms shall, as a minimum, be housed in enclosures meeting NEMA 250, Type 4 requirements. Where electrical mechanisms are located

outdoors or in areas specified as corrosive, enclosures shall meet NEMA 250, Type 4X requirements.

- D. Transmitters located outdoors shall be provided with surge protectors: Rosemount Model 470A, Taylor 1020FP, or Engineer-approved equal.
- E. Where two-wire transmitter is located in an area classified as hazardous, it shall be made safe by means of an intrinsic safety barrier. Intrinsic safety barriers for two-wire transmitters shall be of the active, isolating, loop powered type. Barrier shall be Measurement Technology LTD. type MT3042, Stahl 9005/01-252/100/00, or Engineer-approved equal.
- F. Where four-wire transmitters are permitted, they shall be provided with a loop powered signal current isolator connected in the output signal circuit. Isolator shall provide galvanic isolation of milliamperere transmission signals from transmitters with inadequately isolated output circuits. Isolator shall be housed in a NEMA 250, type 4/7 conduit body and shall derive its operating power from the signal input circuit. Input and output signals shall be 4 to 20 milliamperes, and error shall not exceed 0.1 percent of span. Input resistance shall not exceed 550 ohms with an output load of 250 ohms. Isolator shall be Moore Industries SCX/4-20MA/ 4-20/MA/6.5DC/-RF(EX).

2.4 PROCESS SWITCHES GENERAL REQUIREMENTS

- A. Contact outputs used for alarm actuation shall be ordinarily closed and shall open to initiate the alarm. Contact outputs used to control equipment shall be ordinarily open and shall close to start the equipment. Contacts monitored by solid state equipment such as programmable controllers or annunciators shall be hermetically sealed and designed for switching currents from 20 to 100 mA at 24V dc. Contacts monitored by electromagnetic devices such as mechanical relays shall be rated NEMA ICS 2, designation B300. Double barriers shall be provided between switch elements and process fluids such that failure of one barrier will not permit process fluids into electrical enclosures. Switch electrical enclosures shall be rated NEMA 250, type 4 minimum. Contacts in Class 1, Division 01 areas and monitored by solid-state circuits shall be made safe by suitable intrinsic safety barriers as specified in Division 26.

2.5 AIR TUBING

- A. Air tubing shall be bending temper copper or stainless steel.
- B. Tubing Fittings:
 - 1. Copper Instrumentation Tubing:
 - a. Solder-type fittings shall be wrought sweat fittings applied with 95% tin, 5% antimony solders as manufactured by Mueller Brass "Streamline;" Nibco, Inc.; or Chase Brass & Copper Co.
 - b. Compression-type fittings shall be Swagelok, Imperial-Eastman "Hi-Duty," or Parker Hannifin "CPI."
 - 2. Stainless Instrumentation Tubing:
 - a. Fittings shall be 316 stainless two-ferrule fittings applied as manufactured by Swagelok.
 - b. Compression-type fittings shall be Swagelok, Imperial-Eastman "Hi-Duty," or Parker Hannifin "CPI."

2.6 CONTROL VALVES

- A. Approved manufacturers are Val-Tek and Fischer. Performance criteria listed in the Valve List takes priority over the general requirement listed herein.
- B. Control valves shall be 2-way or 3-way type for two-position or modulating service as scheduled, shown on drawings, or as specified in Sequence of Operation.
- C. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum closeout pressure ratings:
 - 1. Water Valves:
 - a. 2-way - 150% of total system (pump) head.
 - b. 3-way - 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 - 2. Steam Valves: 150% of operating (inlet) pressure.
- D. Control Valves:
 - 1. Body and trim style and materials shall be per manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - 2. Rangeability of control valves shall be as follows:
 - a. Valves NPS 1/2 through NPS 1, 25:1 minimum
 - b. Valves over NPS 1, 50:1 minimum
 - 3. Sizing and Selection Criteria:
 - a. Flow velocities shall not exceed the manufacturer's recommendations.
 - b. Two-position service: Line size.
 - c. Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 4 psi maximum, 2 psi minimum.
 - d. 3-way Modulating Service: Pressure drop equal to twice the pressure drop through the coil exchanger (load), 3 psi maximum, 2 psi minimum.
 - e. 2-way modulating valves NPS 2 and smaller may be ball type valves with factory installed actuators (in lieu of globe type) for water service.
 - f. Modulating water valves NPS 4 and larger may be tight-closing butterfly type with electric or pneumatic actuators with positioners (in lieu of globe type). Maximum 60-degree rotation.
 - 4. Materials:
 - a. Valves NPS 1/2 through NPS 2 shall be bronze body or cast brass ANSI Class 250, spring loaded, Teflon packing, quick opening for two-position service. Two-way valves to have replaceable composition disc.
 - b. NPS 2-1/2 valves and larger shall be cast iron ANSI Class 125 with guided plug, stainless steel stems, and Teflon packing.
 - 5. Ball Valves (water service only): Valve body shall be forged brass or bronze, two-piece construction with stainless steel ball and stem, reinforced Teflon seat and two O-ring packing, 600 psi (NPS 1/2 to NPS 1-1/4) 300 psi, (NPS 1-1/2 to NPS 4) pressure rating at 254°F. The valve shall have a flow characterizing disk in the inlet of the valve to provide an equal percentage response. Provide with factory assembled actuators. The valve actuator assembly shall have a minimum 200 psi close off. Belimo or Engineer-approved equal.
 - 6. Valves shall fail normally open or closed as scheduled on plans or as follows:
 - a. Heating coils in air handlers - normally open.
 - b. Other applications - as scheduled or as required by sequence of operation.

2.7 ACTUATORS AND POSITIONERS - ELECTRIC

A. Valve Actuators:

1. Electric actuators shall be either, direct coupled or rotary (gear-train) type for two-position or modulating service as required by application. All electric actuators shall be UL listed with NEMA 4 enclosures, unless otherwise specified.
2. Actuators shall be permanently lubricated; gear-train units shall be oil-immersed type or shall have permanently lubricated high-density polymer gears.
3. Ambient temperature range shall be at least 40° to 120°F, except actuators subjected to outdoor ambient temperatures shall have ambient range of -40° to 125°F minimum.
4. Input signal requirements and voltages compatible with controller output signals.
5. Actuator size and rating shall be suitable for intended application.
6. Damper actuators shall be selected per manufacturer's recommendations to provide sufficient close-off force to effectively seal damper. Modulating actuators shall provide smooth modulating control under design flow and pressure conditions. Furnish a separate actuator for each damper section.
7. Valve actuators shall provide tight close-off at design system pressure. Modulating actuators shall provide smooth modulation at design flow and pressure conditions.
8. Actuators shall have a spring return to fail to the safe position as indicated on the drawings. Actuators relying on batteries are not acceptable.
9. Actuators shall be Belimo, or Engineer-approved equal.

2.8 TEMPERATURE DEVICES

- ### A. Temperature sensors shall be thermistor (10K or 20K), or platinum RTD type (100-ohm wire wound, or 1000-ohm, thin film. Accuracy shall be $\pm 0.5^{\circ}\text{F}$ with stability of 0.25°F over five years. Sensors used for BTU calculations shall be accurate to $\pm 0.2^{\circ}\text{F}$ or 1% of span, whichever is less. Temperature transmitters shall have NEMA 4x aluminum housing, auto-diagnostic error detection, and scalable 4-20 mA output signal, if pneumatic conversion is needed. Approved manufacturers are Endress + Hauser, Rosemount, or Engineer-approved equal.
- ### B. Duct and immersion sensors shall be immune to moisture and shall have a junction box for electrical connections. Sensing element shall be suitable for the application.
1. Provide averaging elements for mixed air applications.
 2. Provide separable wells and insulation extension for immersion applications.
 3. Provide sun shields for outdoor sensors.
- ### C. Thermowells for all immersion sensors shall be stainless steel as recommended by manufacturer for the application and shall have a pressure rating of at least 150% of the maximum system pressure. They shall have 1/2-inch or 3/4-inch external NPT threads and shall provide for extension to sensor electrical junction box on insulated pipes.
- ### D. Temperature Transmitters
1. Temperature transmitter shall be Rosemount 3144 Series, or Engineer-approved equal. Power supply shall be 24 VDC, powered from PLC panel power supply. Process connection shall be 1/2-inch female NPT flange adapter. Signal output shall be 4 to 20 mA.
 2. Temperature transmitter shall be RTD or Thermocouple type. Unless otherwise specified, wetted parts shall be ASTM A276, type 316 stainless steel. Stability shall be $\pm 0.1\%$ of reading or 0.5°C , whichever is greater, for 5 years.
 3. Update Time shall be approximately 0.5 seconds.

4. Self Calibration. The analog-to-digital measurement circuitry will automatically self-calibrate for each temperature update by comparing the dynamic measurement to extremely stable and accurate internal reference elements.
- E. Duct, Immersion, and Outdoor Thermostats:
1. Provide single or multistage type with contact arrangement and rating suitable for application. Line voltage units shall be UL listed.
 2. Sensing element shall be liquid-filled remote bulb type or bi-metal type as required.
 - a. Remote bulb type shall have sufficient capillary lengths to allow mounting of thermostat at convenient location for adjustment.
 - b. Provide separable wells for immersion applications.
 - c. Provide sun shields for outdoor sensing bulbs.
 - d. Provide ambient temperature compensation where thermostat body is subjected to outdoor ambient temperature variations.
 3. Individual stage differential -2°F maximum (fixed). Provide adjustable differential type when thermostat is used for capacity control of DX refrigeration or to cycle fans.

2.9 PRESSURE INSTRUMENTATION

A. Seals:

1. All pressure switches and/or transmitters dealing with steam or water above 200 °F shall be provided with steam siphons.
2. Pressure switches, gauges, and/or transmitters and seals shall be assembled and oil filled at the factory prior to shipment. Filling fluid shall be compatible with piping contents and temperature.
3. Pressure switches and/or transducers attached to systems involving chemical solutions, corrosive fluids, or other liquids containing one percent or more of solids, shall be equipped with diaphragm or annular seals whether shown or not on the drawings, or equal protective pressure sensing devices, as follows:
 - a. Clear process water applications:
 - 1) Type 316 stainless steel for pressures over 15 psi.
 - 2) Elastomer for pressures of 15 psi and below.
 - 3) Type 316 stainless steel nuts and bolts, fill connection and valved flush port size of ¼-inch NPT, capable of disassembly without loss of filler fluid.
 - 4) Ashcroft Type 101 or prior Engineer-approved equal.
 - b. For chemical solutions, etc., where breakage does not create major shutdown:
 - 1) Seals with PVC body for removable mounting rated at 200 psi.
 - 2) Type 316 stainless steel bolts and nuts
 - 3) ½-inch inlet
 - 4) ¼-inch outlet
 - 5) Liquid-filled with Teflon diaphragm for pressure.
 - 6) Elastomer diaphragm for vacuum service.

B. Pressure and Differential Pressure Switches

1. General:
 - a. Enclosure NEMA 4X
 - c. DPDT
 - d. Actuator Seal: Teflon
 - e. Each pressure switch shall have visible scale.
2. Pressure switches shall have a contact rating of 10 amperes at 125V ac.

3. Pressure switches shall be snap-action switches (not mercury).
4. Diaphragm seals shall be provided and included at the locations shown.
5. Automatic reset
6. Proof-pressure shall be 150% minimum of the maximum operating pressure.
7. As manufactured by: Mercoid, United Electric Controls, or Engineer-approved equal.

2.10 PRESSURE TRANSMITTERS

- A. Pressure transmitters shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum, and the accuracy shall be $\pm 0.2\%$ of calibrated span. Transmitter shall be complete with 4-20 mA output, required mounting brackets, and block and bleed valves. Indicating transmitters shall display output in either English or metric units. Mount in location accessible for service and where the display is visible from the operating floor.
1. Endress-Hauser, Foxboro IGP-10 series, Rosemount 3051 Series, or Engineer-approved equal.
 2. Power supply shall be 24VDC, powered from PLC panel power supply. Process connection shall be 1/2-inch female NPT flange adapter.
 3. Pressure transmitter shall be capacitance or resonant-wire type. Unless otherwise specified, wetted parts shall be ASTM A276, type 316 stainless steel. Span shall be adjustable over a 6:1 or greater range. Over range capacity without affecting calibration shall be not less than 200% of maximum specified range. Volumetric displacement shall not exceed 0.01 cubic inch over the specified span. Fill fluid unless otherwise specified shall be silicone oil. Adjustable dampening shall be provided. External zero adjustment shall be provided. Accuracy shall be ± 0.15 percent of span.
 4. Higher ranges and spans shall be provided as specified in the instrument schedule. Steam pressure transmitters are described in paragraph "D" below. Transmitter for spans less than or equal to 25 psig shall be provided with one 1/2-inch flanged process connection and two 1/4-inch drain/vent ports, one plugged and one provided with bleed valve. Differential-pressure transmitters shall have 5-valve manifolds. Transmitter shall be provided with an evacuated sealed chamber and reference diaphragm shall be provided with a weatherproof, bug proof atmospheric vent. Transmitters for spans greater than 25 psig shall be similar except designed for gage pressure service, and overpressure rating shall be greater than the lesser of 2000 psig and 150% of maximum range.

2.11 AUXILIARY DEVICES - ELECTRIC

- A. Current-operated switches shall be self-powered, solid state split core with manually adjustable trip current. The switches shall be selected to match the current of the application and output requirements of the PLC system. The current switch shall have sufficient accuracy and hysteresis to detect drive belt failure. Where used in conjunction with variable frequency drives the current operated switch shall be recommended for such service by the manufacturer. Neilsen-Kuljian, Veris Industries, or Engineer-approved equal.
- B. Current transducers shall be 4-20 mA output solid state with $\pm 0.5\%$ of full scale accuracy. Unit shall have reverse voltage protection, and a flat frequency response from 20 to 100 Hz. The range shall be selected to meet the application. Neilsen-Kuljian AT-420, Veris Industries Hawkeye 720, or Engineer-approved equal.
- C. Control relays shall be UL listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage suitable for application. Idec series RH-L, ULAC or Engineer-approved equal.

- D. Control transformers shall be UL listed Class 2 current-limiting type or shall be furnished with over-current protection in both primary and secondary circuits for Class 2 service.
- E. Manual control switches shall be UL listed for use in NEMA 4 enclosures with contact arrangement and rating suitable for application. Bat handle or knob actuator with nameplate clearly identifying function of each switch position.
- F. Electrical 3-phase power transducer:
 - 1. Shall be NK Technologies, Inc. APOKWKWH Series or Engineer-approved equal.
 - 2. Shall provide a selectable rate pulse output for kWh reading, 4-20 mA output for kW reading, N.O. alarm contact and shall operate with 5.0 amp current inputs or 0-0.33 volt inputs.
 - 3. Unit shall have 1.0% full scale true RMS power accuracy, + 0.5 Hz. Voltage input range 120-600V, and auto range select.
 - 4. Shall incorporate under voltage/phase monitor circuitry.
 - 5. Shall be furnished with NEMA 1 enclosure.
 - 6. Current Transformers shall be NK Technologies, Inc. Model CPT Series with 0.5% FS accuracy 600V ac isolation voltage with 0-0.33V output. If 0-5A current transformers are provided, a 3-phase disconnect/shorting switch assembly is required.
- G. All safeties shall be hard wired. Safety interlocks using software are not acceptable.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. General:
 - 1. Electrical and Instrumentation components, including instrumentation components furnished under other Specification Sections, shall be installed under Division 40 per the Manufacturers' instructions.
 - 2. Equipment Locations: The monitoring and control system arrangements indicated are diagrammatic. The locations of the components are approximate. The exact locations and routing of wiring and cables shall be governed by the structural conditions of the proposed location, physical interferences of adjacent equipment, and by the location of electrical terminations required to the equipment. All equipment shall be located and installed so that it will be easily accessible for operation and maintenance activities. Where the as-built site conditions may require minor changes in the approximate locations and configurations of equipment shown, or when the Owner exercises the right to require changes in location of the equipment, which do not significantly increase material quantities or cause material rework, the Contractor shall make these changes without additional cost to the Owner.
 - 3. Provide thermal conducting compound for all sensors in thermowells.
- B. Instrumentation Mounting: Lone instruments, control panels, and equipment skids shall be anchored by methods that comply with Project seismic requirements. Refer to the Structural drawings for seismic design data.
- C. Existing Instrumentation: Any existing instrument to be removed and reinstalled shall be cleaned, reconditioned, and recalibrated by an authorized service facility or the original instrument manufacturer. The Contractor shall provide certification of this WORK prior to reinstallation of each refurbished instrument.

- D. Ancillary Devices: The Contract Documents show necessary instruments required to make a complete instrumentation system. The Contractor shall be responsible for providing any additional or different type of connections or mounting hardware as required by the instruments and specific installation requirements. These additions and changes, including the proposed method of mounting, shall be submitted to the Engineer for approval prior to commencing that installation. Such changes shall not be a basis of claims for extra installation or delay.
- E. Component Mounting Criteria and Validation: All field-mounted components and assemblies shall be installed and connected according to the requirements below:
1. Contractor personnel shall have instruction on the installation requirements of the Contract Documents and of the device manufacturer.
 2. Manufacturer Technical assistance shall be available to Contractor personnel by telephone, or in person via a local service representative.
 3. Contractor personnel shall have at least one copy of the approved Submittal Drawings and manufacturer's data.
 4. Power and signal wires shall be terminated with crimped or compression type lugs; spring-type terminations shall be unacceptable.
 5. All field connectors shall be water tight.
 6. All wires shall be installed with an identification tag that is of a permanent nature. See Division 26 for further labeling requirements.
 7. All wiring shall be routed in a neat manner and securely supported in cable groups and connected from terminal to terminal without splices unless specifically approved by the Engineer. All wiring shall be protected from sharp edges and corners. All wiring routed from the back of a panel to devices mounted upon panel doors shall have adequate slack and braided wire sleeves (snakeskin) to prevent chaffing of the wire harness.
 8. Mounting stanchions and bracket materials and assembly shall comply with requirements of the Contract Documents and shall be constructed of materials approved for use in the environment they are to be located.
 9. The Contractor shall verify the correctness of each installation, including polarity of electric power and signal connections, and make sure any liquid facility connections are free of leaks. Contractor shall certify, in writing that discrepancies have been corrected for each loop or system checked out as described in the pre-commissioning requirements.
 10. The Owner will not be responsible for any additional cost of rework or errors attributable to actions of the Contractor personnel or the Control Systems Integrator personnel.

3.2 CONTROL AIR PIPING

- A. All control air piping shall be concealed except in equipment rooms or unfinished areas. Installation methods/materials as follows:
1. Concealed and Inaccessible: Copper or stainless steel tubing without joints. Exceptions: Lines buried in concrete must be in metal conduit.
 2. Concealed and Accessible (including ceiling return air plenums): Copper tubing (Bending Temper or ACR) or stainless steel.
 3. Exposed: Bending temper or ACR copper or stainless steel.
 4. Pneumatic tubing shall not be run in raceway containing electrical wiring.
 5. Where pneumatic tubing exits control panels, provide bulkhead fittings. Where tubing exits junction boxes or panels, provide bulkhead fittings.
 6. Support tubing, 3/8-inch diameter and less, at intervals not exceeding 48 inches.
 7. Solder or braze copper tubing or use compression fittings, Swagelok or Engineer-approved equal.

- B. All control air piping shall be installed in a neat and workmanlike manner parallel to building lines with adequate support. Piping above suspended ceilings shall be supported from or anchored to structural members or other piping and/or duct supports. Tubing shall not be supported by or anchored to electrical conduits or ceiling suspension systems.
- C. Pressure-test all low-pressure control air piping at 30 psi for 24 hours prior to connection to control devices. High-pressure piping shall be tested at 150 psig for 24 hours. Test fails if there is a loss of more than 5 psi. Provide pressure test certification to the Owner.
- D. Vertical runs of main or high pressure control air piping greater than 15 feet shall be copper. Vertical runs of branch control air piping greater than 30 feet shall be copper.

3.3 IDENTIFICATION

- A. All control equipment shall be clearly identified by control shop drawing designation as follows:
 - 1. Control valves - brass tags.
 - 2. Other remote control devices and sensors: metal tags; plastic laminate labels; or, on non-porous surfaces only, permanent label tape as produced by the Brother "Easy Touch" label maker. Do not attach tag or label to removable covers, etc. Rivet to device or adjacent surface.
 - 3. Control panel doors - engraved nameplate with panel number and systems served.
 - 4. Devices in control panels: engraved plastic tags; metal tags; or, on non-porous surfaces only, permanent label tape as above, mounted to panel adjacent to control device. 1/4-inch -high letters minimum
 - 5. All wiring, including wiring within factory-fabricated panels, shall be labeled within 2 inches of termination with PLC point number/controller number or other descriptive information.
 - 6. All pneumatic tubing shall be labeled within 2 inches of termination with a descriptive identifier.
 - 7. All metal and plastic engraved labels shall be secured with chains, nylon tie-wraps, or rivets. Screws with exposed threads are not acceptable. Permanent adhesive is acceptable only when mechanical fasteners would damage the labeled equipment.
 - 8. All switches, relays, and panel components shall be labeled. Relays shall be labeled such that removal of the relay does not move the label.
 - 9. Raceway identification: For ease of identification, junction and pull box covers shall be color coded. Coordinate the color of the junction box covers with Division 26 and the Owner.

END OF SECTION 40 9100