

Intermountain Bear River Valley Hospital

MRI Replacement

905 N 1000 W, Tremonton, Utah 84337

Project Number 25018

Construction Document Specifications

June 6, 2025

FFKR ARCHITECTS

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section references other information relevant to the construction of this Project that is available project information.
- B. At the request of the Owner, the information identified below represents services that have been provided by others, not as an Architect's Consultant, regarding conditions that affect this Project that are beyond the responsibilities of the Architect and Architect's Consultants. Reference to such information herein is solely for the convenience of the Owner. Architect makes no representation, express or implied, as to the accuracy or validity of the information.
- C. Bidders are expected to examine the site and the information available from the Owner to determine for themselves the conditions to be encountered.
- D. If conditions other than those indicated in the information available from the Owner are encountered before or during construction, notify the Owner before work continues.

1.2 INFECTION CONTROL RISK ASSESSMENT REPORT

- A. The Owner's Risk Assessment Consultant has assessed the environmental impact of the work on the existing, adjacent healthcare functions, and has prepared an Infection Control Risk Assessment (ICRA) report that includes specific requirements of the Contractor.
- B. Copies will be provided by the Owner.
- C. The ICRA establishes strategic infection control provisions and requirements for the purpose of controlling the dissemination of airborne micro-organism contaminants encountered or generated during the construction process through the use of containment protocols and environmental monitoring.

1.3 TAX EXEMPTION STATUS INFORMATION

- A. This Project qualifies for exemption from taxes, and the Owner will provide a letter for documentation.

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 00 3100

SECTION 00 7200 – GENERAL CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

- A. The General Conditions of this Contract are that which is referenced in the Owner-Contractor Agreement and hereinafter is referred to as the “General Conditions.”
- B. A copy of the Document is included in this Project Manual, and shall apply to each and every Section of the Work as though written in full therein.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION 00 7200

GENERAL CONDITIONS

1. General Provisions	8. Payments and Completion
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3. A/E	10. Insurance and Bonds
4. Contractor	11. Miscellaneous Provisions
5. Subcontractors	12. Termination or Suspension of the Contract
6. Protection of Persons and Property	
7. Modifications, Request for Information, Proposed Change Orders, and Claims Process	

1. GENERAL PROVISIONS.

1.1 Basic Definitions.

“Adverse Weather”: Weather conditions that are seasonably abnormal and could not reasonably have been anticipated.

“A/E”: Generally, the licensed architect (or architecture firm) or engineer (or engineering firm) for the Project. For Contracts where the design professional is an interior designer, landscape subconsultant or other design professional, “A/E” will be deemed to refer to that design professional. If the type of design professional is not subject to professional licensure requirements, the professional must meet the prevailing standards in the State in which the Project is located for the applicable practice. When Intermountain elects not to engage an A/E for a Project, Intermountain will be considered the A/E for the Project.

“A/E’s Agreement”: Unless the context requires otherwise, the agreement executed by A/E and Intermountain for the Project.

“Addenda”: Written or graphic instruments issued before the opening of Bids, which clarify, correct or change the bidding documents or the Contract Documents.

“ASI”: A Supplemental Instruction issued by A/E to Contractor, which may result in clarifications or minor changes in the Work, but which does not affect the Contract Time or the Contract Sum.

“Bid”: The offer of the bidder submitted on the prescribed form setting forth the proposed stipulated sum for the Work to be performed.

“Bonds”: The bid bond, payment and performance bonds, and other instruments of security.

“Change Order”: A written instrument signed by Intermountain and Contractor, stating their agreement for changes to the Contract as specified on the required Intermountain change order form.

“Claim”: A dispute, demand, assertion or other matter arising in connection with the Contract or the Project submitted by Contractor or a Subcontractor at any tier in accordance with these General Conditions. A requested amendment, requested Change Order, or a Construction Change Directive (CCD) is not a Claim unless agreement cannot be reached in accordance with the procedures in these General Conditions.

“Construction Change Directive” or “CCD”: A written order signed by Intermountain, directing a change in the Work, and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. Intermountain may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions; even if it may impact the Contract Sum and Contract Time.

“Contract”: The Contract Documents form the Contract for Construction.

“Contract Documents”: The documents identified as such in the Contractor’s Agreement.

“Contract Sum”: The amount stated in the Contractor’s Agreement payable by Intermountain to Contractor for performance of the Work under the Contract Documents.

“Contract Time”: The Contract Time means the period of time for Contractor’s Substantial Completion of the Work to be established as set forth in the Contractor’s Agreement.

“Contractor”: The person or entity identified as the “Contractor” in the Contractor’s Agreement.

“Contractor’s Agreement”: The “Contractor’s Agreement” means the Construction Manager/General Contractor Agreement or the General Contractor Agreement for a Stipulated Sum, as applicable, executed by Contractor and Intermountain for the Project.

“Contractor’s Direct Costs”: Actual costs incurred by the Contractor for labor, materials, equipment, insurance, bonds, Subcontractors and on-site supervision. They do not include labor costs for project managers or other off-site administration.

“Day” or “Days”: Calendar day unless otherwise specified.

“Defective”: 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 by applicable law, or has been damaged.

“Director”: Intermountain’s Executive Director of Design & Construction unless the context requires otherwise. Director may include a designee selected by the Director for a specific function.

“Drawings”: The construction drawings identified in the Contractor’s Agreement.

“Inspection” (or any derivative): A review of the Project, including but not limited to a visual review of the Work to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

Intermountain: IHC Health Services, Inc., operating through its Department of Facility Design and Construction. Unless the context requires otherwise, Intermountain is the “Owner” as that term is commonly referred to in the construction industry.

“Intermountain Representative” or “Owner’s Representative”: The person identified as such in the Contract Documents.

“Intermountain’s Digital Information System”: The digital information system or other electronic project management system designated by Intermountain for the Project.

“Invitation to Bid”: Intermountain’s solicitation or request to a contractor to provide a Bid.

“Modification”: (1) Change Order, (2) Construction Change Directive, or (3) ASI.

“Notice to Proceed”: A document prepared by Intermountain authorizing Contractor to commence Work on the Project. It is deemed issued upon delivery to Contractor or upon being sent by Intermountain to the address for Contractor’s specified in the Bid or Proposal.

“Partial Use”: Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work. Partial Use does not constitute “substantial completion.”

“Product Data”: 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.

“Project”: Generally identified and defined in the Contractor’s Agreement and Contract Documents. It includes all of the Work to be performed under the Contract Documents.

“Project Manual” (for construction): The volume of assembled Specifications for the Work, which may include the bidding/proposal requirements, sample forms, and General or Supplementary Conditions of the Contract.

“Proposal”: A/E’s or Contractor’s response to Intermountain’s Request for Proposal.

“Proposal Request” or “PR”: A written request submitted to Contractor for a proposal to resolve an issue as part of the Change Order or Contract Modification process.

“Proposed Change Order” or “PCO”: An informal request by Contractor to Intermountain Representative to commence the Contract Modification Process. It will not be considered a “Claim.” The PCO may be related to any potential or actual delay, disruption, unforeseen condition or materials or any other matter for which Contractor intends to seek additional monies or time.

“Record Drawings”: Record drawings, compiled by the A/E based upon redline “as-built” construction drawings and/or other information provided by Contractor, for each completed phase or portion of the Project for which a certificate of occupancy is issued, or for the final, completed Project (as applicable), in both AutoCAD (.dwg) and REVIT (.rvt) format (or other format as reasonable requested by Intermountain).

“Request for Information” or “RFI”: A request by Contractor to A/E for information, direction or clarification regarding the Contract Documents, plans or specifications.

“Request for Proposal” or “RFP”: Intermountain’s solicitation for Contractor Proposals.

“Sales Tax” and/or “Use Tax”: Unless the context requires otherwise, the sales tax or use tax collected or to be collected by any Federal or State Tax Commission as well as by any special district, local government or political subdivision.

“Samples”: Physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

“Shop Drawings”: Drawings, diagrams, schedules and other data specially prepared for the Work by Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

“Specifications”: The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, installation and workmanship for the Work, and for performance of related systems and services.

“Subcontractor”: Any person or entity that has a direct contract with Contractor, including any trade contractor or specialty contractor, and/or with any other Subcontractor at any tier to provide labor or materials for the Work.

“Subcontractor’s Direct Costs”: Actual costs incurred by a Subcontractor for labor, materials, equipment, insurance, bonds, lower-tier Subcontractors and supervision.

“Substantial Completion”: Completion of the Work or designated portion thereof in accordance with the Contract Documents to a point sufficient to allow Intermountain to occupy and use the Work for its intended purposes, including without limitation all systems shall be fully functional and operate as designed, and the A/E’s certification that Contractor has achieved Substantial Completion of the Work. The date of Substantial Completion is the date certified as such by the A/E in accordance with the Contract Documents.

“Work”: All labor, materials, tools, equipment, construction and services required by the Contract Documents.

1.2 Correlation and Intent of Contract Documents.

- 1.2.1 The intent of the Contract Documents is to require Contractor to provide all labor, materials, equipment, construction, and services necessary for the proper execution and completion of the

Work. The Contract Documents are complementary and what is required by any one will be as binding as if required by all. Contractor will perform the Work in accordance with the requirements expressly set forth in or reasonably inferable from the Contract Documents.

- 1.2.2 The organization of the Contract Documents is not intended to control Contractor in dividing the Work among Subcontractors or to establish the extent of the Work to be performed by any trade.
- 1.2.3 Words used in the Contract Documents that have well known technical or trade meanings are used therein in accordance with such recognized meanings.
- 1.2.4 In the interest of brevity, the Contract Documents may omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

1.3 Ownership and Use of Contract Documents. The Drawings, the Project Manual, and copies thereof are the property of Intermountain. Contractor will not use these documents on any other project. Contractor may retain one copy of the Drawings and the Project Manual as a contract record set and will return or destroy all remaining copies following final completion of the Work.

1.4 Public Statements Regarding Project. Contractor will not make any statements or provide any information to the media about the Project without the prior written consent of Intermountain. If Contractor receives any requests for information from media, Contractor will refer such requests to Intermountain.

1.5 Ownership and Use of Renderings and Photographs. Renderings representing the Work are the property of Intermountain. All photographs of the Work, whether taken during performance of the Work or at completion, are the property of Intermountain. Intermountain reserves all rights including copyrights to renderings and photographs of the Work. No renderings or photographs will be used or distributed without written consent of Intermountain.

1.6 Confidentiality / Property Rights.

- 1.6.1 All Drawings, Specifications and other documents prepared by A/E are and will remain the property of Intermountain, and Intermountain will retain all common law, statutory and other reserved rights with respect thereto. These documents were prepared and are intended for use as an integrated set for the Project which is the subject of the Contractor's Agreement and constitute works made for hire. Contractor will not modify or use Contract Documents on any other project without the prior written consent of Intermountain. Intermountain may withhold its consent in its absolute discretion. Any non-permissive use or modification, by Contractor, Contractor's Subcontractors at any tier or anyone for whose acts Contractor is liable, will be at Contractor's sole risk. Contractor will hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by Contractor. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by A/E or Intermountain appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license will bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by A/E or Intermountain. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of Intermountain's copyright or other reserved rights.
- 1.6.2 In addition, Contractor will ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors maintain in strict confidence, and will use and disclose only as authorized by Intermountain all Confidential Information of Intermountain that Contractor receives in connection with the performance of the Contract. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or authority having jurisdiction, but only after it has notified Intermountain and Intermountain

has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of the Contract, "Confidential Information" means:

- 1.6.3 The name or address of any affiliate, customer or contractor of Intermountain or any information concerning the transactions of any such person with Intermountain;
- 1.6.4 Any information relating to contracts, agreements, business plans, budgets or other financial information of Intermountain to the extent such information has not been made available to the public by Intermountain; and
- 1.6.5 Any other information that is marked or noted as confidential by Intermountain at the time of its disclosure.

1.7 Comply with Intellectual Property Rights of Others. Contractor represents and warrants that no Work (with its means, methods, goods, and services attendant thereto), provided to Intermountain will infringe or violate any right of any third party and that Intermountain may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).

1.8 Intermountain's Digital Information System. In performing services, Contractor will access information, make submissions to Intermountain, provide notices to Intermountain, and provide and track items for the Project electronically in, and will otherwise use for purposes associated with the Project, Intermountain's Digital Information System, all as directed by Intermountain. Contractor will ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors comply with the applicable terms and conditions of all third-party software and programs used by the parties related to the Project, including, without limitation, any electronic project management system, whether such terms are provided by Intermountain or otherwise provided or made available by the third-party provider. Contractor will hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of its, its Subcontractors' or their employees', agents', and representatives' use of such third-party software or failure to comply with such terms.

2. INTERMOUNTAIN.

2.1 Information and Services Required of Intermountain.

- 2.1.1 Intermountain Representative. Intermountain will designate an Intermountain Representative authorized to act in Intermountain's behalf with respect to the Project. Intermountain or such authorized representative will furnish to Contractor information or services Intermountain is required to furnish under the Contract Documents within a reasonable time in order to avoid a delay in the orderly and sequential progress of the Work.
- 2.1.2 Specialists and Inspectors. Intermountain reserves the right (but without obligation to provide building inspection services. This may include 'routine' and 'special' inspections. Intermountain 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 or specialist's activities in no way relieve Contractor of the responsibilities set forth in the Contract Documents.
- 2.1.3 Inspections. Intermountain and its representatives will have the right to inspect any portion of the Work wherever located at any time; provided that in no event will Intermountain be deemed to have assumed any obligation or liability whatsoever as a result of any such observation.
- 2.1.4 Surveys and Legal Description. Intermountain will furnish surveys describing the property lines and benchmarks for grading. Contractor will review this information, including the surveys and any provided geotechnical studies, and compare such information with observable physical conditions and the Contract Documents.

- 2.1.5 Prompt Information and Services. Upon receipt of a written request from Contractor, Intermountain will furnish information or services under Intermountain's control with reasonable promptness to avoid delay in the orderly progress of the Work.
- 2.1.6 Copies of Drawings and Project Manuals (for Construction). Unless otherwise provided in the Contract Documents, Contractor will be furnished electronic copies of Drawings and Project Manuals for Contractor's use in connection with the execution of the Work for the Project. Contractor will be responsible for making any further needed copies of the Construction Documents, subject to the copyright requirements.

2.2 Construction by Intermountain or By Separate Contractors.

- 2.2.1 Intermountain's Right to Perform Construction and to Award Separate Contracts.
- a. *In General.* Intermountain reserves the right to perform construction or operations related to the Project with Intermountain's own forces, and to award separate contracts related to the Project or other construction or operations on the site.
 - b. *Coordination and Revisions.* Intermountain will provide for coordination of the activities of Intermountain's own forces and of each separate contractor with the Work of Contractor, who will cooperate with them. Contractor will promptly notify in writing if any such independent action will in any way compromise Contractor's ability to meet Contractor's responsibilities under the Contract. Contractor will participate with other separate contractors and Intermountain in reviewing their construction schedules when directed to do so. Contractor will make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and agreement by Intermountain. The construction schedules will then constitute the schedules to be used by Contractor, separate contractors and Intermountain until subsequently revised.
- 2.2.2 Mutual Responsibility.
- a. *Contractor Coordination.* Contractor will afford Intermountain and separate contractor(s) a reasonable opportunity for delivery and storage of their materials and equipment and performance of their activities and will connect and coordinate Contractor's construction and operations with theirs where applicable.
 - b. *Reporting Problems to Intermountain.* If part of Contractor's Work depends on work by Intermountain or a separate contractor, Contractor will, before proceeding with that portion of the Work, inspect and promptly report in writing to Intermountain apparent discrepancies or defects in workmanship that would render it unsuitable for proper execution, performance, or results. Failure of Contractor to so inspect and make this report will constitute an acceptance and acknowledgment that Intermountain's or separate contractors completed or partially completed construction is fit and proper to receive Contractor's Work, except as to defects in workmanship not then reasonably discoverable.
 - c. *Costs.* Costs caused by delays or by improperly timed activities or Defective construction will be borne by the responsible party in accordance with the procedures and provisions of the Contract Documents.
 - d. *Contractor Remedial Work.* Contractor will promptly remedy damage caused by Contractor or any Subcontractor to completed or partially completed work of Intermountain or of separate contractors or to the property of Intermountain or separate contractors and subcontractors.
 - e. *Intermountain's Right to Clean Up.* If a dispute arises among Contractor and separate contractors as to the responsibility under their separate contracts for maintaining the Project free from waste materials and rubbish, Intermountain may clean the Project, allocate the cost among those

responsible as Intermountain and A/E determine to be just, and withhold such cost from any amounts due or to become due to Contractor.

3. A/E.

3.1 A/E's Administration of the Contract.

- 3.1.1 In General. A/E assists Intermountain with the administration of the Contract as described in the Contract Documents.
- 3.1.2 Site Visits. Site visits or inspections by A/E, Intermountain or any Intermountain representative will 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 applicable laws, statutes, ordinances, resolutions, codes, rules, regulations, orders and decrees. A/E will promptly submit to Intermountain a written report subsequent to each site visit.
- 3.1.3 Communications Facilitating Contract Administration. Except as authorized by Intermountain or as otherwise provided in the Contract Documents, including these General Conditions, A/E and Contractor will communicate through the Intermountain Representative on issues regarding the timing of the Work, cost of the Work, and scope of the Work. Contractor will comply with communication policies agreed upon at any pre-construction meeting with Intermountain. Communications by and with A/E sub-consultants will be through A/E. Communications by and with Subcontractors will be through Contractor. Communications by and with separate contractors will be through Intermountain.
- 3.1.4 A/E May Reject Work, Order Inspection, Tests. A/E will have the authority to reject Work which, based upon A/E's knowledge or what may be reasonably inferred from A/E's site observations and review of data, does not conform to the Contract Documents or is damaged or rendered unsuitable. Whenever A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, A/E will 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, neither this authority of A/E nor a decision made in good faith either to exercise or not to exercise such authority will give rise to a duty or responsibility of A/E to Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors.
- 3.1.5 A/E Review Contractor's Submittals.
 - a. Contractor will submit shop drawings, product data, and samples and other submittals required by the Contract Documents to A/E as required by the approved submittal schedule.
 - b. A/E will review and approve or take other 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 will not constitute a Modification of the Contract.
 - c. A/E's action will be taken no later than fifteen (15) Days following A/E's receipt of the submittal, unless agreed to otherwise by Contractor and Intermountain.
 - d. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities or for substantiating

instructions for installation or performance of equipment or systems, all of which remain the responsibility of Contractor as required by the Contract Documents.

- e. A/E's review of Contractor's submittals will not relieve Contractor of the obligations under the Contract Documents.
- f. A/E's review will not constitute approval of safety precautions or, unless otherwise specifically stated by A/E, of any construction means, methods, techniques, sequences or procedures.
- g. A/E's approval of a specific item will not indicate approval of an assembly of which the item is a component.
- h. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, A/E will be entitled to rely upon such certifications to establish that the materials systems or equipment will 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 A/E are and will remain the property of Intermountain, and Intermountain will retain all common law, statutory and other reserved rights with respect thereto. These documents were prepared and are intended for use as an integrated set for the Project which is the subject of the Contractor's Agreement and constitute works made for hire. Contractor will not modify or use Contract Documents on any other project without the prior written consent of Intermountain. Intermountain may withhold its consent in its absolute discretion. Any non-permissive use or modification, by Contractor, Contractor's Subcontractors at any tier or anyone for whose acts Contractor is liable, will be at Contractor's sole risk. Contractor will hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by Contractor. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by A/E or Intermountain appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license will bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by A/E or Intermountain. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of Intermountain's copyright or other reserved rights.

4. CONTRACTOR. Contractor's duties include the professional services of a business, administrative and management consultant to Intermountain; including all budget, scheduling, quality, safety and all other services related to assuring compliance with the Contract Documents.

4.1 Review of Contract Documents and Field Conditions by Contractor. By executing the Contractor's Agreement, Contractor represents that it has visited the Project site, familiarized itself with the local conditions under which the Work is to be performed, and correlated its own observations with the requirements of the Contract Documents.

4.1.1 Reviewing Contract Documents, Information, Reporting Errors, Inconsistencies or Omissions.

- a. Contractor will carefully study and compare the Contract Documents with each other and with information available relating to the Project or furnished by Intermountain before commencing and during performance of each portion of the Work and will at once report to Intermountain and A/E any errors, inconsistencies or omissions it discovers. If Contractor performs any construction activity without such notice to Intermountain and A/E and before the resolution of the error, inconsistency or omission, Contractor will assume responsibility for such performance and will bear the attributable costs for correction.

- b. Contractor will give Intermountain and/or A/E notice of any additional drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work, sufficiently in advance of the need for information so as not to delay the Work.
- c. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with requirements of applicable laws, statutes, ordinances, building codes, rules and regulations. However, if Contractor observes that portions of the Contract Documents are at variance with those requirements, Contractor will immediately notify Intermountain and/or A/E in writing. Contractor will not proceed unless Intermountain and/or A/E effects Modifications to the Contract Documents required for compliance with such requirements. Contractor will be fully responsible for any work knowingly performed contrary to such requirements and will fully indemnify Intermountain against loss and bear all costs and penalties arising therefrom.

4.1.2 Field Conditions.

- a. Contractor will take field measurements and verify field conditions and will carefully compare such field measurements and conditions and other information known to Contractor, or information which a Contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing activities. Errors, inconsistencies or omissions discovered will be reported to Intermountain and A/E at once. If Contractor performs any construction activity without such notice to Intermountain and A/E and before the resolution of the error, inconsistency or omission, Contractor will not be entitled to any compensation for additional costs attributable to correction or otherwise to Contractor resulting from field measurements or conditions different from those anticipated by Contractor which would have been avoided had Contractor taken field measurements and verified field conditions before ordering the materials or commencing construction activities.
- b. If site conditions indicated in the Contract Documents or other information provided by Intermountain or A/E to Contractor differ materially from those Contractor encounters in performance of the Work, Contractor will immediately notify Intermountain and/or A/E in writing of such differing site conditions.

4.1.3 Perform in Accordance with Contract Documents and Submittals. Contractor will perform the Work in accordance with the Contract Documents and submittals approved in accordance with the Contract Documents. Should Contractor or any of its Subcontractors become aware of any question regarding the meaning or intent of any part of the Contract Documents before commencing that portion of the Work about which there is a question, Contractor will request an interpretation or clarification from Intermountain and/or A/E before proceeding. Contractor proceeds at its own risk if it proceeds with the Work without first making such a request and receiving an interpretation or clarification from Intermountain and/or A/E.

4.1.4 Performance to Produce the Complete System and Intended Results. Performance by Contractor will be required to the extent consistent with the Contract Documents and reasonably inferable from the Contract Documents as being necessary to allow the system to function within its intended use.

4.1.5 Intent and Hierarchy. The Contract Documents should be read as a whole and wherever possible, the provisions should 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. The Contract Documents are complimentary, and what is required by one Document or provisions thereof will be as binding as if required by all the Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities will govern as listed below:

- a. A particular Modification will govern over all Contract Document provisions or Modifications issued before this particular Modification.

- b. A particular Addendum will govern over all other Contract Document provisions issued before this particular Addendum. Subsequent Addenda will govern over all prior Addenda.
 - c. The Supplementary Conditions will govern over the General Conditions.
 - d. The Agreement and these General Conditions will govern over all other Contract Documents except for the Supplementary Conditions, Addenda, Modifications.
 - e. The drawings and specifications will not govern over any of the documents listed above. The specifications take precedence over the drawings.
 - f. Within the Drawings, larger scale drawings take precedence over smaller scale drawings, figured dimensions over scaled dimensions, and noted materials over graphic indications.
 - g. In case of a conflict or ambiguity within the same level of hierarchy of described documents, Intermountain reserves the right to select the most stringent requirement unless the preponderance of the contract indicates the less stringent requirement.
- 4.1.6 Dividing Work and Contractor Representation. Organization of the specifications into divisions, sections and articles, and arrangement of Drawings, will not control Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations. Where the Contract Documents require Contractor to provide professional services for architecture or engineering, Contractor will cause such services to be performed by appropriately licensed professionals.
- 4.1.7 Planning and Priority. Contractor will plan and schedule its work to facilitate the Project and will maintain a work schedule to place proper priority to sequence work to complete the project timely.
- 4.1.8 Prior to Contractor taking control over any area in any existing facility or on any project site, Contractor will provide prior written notice to Intermountain with sufficient time (no less than 30 Days) to allow Intermountain's Asset Recovery Team to remove, secure, and otherwise address existing materials, furniture, fixtures, equipment, and other assets located thereon.

4.2 Supervision and Construction Procedures.

- 4.2.1 Supervision and Control.
- a. Contractor will utilize its best skill, efforts, and judgment to provide efficient business administration and supervision, to furnish at all times an adequate supply of workers and materials, and to perform the Work in an expeditious and economical manner consistent with the interests of Intermountain.
 - b. Contractor will supervise and direct the Work. Contractor will be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work.
 - c. All loss, damage, liability, or cost of correcting Defective work arising from the use of any construction means, methods, techniques, sequences or procedures will be borne by Contractor, notwithstanding that such construction means, methods, techniques, sequences or procedures are referred to, indicated or implied by the Contract Documents, unless Contractor has given timely notice to Intermountain and A/E in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and Intermountain has then instructed Contractor in writing to proceed at Intermountain's risk.
- 4.2.2 Responsibility. Contractor will be responsible to Intermountain for 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.

4.2.3 Not Relieved of Obligations. Contractor will not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of Intermountain or its agents in Intermountain's administration of the Contract, or by tests, inspections or approvals by Intermountain, A/E, or their consultants, or as required or performed by persons other than Contractor or for those that Contractor is liable.

4.2.4 Inspections and Approvals.

- a. Contractor is responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner.
- b. Contractor will be responsible for inspection of portions of the Work already completed to determine that such portions are in proper condition to receive subsequent portions of the Work.
- c. If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, Contractor will timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, work will not proceed without any required inspection and the associated authorization to proceed. Contractor will promptly notify Intermountain if the inspector fails to appear at the site.

4.3 Labor and Materials.

4.3.1 Payment by Contractor. Except to the extent it is otherwise stated in the Contract Documents, Contractor will provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, 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.

4.3.2 Discipline and Competence. Contractor will enforce strict discipline and good order among Contractor's employees, Subcontractors, agents, representatives and other persons performing under the Contract Documents. Contractor will not permit employment of unfit persons or persons not skilled in tasks assigned to them.

4.3.3 Phased Construction / Accommodations for Facilities to Stay Operational. Contractor and all Subcontractors will direct and perform the Work, phase and coordinate all construction and related activities and timing, in a manner to preserve ongoing patient care and safety to all and to accommodate in every instance Intermountain's ongoing business operations such that facilities stay fully functioning, operational, and in compliance with applicable laws and regulations at all times.

4.4 Taxes and Other Payments to Government. Intermountain will pay all taxes and assessments on the real property comprising the Project site. Contractor will pay all applicable sales, consumer, use, payroll, workers compensation, unemployment, old age pension, surtax, and employment-related and similar taxes related to performance of 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, and will comply with the laws and regulations regarding the payment of Sales and/or Use Tax and any applicable exemptions.

4.5 Permits, Fees, Notices, Labor and Materials.

4.5.1 Permits and Fees.

- a. Intermountain will obtain and pay for all zoning and use permits and permanent easements necessary for completion of the Work.
- b. Contractor will obtain and pay for the building permit, and all other permits, governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.
- c. Contractor will secure any certificates of inspection and of occupancy required by authorities having jurisdiction over the Work. Contractor will deliver these certificates to A/E before issuance

of the Certificate of Substantial Completion by A/E.

4.5.2 Compliance with Law, Public Authorities, Notices. Contractor will comply with all applicable federal, state and local laws, statutes, ordinances, resolutions, rules, regulations, codes, and lawful orders of public authorities.

4.5.3 Correlation of Contract Documents and Enactments.

- a. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, resolutions, building codes, and rules and regulations. Notwithstanding this, if Contractor observes, or if such is 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 will promptly notify A/E and Intermountain in writing, and necessary changes will be accomplished by appropriate Modification.
- b. Contractor will coordinate and supervise the work performed by Subcontractors so that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. Contractor and all Subcontractors will at all times afford each trade, any separate contractor, or Intermountain, reasonable opportunity for the installation of Work and the storage of materials.
- c. Contractor is fully responsible for the Project and all materials and work connected therewith until Intermountain has accepted the Work in writing. Contractor will replace or repair at its own expense any materials or work damaged or stolen, regardless of whether it has received payment for such work or materials from Intermountain.
- d. Contractor will remedy all damage or loss to any property caused in whole or in part by Contractor, any Subcontractor, or by anyone for whose acts any of them may be liable.
- e. Intermountain may elect to purchase materials required for the Work. In that event, Contractor will comply with the procedures set forth in the Contract Documents relating to such materials.

4.5.4 Failure to Give Notice. If Contractor, or any Subcontractor thereof performs Work without complying with the requirements of this Article 4.5 hereinabove, Contractor will assume appropriate responsibility for such Work and will bear the appropriate amount of the attributable costs.

4.5.5 Intermountain-Purchased Materials and Equipment.

- a. In addition to Contractor's other obligations with respect to separate Intermountain provided work or materials, Contractor's obligations and duties with respect to Intermountain-purchased materials, equipment, and work include:
 - (i) Scheduling: The Contractor shall furnish Intermountain with a schedule of dates on which the Contractor requires delivery of Intermountain-purchased materials. Intermountain will arrange for the materials to be delivered to the construction site or picked up by Contractor on or before the specified dates. If delivery or pick up dates are changed, rescheduled, or otherwise varied from the original schedule, the Contractor shall notify Intermountain in writing of delivery or pick up date rescheduling and the Contractor shall coordinate the delivery or pick up of the Intermountain-purchased materials or equipment directly with the supplier.
 - (ii) Equipment / Vehicles: If Intermountain buys equipment or vehicles for Contractor's use on the Project, Contractor will (in addition to all other obligations herein relative to such equipment or vehicles) be fully and solely responsible for such equipment and vehicles as well as the use and use consequences thereof for any and all purposes (including without limitation to protect, secure, inspect, upkeep and make repairs, and insure such equipment and vehicles as well as to monitor, guide, direct, oversee, protect, and control the use and

use consequences of such equipment and vehicles) until completion of the Project and Contractor's return of such equipment and/or vehicles to Intermountain.

- (iii) Pre-Installation Inspection: The Contractor shall be responsible for receiving, inspecting and storing all Intermountain- purchased materials and equipment until the materials or equipment are needed for installation or use by the Contractor. Regardless of any inspection performed by Intermountain of the Intermountain-purchased materials or equipment, the Contractor shall be responsible for inspecting the Intermountain-purchased materials and equipment to determine suitability, quality and conformance with specifications before installation or use or at such other times as the Contractor may desire in order to avoid interruptions and delays in the progress of the Project. The Contractor shall reject any material which does not meet specifications or which appears to have any defect which may make the material unsuitable for use in the Project. The Contractor shall notify Intermountain and the manufacturer or supplier of all defects and assist Intermountain in arranging for the repair, replacement or correction of the defective condition. The Contractor shall not be entitled to an extension of any deadline or completion date which results from failure to discover defects which the Contractor should have discovered through an inspection.
- (iv) Defective Materials: The Contractor acknowledges that use of improper or defective material may result in costs and damages to Intermountain in excess of the value of the materials; that after use in the Project it may be difficult or impossible to inspect the material to determine the cause of any failure; and that in the event of the failure of material there may be a question as to the cause of the failure. Because the Contractor's employees will be the last to handle and inspect material prior to incorporation into the Project, the Contractor will be liable to Intermountain for damages resulting from failure of Intermountain- purchased materials during the Contractor's warranty period specified herein from any cause whatsoever unless the Contractor provides clear and convincing proof that (1) the entire loss from a failure is covered by a valid manufacturer's or supplier's warranty, or (2) the Contractor could not have prevented the failure by complying with the requirements of this Section concerning Intermountain-purchased materials.
- (v) Claims: The Contractor agrees to assist Intermountain to present claims to manufacturers and suppliers for defects in Intermountain-purchased materials. Where there is any question as to the division of liability between the Contractor and a manufacturer or vendor, the Contractor shall provide all relevant information in the Contractor's possession which may aid Intermountain in determining the division of responsibility. Intermountain shall have final approval of any proposed adjustment or settlement of warranty claims.
- (vi) Implied Warranties: The benefit of contractual and implied warranties with respect to Intermountain-purchased materials and equipment shall run to Intermountain and not to the Contractor.
- (vii) Unloading: Except as otherwise provided herein, the Contractor shall be responsible for unloading all Intermountain- purchased materials and equipment and for verifying delivery amounts to Intermountain.
- (viii) Custody and Security: The Contractor shall secure and protect Intermountain-purchased materials and equipment from loss, deterioration, damage, theft, vandalism or destruction. If any Intermountain-purchased materials or equipment are damaged, stolen, or lost, Contractor will timely replace such at Contractor's sole cost and expense. In such event, Contractor will not be entitled to any modification in Contract Time or Contract Sum.
- (ix) Reports: At Intermountain's request, the Contractor shall furnish reports to the Intermountain Representative demonstrating the Contractor's compliance with this Section.

(x) **Retained Ownership:** All materials and equipment purchased by Intermountain which remain after completion of the Project shall be the property of Intermountain. If Intermountain does not wish to retain or dispose of surplus Intermountain-purchased materials or equipment, the Contractor shall remove and dispose of them.

b. None of the foregoing duties of the Contractor with respect to Intermountain-purchased materials shall prevent Intermountain from exercising any prerogative of ownership of the materials or equipment.

4.6 Superintendent. Contractor will employ a competent superintendent and necessary assistants who will be in attendance at the Project site at all times during performance of the Work. The superintendent will represent Contractor, and communications given to the superintendent will be as binding as if given to Contractor. Important communications will be confirmed in writing. Other communications will be similarly confirmed on written request in each case.

4.7 Time and Contractor's Construction Schedules.

4.7.1 Progress and Completion.

- a. *Time Is of The Essence; Complete Within Contract Time.* Time is of the essence. By executing the Contractor's Agreement, Contractor confirms that the Contract Time is adequate to perform the Work. Contractor will proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.
- b. *Notice to Proceed and Insurance.* Contractor will not prematurely commence operations on the site or elsewhere before the issuance of a Notice to Proceed by Intermountain and in no event before the effective date of insurance required by Article 10 to be furnished by Contractor. In addition and without limitation of the foregoing, Contractor will not proceed with further Work or services after performing preconstruction services until Contractor receives a subsequent Notice to Proceed.

4.7.2 Schedule Preparation. Contractor, promptly after being awarded the Contract, will prepare and submit for Intermountain's and A/E's review a reasonably detailed CPM schedule for the Work. The schedule will indicate the 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, submittals and approvals of samples, shop drawings, procedures, or other documents. Work items of Intermountain, other Contractors, utilities and other third parties that may affect or be affected by Contractor will be included. If Intermountain is required, by the Contract Documents, to furnish any materials, equipment, or the like, to be incorporated into the Work by Contractor, Contractor will submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Project site. The critical path should be identified, including the critical paths for interim completion dates and milestones. The CPM schedule will be developed using Primavera, MS Project, or Suretrack unless otherwise authorized by Intermountain Representative. Contractor's schedule will be updated at least once per month and submitted with each pay request. Contractor will maintain an original baseline schedule and will provide Intermountain monthly written reports indicating Contractor's compliance or noncompliance with the original schedule.

4.7.3 Initial Contract Time. Unless otherwise specified in the bidding documents, the initial Contract Time is the time identified in the Contractor's Agreement.

4.7.4 Interim Completion Dates and Milestones. The schedule must include contractually specified interim completion dates and milestones. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all Work on the Project. The milestone dates listed are not intended to be a complete listing of all Work under this Contract or of interfaces with other Project contractors.

- 4.7.5 Schedule Content Requirements. The schedule will indicate an early completion date for the Project that is no later than the Project's required completion date. The schedule, including all activity duration's will be given in calendar days. The Schedule will also indicate all of the following:
- a. Interfaces with the work of outside contractors (e.g., utilities, power and with any separate Contractor);
 - b. Description of activity including activity number/numbers;
 - c. Estimated duration time for each activity;
 - d. Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity;
 - e. Float time available to each path of activities;
 - f. Actual start date for each activity begun;
 - g. Actual finish date for each activity completed;
 - h. The percentage complete of each activity in progress or completed;
 - i. Identification of all critical path activities;
 - j. The critical path for the Project, with this path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float time must be identified. Unless otherwise authorized by Intermountain Representative, no more than 40% of all activities may be identified as critical path items. The relationship between non-critical activities and activities on the critical path will be clearly shown on the network diagram;
 - k. Unless otherwise authorized by Intermountain Representative, all activities on the schedule representing construction on the site may not have 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
 - l. Additional requirements as specified in the Supplemental General Conditions.
- 4.7.6 Intermountain's Right to Take Exceptions. Intermountain reserves the right to take reasonable exception to activity duration, activity placement, construction logic or time frame for any element of the Work to be scheduled.
- 4.7.7 Float Time. Float time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Schedule. By a proposal request or modification delivered to Contractor, Intermountain has the right to use the float time for non-critical path activities until Contractor has reallocated such time on a newly submitted schedule.
- 4.7.8 Initial Schedule Submission. No progress payments will be approved until Contractor has submitted a Project detailed CPM schedule for the entire project.
- 4.7.9 Updates. Before any approval of a pay request, Intermountain, A/E and Contractor will review Contractor's schedule compared to the Work completed. Intermountain approves the amount of Work completed as supported by the schedule of values and as verified by the determination of Work completed. If necessary, Contractor will then update and submit to Intermountain the schedule with the pay request; all of which in accordance with Intermountain's approval. All updates will be provided in electronic and hard copy formats. At each scheduled meeting with Intermountain

Representative, Contractor will provide at minimum a “three week look ahead” with long lead items identified.

- 4.7.10 Schedule of Submittals. Contractor will prepare and keep current, for A/E’s and Intermountain’s review, a schedule of submittals required under the Contract Documents which is coordinated with Contractor’s construction schedule and allows A/E a reasonable time to review the submittals. This submittal schedule is to be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals.
- 4.7.11 Schedule Recovery. If the Work represented by the critical path falls behind by more than seven (7) Days, the project schedule will be redone within fourteen (14) Days showing how Contractor will recover the time. A narrative that addresses the changes in the schedule from the previously submitted schedule will be submitted along with the schedule in both hard copy (appropriate report formats to be determined by Intermountain Representative) and electronic copy. Contractor will comply with the most recent schedules.
- 4.7.12 Schedule Changes and Modifications.
- a. *Contract Time Change Requires Modification*. The Contract Time may only be shortened or extended by a Modification fully executed by Intermountain.
 - b. *Contractor Changing Activity Durations*. Should Contractor, after approval of the complete detailed construction schedule, desire to change his plan of construction, he will submit his requested revisions to Intermountain and 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 contract completion date and the reasons for the revisions. If the requested changes are acceptable to Intermountain, which acceptance will not be unreasonably withheld, they will be incorporated into the Schedule in the next reporting period. If after submitting a request for change in the Contract Schedule, Intermountain does not agree with the request, Intermountain will schedule a meeting with Contractor to discuss the differences.
 - c. *Changes in Contract Time*. The critical path schedule as the term is used in the provisions herein will be based on the current version of Contractor’s schedule for the Project and accepted by Intermountain just before the commencement of the modification, asserted delay, suspension or interruption. If Contractor believes it is entitled to an extension of Contract Time under the Contract Documents, Contractor will submit a PCO in accordance with Article 7.2 to A/E and Intermountain Representative accompanied by an analysis of the requested time adjustment.
- 4.7.13 Extensions of Time.
- a. If Substantial Completion of the Project is delayed because of any of the following causes, then the Contract Time will be extended by Modification for a period of time equal to such delay:
 - (i) Labor strikes or lock-outs;
 - (ii) Unusual delay in transportation;
 - (iii) Unforeseen governmental requests or requirements;
 - (iv) A Change in the Work resulting from an instruction by Intermountain or A/E to Contractor subject to the conditions set forth in Section 7.1.5;
 - (v) Unforeseen Subsurface Condition subject to the conditions set forth in Section 7.1.6; or
 - (vi) Any other event or circumstance caused by the willful or negligent act or omission of Intermountain or A/E subject to the conditions set forth in Section 7.1.6.

- b. Contractor will not be entitled to any compensation for delay described in Section 4.7.13, Paragraph a, subparagraphs (i), (ii), and (iii).
- c. In no event will any time extension or cost adjustment be given on account of delay which reasonably should have been anticipated by the Contractor or in circumstances where performance of the Work is, was, or would have been, delayed by any other cause for which the Contractor is not entitled to an extension.
- d. Adverse Weather delays. Completion time will not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the contract. The time for completion as stated in the contract documents includes due allowance for calendar days on which Work cannot be performed due to weather conditions. The Contractor acknowledges that it may lose days due to weather conditions. Notwithstanding, the Contract Time may be extended (but at no cost to Intermountain) if all of the following are established by the Contractor:
 - (i) That the weather prevented Work from occurring that is on the critical path for the project based upon a critical path schedule previously submitted to Intermountain and to the extent accepted by Intermountain;
 - (ii) There are no concurrent delays attributed to the Contractor;
 - (iii) The Contractor took all reasonable steps to alleviate the impact of the weather and took reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and
 - (iv) One of the following occurred:
 - 1. The weather was catastrophic, such as a tornado, hurricane, severe wind storm, severe hail storm; or
 - 2. Based on the full history of information published from the closest station as indicated from the Western Regional Climate Center (Desert Research Institute 2215 Raggio Parkway Reno, Nevada 89512, and as may be described on the website at <http://www.wrcc.dri.edu/summary/>), one or more of the following occurred:
 - a. For any day between November 1 and March 31, the minimum temperature fell below the average minimum temperature plus the extreme low temperature recorded for the month divided by 2.
 - b. For any day between November 1 and March 31, the maximum temperature fell below the monthly average for the minimum temperature.
 - c. The daily precipitation exceeded 75% of the historical one day maximum for the month.
 - d. The snowfall for the month exceeded 175% of the historical average snow fall for the month.

Contractor will not be entitled to any compensation for Adverse Weather.

4.7.14 Time Extension Request. Unless a shorter time period is set forth herein or in other Contract Documents, any time extension will be requested by Contractor within twenty-one (21) Days after Contractor knew or should have known about the delay and will be supported by the critical path schedule analysis.

4.7.15 Delay in Completion of the Work.

- a. *Prior to Substantial Completion.* For each Day after the expiration of the Contract Time that Contractor has not achieved Substantial Completion, Contractor will pay Intermountain the amount set forth in the Agreement as liquidated damages for Intermountain's loss of use of the Project and the added administrative expense to Intermountain to administer the Project during the period of delay. In addition, Contractor will reimburse Intermountain for any additional

Consultant's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Intermountain as a result of the delay. The parties have agreed on this liquidated damages provision because actual damages which will result from a delay in Substantial Completion cannot readily be ascertained at the time of execution of the Agreement and the parties wish to fix such damages as a their reasonable estimate of such actual damages, and not as a penalty. Intermountain may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Intermountain within ten (10) Days after receipt of a written request from Intermountain for payment

- b. *After Substantial Completion.* For each Day that Contractor exceeds the time allowed for completion of the remaining items set forth in the Certificate of Substantial Completion, Contractor will pay to Intermountain as liquidated damages for additional administrative expenses the amount set forth in the Agreement. In addition, Contractor will reimburse Intermountain for any additional Consultant's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Intermountain as a result of the delay in completing such items.
- c. *No Waiver of Intermountain's Rights.* Permitting Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof, will in no way operate as a waiver or estoppel on the part of Intermountain of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

4.8 Documents and Samples at the Site; Certifying "As-Built". Contractor will maintain at the site for Intermountain, one record copy of the Drawings, Specifications, Addenda, Change Orders and other 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 will be available to A/E and will be delivered to A/E for submittal to Intermountain upon completion of the Work, or upon completion of any phase of the Work as agreed to by the parties, signed by Contractor, certifying that they show complete and exact "as-built" conditions and location, stating sizes, kind of materials, vital piping, conduit locations and similar matters. All notes of encountered or changed conditions will be included.

4.9 Shop Drawings, Product Data and Samples.

- 4.9.1 Not Contract Documents. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The submittal will 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.
- 4.9.2 Promptness. Contractor will review, approve and submit to A/E, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work, or the activities of Intermountain or separate contractors.
- 4.9.3 Not Perform Until A/E Approves. Contractor will perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved in writing by A/E. Such Work will be in accordance with the approved submittals.

- 4.9.4 Representations by Contractor. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, Contractor represents that Contractor has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
- 4.9.5 Contractor's Liability. Contractor will not be relieved of responsibility for deviations from the requirements of the Contract Documents by A/E's approval of Shop Drawings, Product Data, Samples or similar submittals unless Contractor has specifically informed A/E in writing of such deviation at the time of the submittal and A/E has given written approval to the specific deviation. Contractor will not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by A/E's review and comment.
- 4.9.6 Direct Specific Attention to Revisions. Contractor will direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples or similar submittals, except those requested by A/E and indicated on previous submittals.
- 4.9.7 Informational Submittals. Informational submittals upon which A/E is not expected to take responsive action may be so identified in the Contract Documents.
- 4.9.8 Reliance on Professional Certification. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, Intermountain and A/E will be entitled to rely upon the accuracy and completeness of such calculations and certifications. If a professional stamp is required, the professional will be licensed in the State in which the Project is located unless otherwise approved by Intermountain in writing. Likewise, Contractor is entitled to rely upon the accuracy and completeness of the calculations made by A/E in developing the Contract Documents, unless a Contractor of ordinary skill and expertise for the type of Work involved would know that such is inaccurate or incomplete and therefore must immediately notify Intermountain in writing.

4.10 Use of Project Site.

- 4.10.1 In General.
- a. Intermountain may, in Intermountain's discretion, permit Contractor to occupy or otherwise use portions of the Project site or, if applicable and available, other Intermountain property within the vicinity of the Project, for general office, staging, or other purposes as more particularly provided in the Project Specifications. As used herein, the term "Project site" or "site" will be deemed to refer to any other Intermountain property used by Contractor in connection with the Project, in addition to the actual Project site. Intermountain may, in its discretion, require Contractor to enter into a separate license agreement, on Intermountain's standard form, with respect to Contractor's occupancy or other use of Intermountain space at the actual Project site or within other Intermountain property.
 - b. Contractor will confine operations at the site to areas permitted by the Contract Documents, law, ordinances, resolutions, rules and regulations, and permits and will not unreasonably encumber the site with materials or equipment. Contractor will take all reasonable means to secure the site, protect the site and protect the Work from any damage. The site will be left free and clear of refuse, equipment, materials, etc. and the site will not be subject to spilled liquids and chemicals, toxic or otherwise. Should such an incident occur while Contractor has control of the site, Contractor will be responsible to clean, repair, or restore the site and pay all associated costs, fines and penalties. Contractor will indemnify and hold Intermountain harmless from and against any and all loss, cost, damage, injury or expense, including claims for death or injury to person or damage to property, and including without limitation attorney's fees and court costs, to the

extent arising out of or in connection with use of the site by Contractor or its contractors, employees, or invitees. Notwithstanding the foregoing, Contractor is not responsible for any damage to the site or the Work to the extent caused by Intermountain or Intermountain's agents.

- c. Contractor recognizes that the Project site and the surrounding area is frequently visited by the public and is important to Intermountain's image and function and will maintain the premises free from debris and waste materials resulting from Construction. At the completion of Construction, Contractor will promptly remove construction equipment, tools, surplus materials, waste materials and debris.

4.10.2 Access to Neighboring Properties. Contractor will not, except as provided in the Contract Documents or with Intermountain's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Project site by the owners of such properties and their respective tenants, agents, invitees and guests.

4.11 Access to Work. Contractor will provide Intermountain and A/E access to the Work in preparation and progress, wherever located.

4.12 Royalties and Patents. Contractor will pay all royalties and license fees. Contractor will defend suits or claims for infringement of patent rights and will hold Intermountain and A/E harmless from loss on account thereof, but will 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 a patent, Contractor will be responsible for such loss unless such information is promptly furnished to Intermountain in writing.

4.13 Indemnification.

- 4.13.1 To the fullest extent permitted by law, Contractor will indemnify and hold harmless Intermountain and its affiliates, subsidiaries, officers, employees, agents, authorized volunteers (hereinafter the above listing of entities and persons is referred to as "**indemnitees**") from and against every kind and character of claims, liabilities, damages, losses, settlements, and expenses, including but not limited to attorneys' fees, consultant fees, expert fees, and other costs and expenses, and including without limitation those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of or resulting from performance of the Work, including without limitation the work of all the Subcontractors and their employees, except to the extent that such liability arises out of the negligence of Intermountain, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Intermountain from all losses or injury to Intermountain's property, except to the extent that such loss or injury arises out of the negligence of Intermountain, its representatives, agents, and employees. This indemnity applies, without limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party. Notwithstanding, Intermountain will have the right, at its option, to participate in the defense of any such action without relieving Contractor of any obligation hereunder.

- 4.13.2 In addition to the foregoing, Contractor will be liable to defend Intermountain in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Intermountain's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Intermountain with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Intermountain in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.
- 4.13.3 In addition to the foregoing, Contractor will indemnify and hold Intermountain harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.
- 4.13.4 The indemnification obligation under this Article 4.13 will not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for Contractor or Subcontractor under workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.
- 4.13.5 Intermountain and Contractor waive all rights against each other for damages to the Work during construction to the extent covered by the applicable Builder's Risk Policy, except such rights as they may have to the proceeds of such insurance as set forth in the Contract. Contractor will require similar waivers from its Subcontractors, subconsultants, and agents, at any tier.

4.14 Additional Services/Work. It is understood and agreed by the parties hereto that no money will be paid to Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. Intermountain specifically reserves the right to modify or amend the Contract and the total sum due hereunder, either by enlarging or restricting the scope of the Work.

4.15 Building Information Modeling. Contractor will perform, throughout the Project, as requested by Intermountain and/or as otherwise required to execute the Project, building information modeling ("BIM") services and coordination among trades. Such BIM services are included in Contractor's Work and services and shall be provided by Contractor and Subcontractors without additional fee or charge to Intermountain. Contractor will provide BIM services using software acceptable to Intermountain.

5. SUBCONTRACTORS.

5.1 Award of Subcontracts and Other Contracts for Portions of the Work.

5.1.1 Approval Required.

- a. Listing of Subcontractors will be as stated in the Contract Documents, including but not limited to the "Intermountain Subcontractors List Form".
- b. Contractor will not contract with a proposed person or entity to whom Intermountain has made a reasonable and timely objection. Contractor will not be required to contract with anyone to whom Contractor has made reasonable objection.

5.1.2 Business and Licensing Requirements. All Subcontractors used by Contractor will comply with all applicable business and licensing requirements.

5.1.3 Subsequent Changes. After the bid opening, Contractor may change its listed Subcontractors only in accordance with the Contract Documents and with written approval of the Director.

- a. Intermountain will pay the additional costs for an Intermountain requested change in Subcontractor if all of the following are met:
 - (i) If Intermountain in writing requests the change of a Subcontractor;

- (ii) The original Subcontractor is a responsible Subcontractor that meets the requirements of the Contract Documents; and
 - (iii) The original Subcontractor did not withdraw as a Subcontractor on the project.
 - b. In all other circumstances, Contractor will pay the additional cost for a change in a Subcontractor.
- 5.1.4 **Bonding of Subcontractors.** Subcontractors as identified by Intermountain 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.
- 5.1.5 **Unrelated Subcontractors / Contractor Self-Performed Work.**
- a. Contractor will procure bids for subcontract work from at least three (3) qualified bidders unless Intermountain waives such requirement in writing. Except as provided in the following section, Contractor will enter into contracts with Subcontractors not owned, related to or controlled by Contractor to perform all portions of the Work. Subcontracts will contain payment provisions consistent with the Contract Documents and will not be awarded on the basis of cost plus a fee without the prior written consent of Intermountain.
 - b. If Contractor wishes to self-perform any portion of the Work or subcontract such portion of the Work to an entity owned or controlled by or related to Contractor, Contractor will:
 - 1) Advise Intermountain at least thirty (30) Days in advance of bid opening that Contractor wishes to self-perform such Work or subcontract it to an entity owned, controlled by or related to Contractor and request Intermountain's written approval thereof;
 - 2) Submit to Intermountain Contractor's or such related entity's bid at least seventy-two (72) hours prior to bid opening;
 - 3) Procure bids for such subcontract Work from at least three qualified bidders unless Intermountain waives such requirement in writing; and
 - 4) Abide by Intermountain's determination as to whether Contractor or another subcontractor will be used to perform such Work.
 - c. If Intermountain both approves Contractor to self-perform Work and approves Contractor proceeding without obtaining bids from other Contractors, then Contractor's overhead and profit on Work performed by Contractor's crews will not be more than the percentage fee, if any, stated in the Contractor's Agreement or such fee as agreed by Intermountain and Contractor by a written Modification executed prior to Contractor's commencing the applicable self-performed Work.

5.2 Subcontractual Relations.

- 5.2.1 **Comply with Contract Documents.** By appropriate enforceable agreement, and to the extent it can be practically applied, Contractor will 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 which Contractor, by these Documents, assumes towards Intermountain and A/E.
- 5.2.2 **Rights.** Each Subcontractor agreement will preserve and protect the rights of Intermountain and A/E under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and will 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 Intermountain.

- 5.2.3 Sub-Subcontractors. Contractor will require each Subcontractor to enter into similar agreements with its Subcontractors which complies with the requirements of Paragraphs 5.2.1 and 5.2.2 hereinabove.
- 5.2.4 Document Copies. Contractor will make available to each proposed Subcontractor, before execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractors will similarly make copies of applicable portions of the Contract Documents available to their respective proposed Subcontractors.

5.3 Contingent Assignment of Subcontracts. Each subcontract agreement for a Subcontractor, at any tier for a portion of the Work, is hereby assigned by Contractor to Intermountain provided that the assignment is effective only after termination of the Contract by Intermountain for cause pursuant to Article 12.2 or stoppage of the Work by Intermountain pursuant to Article 12.5, and only for those subcontract agreements which Intermountain accepts by notifying the Subcontractor in writing. The subcontract will be equitably adjusted to meet the new conditions of the work.

6. PROTECTION OF PERSONS AND PROPERTY.

6.1 Safety of Persons and Property.

- 6.1.1 Contractor Responsibility. Contractor will be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. Contractor will take all reasonable precautions for the safety of, and will provide reasonable protection to prevent damage, injury or loss to:
 - a. Employees on the Work and other persons who may be affected thereby;
 - b. The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of Contractor or a Subcontractor; and
 - c. Other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.
- 6.1.2 Safety Program, Precautions. Contractor will institute a safety program at the start of construction to minimize accidents. This program will continue to the final completion of the Project and conform to applicable laws and regulations including the Utah Occupational Safety and Health Rules and Regulations as published by the Utah Industrial Commission - UOSH Division. Contractor will post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as Contractor proceeds with the Work, Contractor will have all workers and all visitors on the site wear safety hard hats, as well as all other appropriate safety apparel such as safety glasses and shoes, and obey all safety rules and regulations and statutes. Contractor will post a sign in a conspicuous location indicating the necessity of wearing hard hats and Contractor will loan such hats to visitors.
- 6.1.3 Compliance with Safety Laws. Contractor will give notices and comply with applicable laws, ordinances, rules, codes, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.
- 6.1.4 Erect and Maintain Safeguards. Contractor will erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including effective fences, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.
- 6.1.5 Utmost Care. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, Contractor will exercise utmost care and carry on such activities under supervision of properly qualified personnel.

- 6.1.6 **Prompt Remedy.** Contractor will promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Paragraph 6.1.1 of these General Conditions caused in whole or in part by Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which Contractor is responsible under this Paragraph 6.1.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of A/E or Intermountain. The foregoing obligations of Contractor are in addition to Contractor's obligations under the Contract Documents.
- 6.1.7 **Safety Designee.** Contractor will designate a responsible member of Contractor's organization at the site whose duty will be the prevention of accidents, damage, injury or loss. This person will be Contractor's superintendent unless otherwise designated by Contractor in writing to Intermountain and A/E.
- 6.1.8 **Load Safety.** Contractor will not load or permit any part of the construction or site to be loaded so as to endanger its safety.
- 6.1.9 **Off-Site Responsibility.** In addition to its other obligations under this Article 6, Contractor will, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of Intermountain and third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by it or by its Subcontractors at any tier. Contractor will 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 will act, at Contractor's discretion, to prevent threatened damage, injury or loss. Contractor will promptly notify Intermountain Representative of the action taken.
- 6.2 Hazardous Materials.** In the event Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or any other hazardous waste or substance which may endanger the health of those persons performing the Work or being on the site, Contractor will immediately stop Work in the area affected and immediately report the condition to Intermountain Representative and A/E by phone with a follow-up document in writing. The Work in the affected area will be resumed when written direction is provided by Intermountain Representative. 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 will not be required to perform without Contractor's consent, any Work relating to asbestos, polychlorinated biphenyl (PCB) or any other hazardous waste or substance. Intermountain will procure a licensed abatement contractor qualified to remove the hazardous material. The abatement contractor will submit notification of demolition to the Utah Division of Air Quality. Abatement contractor will pay the notification fee. A copy of the hazardous material survey report will be available to all persons who have access to the construction site.
- 6.3 Historical and Archeological Considerations.** In the event Contractor knows or should have known of 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 Intermountain, Contractor will cease any work that would interfere with such discovery and immediately report the condition to Intermountain Representative and A/E by phone with a follow-up document in writing. Work will resume based upon the direction of Intermountain Representative. Contractor cooperation with any Intermountain recognized archaeologist or other cultural/historical expert is required.
- 6.4 Contractor Liability.** If Contractor fails in any of its obligations in Articles 6.1 through 6.3 above, Contractor will be liable to any damages to Intermountain or any third party resulting from such noncompliance. Contractor will also be liable for any mitigation or restoration effort resulting from such noncompliance. To

the extent all the following is met, Contractor may treat the discovery of such material similarly to an unforeseen condition:

- 6.4.1 The discovery of such material is reasonably unforeseeable given the site conditions that Contractor should have been aware;
- 6.4.2 The presence of such material was not identified in any part of the Contract Documents;
- 6.4.3 Contractor has undertaken all proper action to mitigate any impact of such discovery on the critical path or monies related to the Project;
- 6.4.4 The discovery affects the critical path or contract price from that which was contemplated by the Contract Documents; and
- 6.4.5 The requirements of 7.1.5 and the Contract documents are met.

7. MODIFICATIONS, REQUEST FOR INFORMATION, PROPOSED CHANGE ORDER, AND CLAIMS 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 Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or ASI, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. Contractor must have a written Modification executed by Intermountain under this Article 7 before proceeding with any Work sought to be an extra.
- 7.1.2 By Whom Issued. A Change Order or Construction Change Directive will be issued by Intermountain Representative. An ASI is issued by A/E. A/E will prepare Change Orders and Construction Change Directives with specific documentation and data for Intermountain's approval and execution in accordance with the Contract Documents, and may issue ASIs not involving an adjustment in the Contract Sum or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents.
- 7.1.3 Contractor to Proceed Unless Otherwise Stated. Changes in the Work will be performed under applicable provisions of the Contract Documents, and Contractor will proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or ASI.
- 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 PCO or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause a substantial inequity to Intermountain or Contractor, the applicable unit prices may be equitably adjusted.
- 7.1.5 Changes in the Work Resulting From An Instruction by Intermountain or A/E to Contractor.
 - a. If Intermountain or A/E gives Contractor an instruction that modifies the requirements of the Contract Documents or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If compliance with the instruction affects the cost to Contractor to perform the Work, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in cost subject to the conditions set forth in Section 7.1.5, subparagraphs b through g. If compliance with the instruction delays Substantial Completion, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in Section 7.1.5, subparagraphs b through g and Section 4.7.13.
 - b. If Contractor receives an instruction from Intermountain or A/E that Contractor considers to be a Change in the Work, Contractor, before complying with the instruction, will notify A/E in writing that Contractor considers such instruction to constitute a Change in the Work. If A/E agrees that compliance with the instruction will constitute a Change in the Work, Contractor will furnish a

proposal for a Modification in accordance with Section 7.1.5 subparagraphs c and d. within ten (10) Days.

- c. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) as a result of an instruction by Intermountain or A/E, Contractor will furnish a proposal for a Change Order containing a price breakdown itemized as required by Intermountain. The breakdown will provide sufficient detail to allow Intermountain to determine any increase or decrease in Direct Costs as a result of compliance with the instruction. Any amount claimed for subcontracts will be supported by a similar price breakdown and will itemize the Subcontractor's profit and overhead charges. Profit and overhead will be subject to the markup limits for additional work, changes, or other Modification set forth in the Contractor's Agreement. Amounts due Intermountain as a result of a credit change will be the actual net decrease in the Contractor's Direct Costs to perform the Work as a result of the Change in the Work. Overhead and profit for the Modification will be calculated based on the net increase or decrease in Contractor's Direct Costs resulting from the Change in the Work.
- d. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an instruction from Intermountain or A/E, Contractor will include in its proposal justification to support Contractor's claim that compliance with the instruction will delay Substantial Completion.
- e. Upon receipt of Contractor's proposal for Modification, A/E and Intermountain will determine whether to proceed with the Change in the Work. If A/E and Intermountain determine to proceed with the Change in the Work, they will execute a Change Order, a Construction Change Directive or a Field Change as appropriate.
- f. Contractor agrees that if it complies with an instruction from Intermountain or A/E without first giving written notice to A/E as provided in Section 7.15, subparagraph b, and receiving a Change Order, Construction Change Directive or Field Change, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.
- g. If Contractor is instructed to perform work which it claims constitutes a Change in the Work but which Intermountain and A/E do not agree constitutes a Change in the Work, Contractor will comply with the instruction. Contractor may submit its claim for adjustment to the Contract Sum, the Contract Time, or both as a dispute pursuant to Section 7.7 within twenty-one (21) Days after compliance with the instruction. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 7.7 within twenty-one (21) Days after compliance with the instruction, then Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.
- h. Contractor agrees that it is responsible for submitting accurate cost and pricing data to support its Change Order Proposals. Intermountain will have the right to examine the Contractor's records to verify the accuracy and appropriateness of the pricing data used to price change order proposals.

7.1.6 Change in the Work Resulting From An Event or Circumstance.

- a. If an event or circumstance other than an instruction from Intermountain or A/E affects the cost to Contractor of performing the Work or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If the circumstance or event affects the cost to Contractor to perform the Work and is caused by a willful or negligent

act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in Contractor's cost to perform the Work resulting from the event or circumstance, subject to the conditions set forth in Section 7.1.6, subparagraphs b through f. If the event or circumstance delays Substantial Completion and is described in Section 4.7.13, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in such section. If the circumstance or event delays Substantial Completion and is caused by a willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, then Contractor will be compensated for costs incident to the delay in accordance with Section 7.1.6, subparagraphs b through g and Section 4.7.13.

- b. Contractor will not be entitled to any adjustment to the Contract Sum or other damages from Intermountain as a result of any event or circumstance unless the event or circumstance results from a willful or negligent act or omission of Intermountain or A/E.
- c. If a Change in the Work results from any event or circumstance caused by the willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, Contractor will give Intermountain Written Notice of such event or circumstance within twenty-four (24) hours after commencement of the event or circumstance so that Intermountain can take such action as is necessary to mitigate the effect of the event or circumstance. Contractor will not be entitled to any adjustment in either the Contract Time or the Contract Sum based on any damages or delays resulting from such event or circumstance during a period more than twenty-four (24) hours prior to Contractor giving such Written Notice to Intermountain.
- d. Contractor will submit in writing any claims for an adjustment in the Contract Time and/or the Contract Sum resulting from an event or circumstance within the time limits set forth below. In the event that Contractor fails to submit its claim in writing within the time limits set forth below, then Contractor agrees it will not be entitled to any adjustment in the Contract Time or the Contract Sum or to any other damages from Intermountain due to the circumstance or event and waives any claim therefor.
 - (i) Claims for an adjustment in the Contract Time due to Adverse Weather will be made within twenty-one (21) Days of the first Day of the occurrence of the Adverse Weather event in which the delay occurred.
 - (ii) Claims for an adjustment in the Contract Time and/or the Contract Sum due to any other circumstance or event will be submitted within seven (7) Days after the occurrence of the circumstance or event.
- e. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) because of an event or circumstance resulting from the willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, Contractor will furnish a proposal for a Change Order containing a price breakdown as described in Section 7.1.5, subparagraph c. Any amount claimed for increased labor costs as a result of the event or circumstance must be supported by a certified payroll. Any claim for rented equipment or additional material costs must be supported by invoices.
- f. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an event or circumstance, Contractor will include with its claim copies of daily logs, letters, shipping orders, delivery tickets, Project schedules, and other supporting information necessary to justify Contractor's claim that the event or circumstance delayed Substantial Completion.

- g. Within thirty (30) Days after receipt of Contractor's claim, A/E will either deny the claim or recommend approval to Intermountain. If Intermountain approves the claim, the adjustment in the Contract Time and/or Contract Sum will be reflected in a Change Order pursuant to Section 7.4 or a Construction Change Directive pursuant to Section 7.5. If Intermountain or A/E denies Contractor's claim, Contractor may submit its claim as a dispute pursuant to Section 7.7 within twenty-one (21) Days of receipt of the denial of the claim. If Contractor fails to submit its claim for resolution pursuant to Section 7.7 within the twenty-one (21) Day time period, then Contractor agrees it is not entitled to any adjustment in the Contract Time and/ or Contract Sum or any other damages as a result of the event or circumstance and waives any claim therefor.

7.2 Contractor Initiated Requests.

- 7.2.1 The Request for Information, RFI, Process and Time to File. Contractor may file an RFI with A/E regarding any concern which will assist Contractor in the proper completion of the Work including, but not limited to issues related to the Contract Documents, plans and specifications. The RFI will be filed with A/E in a timely manner so as not to prejudice Intermountain as to the quality, time or money related to the Work.
- 7.2.2 Proposed Change Order. Unless a shorter time period is set forth herein or in other Contract Documents, within twenty-one (21) Days after Contractor knows or should have known of a situation or concern where Contractor is going to request additional monies or time, Contractor must file a PCO with Intermountain Representative, or Contractor will be deemed to waive any right to claim additional monies or time related to such situation or concern. The PCO will include all available documentation supporting the PCO available to Contractor at the time of filing and Contractor will thereafter diligently pursue the supplementation(s) of such documentation and promptly deliver such supplementation(s) to Intermountain Representative.
 - a. *Intermountain Representative Response.* One of the following may occur after a PCO is filed with Intermountain Representative:
 - (i) Intermountain Representative, after considering any input by A/E, may reach an agreement with Contractor and issue a Change Order.
 - (ii) Intermountain, after considering any input by A/E, may issue a Construction Change Directive.
 - (iii) If Intermountain Representative, after considering any input by A/E, disagrees with Contractor's PCO, Intermountain representative may seek additional information or verification from Contractor, A/E 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. A/E must continually work with Intermountain in providing data, documentation and efforts to resolve the issues related to the PR.

7.3 Proposal Request Initiated by Intermountain. Intermountain may file a Proposal Request with Contractor seeking information, data and/or pricing relating to a change in the Contract Time and or monies owing for particular scope changes or other modifications to the Contract Documents. The PR will provide a time limit for Contractor to file a response with A/E and Intermountain Representative. If a proposal is not timely provided by Contractor, Intermountain may calculate the Change Order under Article 7.4.2 below. Upon such timely receipt of the proposal, one of the following will occur:

- 7.3.1 If Agreement, Change Order Issued. Intermountain Representative, after considering any input by A/E, may reach an agreement with Contractor and issue a Change Order.
- 7.3.2 If Disagreement. If Intermountain Representative disagrees with Contractor's proposal, after considering any input from A/E, Intermountain representative 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 which identifies Intermountain representative's position in regard to the subject contract sum and/or time adjustment, Contractor must initiate the Claim resolution process provided for herein within twenty-one (21) Days of Contractor's receipt of the Construction Change Directive, or Contractor will be deemed to waive any such request for additional time or money as a result of the issuance of the Construction Change Directive. Such waiver will entitle Intermountain 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 additional time or money related to the directed change, then the time period for initiating the Claim resolution process will not accrue until such time as Intermountain has conveyed to Contractor a position as to the time and money owing as a result of the directed change.

7.4 Evaluation of Proposal for Issuing Change Orders.

- 7.4.1 Adjusting Sum Based Upon Agreement. If the Change Order provides for an adjustment to the Contract Sum, the adjustment will be based on the mutual agreement of Contractor and Intermountain, including any terms mandated by unit price agreements or other terms of the Contract Documents.
- 7.4.2 Intermountain Resolution of Sum and Standards in the Absence of an Agreement Under Paragraph 7.4.1. In the absence of an agreement under Paragraph 7.4.1 above, the adjustment will 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 Paragraph will be limited to the following:
- a. 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;
 - b. Costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;
 - c. Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from Contractor or others;
 - d. Costs of permits and other fees, sales, use or similar taxes related to the Work (with no markup);
 - e. Additional costs of field supervision and field office personnel directly attributable to the change; and
 - f. Overhead and profit by the markup limits in the Agreement for additional services or modifications which is not a penalty but a reasonable calculation agreed upon at the time of execution of the Agreement, and provided therein due to the fact that the actual amount due for this overhead and profit cannot easily be ascertained at the time of such execution. The markups set forth in the Agreement are to cover additional payment and performance bond premiums, insurance premiums, home office and on-site overhead and profit. Overhead and profit includes, but is not limited to Contractor's Project Manager and Cost Estimator. Each request for pricing will stand on its own and not be combined with other requests for pricing in determining the allowed markup. A particular request for pricing will include all items reasonably related together and determinable at the time of the request. If several unrelated requests for pricing are grouped together in a single Change Order, each request for pricing will be considered separately for purposes of calculating the markup.
- 7.4.3 Credits. The amount of credit to be allowed by Contractor to Intermountain for a deletion or change which results in a net decrease in the Contract Sum will be actual net cost as confirmed to Intermountain based upon corroboration by an appropriate source.

7.5 Construction Change Directives.

- 7.5.1 When Used and Contractor's Right to Challenge. A Construction Change Directive may be issued by Intermountain Representative in the case of a need for the Work to commence. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the Construction Change Directive will indicate the timeframe(s) in which further information is to be provided to resolve the matter. At any time that Intermountain and Contractor agree upon the time and money related to a Construction Change Directive, a Change Order will be executed by the parties. Additionally, the Construction Change Directive may be converted to a Change Order under Paragraph 7.2.2 or Article 7.3 above.
- 7.5.2 Proceed with Work and Notify Intermountain about Adjustment Method. Upon receipt of a Construction Change Directive, Contractor will promptly proceed with the change in the Work involved.
- 7.5.3 Interim Payments by Intermountain. Pending the final determination of the total cost of the Construction Change Directive, Intermountain will pay any undisputed amount to Contractor.

7.6 A/E's Supplemental Instruction (Commonly referred to as an "ASI"). A/E may at any time that is consistent with maintaining the quality, safety, time, budget and function of the Work, issue to Contractor a supplemental instruction ("ASI") after approval from Intermountain Representative is obtained. Contractor must file with Intermountain Representative a PCO under Paragraph 7.2.2 above, within twenty-one (21) Days of Contractor's receipt of the ASI, or the Contractor will be deemed to have waived any right to additional time or monies as a result of such ASI.

7.7 Resolution of Disputes. If a dispute arises between the Parties regarding the Contract Documents which is not resolved by agreement between the parties, before a party may proceed with judicial action, the dispute must be submitted in writing to Intermountain's Vice President of Financial Strategy, Growth and Development, at 36 South State Street, Salt Lake City, Utah 84111. Upon receipt of such written submission, Intermountain will schedule within seven (7) Days an initial conference or meeting, and if necessary within an additional ten (10) Days thereafter a further conference or meeting, as set forth in the escalation process herein below.

- 7.7.1 Escalation Process. The Parties will arrange in-person meetings or telephone conferences at mutually convenient times and places, according to the levels and time schedules set forth below. The Parties will use reasonable and good faith efforts in this escalation process to respond promptly and to resolve the dispute. Such meetings or conferences will constitute settlement negotiations and any settlement proposal made pursuant to such meetings or conferences will not be admissible as evidence of liability.

Levels and Representatives

Allotted Time Period from Notice or from Previous Level

Level 1

Contractor's Director level employee,
and Intermountain's Director

7 Days

Level 2

Vice President or higher level executive

10 Days

- 7.7.2 Judicial Action. In the event that the parties do not resolve their dispute pursuant to the escalation process, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the initial Level 1 conference/meeting or be time barred. Submission of the dispute under the escalation process as outlined above is a condition

precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute under the escalation process, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorney fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses. Any such legal action must be brought exclusively in the state courts of the State of Utah or in the federal courts of the United States which are located in Salt Lake County, Utah. The Parties hereto hereby agree to submit to the exclusive jurisdiction and venue of such courts for the purposes hereof.

- 7.7.3 Continuation of Performance During Proceedings. Pending final resolution of a dispute hereunder, Contractor will proceed diligently with the performance of its obligations under the Contract Documents.

7.8 Payment of Claim.

- 7.8.1 When a standalone component of a Claim has received a final determination, and is no longer subject to review or appeal, that amount will be paid in accordance with the payment provisions of the Contract Documents or judicial order.
- 7.8.2 When the entire Claim has received a final determination, and is no longer subject to review or appeal, the full amount will be paid within thirty-one (31) Days of the date of the final determination unless the work or services has not been completed, in which case the amount will be paid in accordance with the payment provisions of the Contract Documents to the point that the work or services is completed.
- 7.8.3 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.
- 7.8.4 Any final determination where Intermountain is to pay additional monies to Contractor will not be delayed by any appeal or request for judicial review by another party brought into the process by Intermountain as being liable to Intermountain.
- 7.8.5 Notwithstanding any other provision of the Contract Documents, payment of all or part of a Claim is subject to any set-off, claims or counterclaims of Intermountain.
- 7.8.6 Payment to Contractor for a Subcontractor issue (Claim) deemed filed by Contractor, will be paid by Contractor to the Subcontractor in accordance with the contract between Contractor and the Subcontractor.
- 7.8.7 The execution of a customary release document related to any payment may be required as a condition of making the payment.

7.9 Allocation of Costs of Claim Resolution Process.

- 7.9.1 Except for attorneys' fees and expert fees, and unless otherwise agreed to by the parties to the Claim, the costs of resolving the Claim will be allocated among the parties on the same proportionate basis as the determination of financial responsibility for the Claim. 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.
- 7.9.2 The prevailing party in any Claim, judicial action or other proceeding is entitled to recover its reasonable attorneys' fees, expert and other fees, and costs incurred in the proceeding, in addition to any other relief to which that party may be entitled.

7.10 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 Article 7.

8. PAYMENTS AND COMPLETION.

8.1 Schedule of Values. With the first Application for Payment, Contractor will submit to A/E and Intermountain Representative a schedule of values allocated to all the various portions of the Work. The Schedule of Values will be submitted on the form approved and provided by Intermountain. A/E will make recommendations to Intermountain Representative regarding the Schedule of Values including any suggested modifications. When approved, including any approved modifications, by Intermountain Representative, it will be the basis for future Contractor Applications for Payments. Contractor will 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 will be met:

- a. Not more than once a month, Contractor will submit to 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. Contractor's Applications for Payment will include conditional or final lien waivers (as applicable), in the forms attached to Contractor's Agreement for itself and from each Subcontractor requesting payment, covering all payments requested in the Application for Payment. The Application for Payment will be on a form provided by Intermountain.
- b. Such application will be supported by such data substantiating Contractor's right to payment as Intermountain or A/E may require. This data may include, but is not limited to, copies of requisitions from Subcontractors.
- c. Such applications may include requests for payment pursuant to approved Change Orders or Construction Change Directives.
- d. Such applications may not include requests for payment for portions of the Work performed by a Subcontractor when Contractor does not intend to pay to a Subcontractor because of a dispute or other reason.
- e. In executing the Application for Payment, Contractor will attest that Subcontractors involved with prior applications for payment have been paid, unless Contractor provides a detailed explanation why such payment may not have occurred. Intermountain reserves the right to require Contractor to submit a payment waiver from one or more Subcontractors.

8.2.2 Payment for Material and Equipment. Unless otherwise provided in the Contract Documents, payments will be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by Intermountain and A/E, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site will be conditioned upon compliance by Contractor with procedures satisfactory to Intermountain to establish Intermountain's title to such materials and equipment or otherwise protect Intermountain's interest, and will include applicable insurance, storage and transportation to the site for such materials and equipment stored on or off the site. Intermountain 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 will pass to Intermountain 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 Intermountain will, to the best of Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or

encumbrances in favor of 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 Retainage and Holdback by Intermountain.

- a. *Holdback by Intermountain.* Notwithstanding anything to the contrary contained in the Contract Documents, Intermountain may, as a result of the Claim resolution process, withhold any payment to Contractor hereunder if and for so long as Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents.
- b. *Intermountain's Right to Withhold and Use Funds.* Intermountain may withhold from payment to Contractor such amount as, in Intermountain's judgment, may be necessary to pay just claims against Contractor or Subcontractors at any tier for labor and services rendered and materials furnished in and about the Work. Intermountain may apply such withheld amounts for the payment of such claims in Intermountain's discretion. In so doing, Intermountain will be deemed the agent of Contractor and payment so made by Intermountain will be considered as payment made under the Contract by Intermountain to Contractor. Intermountain will not be liable to Contractor for any such payment properly made. Such withholdings and payments may be made without prior approval of Contractor and may also be made before any determination as a result of any dispute, Claim or litigation. However, Contractor will be notified before any such withholding and will be given an opportunity to inform Intermountain as to any reason why the withholding will not occur.
- c. *Statutory Retainage.* Notwithstanding and in addition, retainage in the amount of 5% will be withheld from each payment to Contractor for any Work under the Contract. The retainage, including any additional retainage imposed and the release of any retainage, will be in accordance with Intermountain policies, including restrictions of retainage regarding Subcontractors and the distribution of interest earned on the retention proceeds. After Contractor achieves Substantial Completion and submits its payment request for retained funds and provides statutory Conditional Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, Intermountain will pay any unpaid statutory retention, less any offsets or withholdings for specific deficiencies or disputes, within forty-five (45) Days. Notwithstanding the foregoing, Intermountain may (but is not obligated to), in its sole discretion, release from time to time any portion of retention funds for early completing subcontractors and/or otherwise reduce the overall retention funds withheld.
- d. *Intermountain Not Responsible for Contractor's Retention Requirements.* Intermountain will not be responsible for enforcing Contractor's obligations under Utah law in fulfilling the retention law requirements with Subcontractors at any tier.

8.2.5 Reimbursement to Intermountain. Notwithstanding any other provision of the Contract, Contractor will reimburse Intermountain for the portion of any expenses paid by Intermountain to Contractor, which is attributable to Contractor's breach of its duties under the Contract, including the breach of any duty by any Subcontractor or supplier at any tier or anyone for whom Contractor may be liable.

8.3 Certificates for Payment.

- 8.3.1 *Issued by A/E.* A/E will within ten (10) Days after receipt of Contractor's Application for Payment, either issue to Intermountain a Certificate for Payment, with a copy to Contractor, for such amount as A/E determines due, or notify Contractor and Intermountain in writing of A/E's reasons for withholding certification in whole or in part as provided in Paragraph 8.4.1. If A/E fails to act within this ten (10) Day period, Contractor may file the Application for Payment directly with Intermountain Representative and Intermountain will thereafter have thirty-one (31) Days from the date of Intermountain's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of Contractor's Applications for Payment will be Contractor's responsibility, not A/E's.

- 8.3.2 A/E's Representations. A/E's issuance of a Certificate for Payment will constitute a representation to Intermountain that to the best of A/E's knowledge, information and belief, based upon 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 before completion and to specific qualifications expressed by A/E. The issuance of a Certificate for Payment will further constitute a representation that Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that A/E has (a) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (b) reviewed construction means, methods, techniques, sequences or procedures, (c) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by Intermountain to substantiate Contractor's right to payment, (d) ascertained how or for what purpose Contractor used money previously paid on account of Contract Sum, or (e) any duty to make such inquiries.
- 8.3.3 Contractor Respond to Financial Responsibility and Related Requests, Waivers, Releases, Bonds. Contractor will respond immediately to any inquiry in writing by Intermountain as to any concern of financial responsibility and Intermountain reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third-party before any payment by Intermountain to Contractor.

8.4 Decisions to Withhold Certification.

- 8.4.1 When Withheld. 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 Intermountain, if in A/E's judgment the representations to Intermountain required in Paragraph 8.3.2 above cannot be made. If A/E is unable to certify payment in the amount of the Application, A/E will notify Contractor and Intermountain as provided in Paragraph above. If Contractor and A/E cannot agree on a revised amount, A/E will promptly issue a Certificate for Payment for the amount to which A/E makes such representations to Intermountain. 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 A/E's opinion to protect Intermountain from loss because of:
- a. Defective Work not remedied;
 - b. Third party claims filed or reasonable evidence indicating probable filing of such claims;
 - c. Failure of Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
 - d. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
 - e. Damage to Intermountain or another contractor;
 - f. Reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
 - g. 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 Paragraph 8.4.1 for withholding certification are removed, certification will 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 A/E or the result of the Claim resolution process with regard to any Certification of Payment, Contractor nevertheless will expeditiously continue to prosecute the Work.
- 8.4.4 Intermountain Not in Breach. Intermountain will not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided Intermountain'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 on Late Payments.
- a. Except as provided in Paragraph 8.3.1, Intermountain will pay any undisputed amount within thirty-one (31) Days of satisfaction of the following requirements: (i) Contractor has submitted the application for payment; (ii) A/E has issued to Intermountain a Certificate recommending payment; (iii) Contractor has obtained conditional or unconditional waiver and release documents executed by all of Subcontractors performing work and/or providing materials covered by the Contractor's payment request; and (iv) Contractor has provided all "as-built" drawings to A/E sufficient for A/E to compile and provide a final set of Record Drawings for each completed phase and for all portions of the Project for which a certificate of occupancy is issued. In no event will Intermountain be required to pay any disputed amount.
 - b. Except as otherwise provided by law, if any payment is made more than sixty (60) Days after receipt by Intermountain of the applicable invoice (with any required supporting documentation), the late payment will bear interest from the due date until payment is made at the rate of five percent (5%) per annum.
- 8.5.2 Contractor and Subcontractor Responsibility. Contractor will promptly pay each Subcontractor, upon receipt of payment from Intermountain, out of the amount paid to Contractor on account of such Subcontractor's portion of the Work, the amount to which this Subcontractor is entitled. Contractor will, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Subcontractors in a similar manner.
- 8.5.3 Information Furnished by A/E Or Intermountain to Subcontractor. A/E or Intermountain will, on request, furnish to the Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by Contractor and action taken thereon by A/E and Intermountain on account of portions of the Work done by such Subcontractor.
- 8.5.4 Intermountain and A/E Not Liable. Neither Intermountain nor A/E will 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 Improper Work. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by Intermountain will 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 A/E, Intermountain will 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, Intermountain may retain up to 200% of the fair market value of the work that has not been completed in accordance with the Contract Documents.

8.7 Partial Occupancy or Use.

- 8.7.1 In General. Intermountain 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 Intermountain 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 will prepare and submit a list to A/E as previously provided for herein. Consent of Contractor to partial occupancy or use will not be unreasonably withheld. Contractor will have continuing responsibility to protect the unoccupied portions of the site and the Work during such partial occupancy and will be responsible for damage except to the extent caused solely by Intermountain during such partial occupancy or use.

The stage of progress of the Work will be determined by written agreement between Intermountain and Contractor.

- 8.7.2 Inspection. Immediately before such partial occupancy or use, Intermountain, Contractor and A/E will 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 Record Drawings. Contractor will provide all “as-built” drawings to A/E and A/E will then provide to Intermountain within forty-five (45) Days of any partial occupancy a final set of Record Drawings for the occupied phase or portion of the Project.
- 8.7.4 Not Constitute Acceptance. Except to the extent it is agreed upon in writing by Intermountain, partial occupancy or use of a portion or portion of the Work will not constitute acceptance of Work not complying with the requirement of the Contract Documents.

8.8 Final Payment.

- 8.8.1 Certificate for Payment. A/E’s final Certificate for Payment will constitute a further representation that the conditions listed in Paragraph 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 will become due until Contractor submits to A/E the following to the extent required by Intermountain Representative:
 - a. A final payment request;
 - b. Waiver and release upon final payment documents executed by all of the Subcontractors performing work and/or providing materials covered by the Contractor’s final payment request;
 - c. An executed Substantial Completion form, which includes remaining Project items to be completed, Final Certificate of Occupancy from the applicable municipality, fire clearance(s) from Fire Marshal, Approval(s) from applicable State Dept. of Health, and any other permits/approvals for occupancy of Project as required by authorities with jurisdiction over the Project;
 - d. Evidence satisfactory to Intermountain that all required utilities are installed, commissioned, and operating consistent with the Specifications;
 - e. Confirmation of completion of any review or, if applicable, audit of Contractor’s Payment Applications and reconciliation, as required by Intermountain;
 - f. All manufacturers’ and other guaranties and warranties, properly signed and endorsed to Intermountain, that are required by the Contract Documents that extend for a period beyond one year after substantial completion. (Delivery of such guaranties and warranties will not relieve Contractor for any obligation assumed under any other provision of the Contract Documents.);

- g. An affidavit that payrolls, bills for material and equipment, and other indebtedness connected with the Work for which Intermountain's property might be responsible or encumbered (less amounts withheld by Intermountain) have been paid or otherwise satisfied;
- h. 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 will not be canceled or allowed to expire until at least thirty (30) Days prior written notice, by certified mail, return receipt requested, has been given to Intermountain;
- i. A written statement that Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;
- j. If requested by surety in a timely manner or by Intermountain, consent of surety, to final payment;
- k. Up to date "as-built" Drawings certified by Contractor as accurate and complete, 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;
- l. Other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by Intermountain. If a Subcontractor refuses to furnish a release or waiver required by Intermountain, Intermountain may require consent of surety to the final payment. If such liens, claims, security interests or encumbrances remain unsatisfied after payments are made, Contractor will refund to Intermountain all money that Intermountain may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees; and
- m. A written statement demonstrating how Contractor will distribute interest earned on retention to Subcontractors as required by Section 13.8.5, U.C.A.

In addition, A/E must declare to Intermountain in writing that the Work is complete and provide a final set of Record Drawings. If the aggregate of previous payments made by Intermountain exceeds the amount due Contractor, Contractor will reimburse the difference to Intermountain within ten (10) Days of Intermountain's request.

- 8.8.3 Waiver of Claims: Final Payment. The making of final payment will not constitute a waiver of Claims or other rights by Intermountain.
- 8.8.4 Waiver by Accepting Final Payment. Acceptance of final payment by Contractor or a Subcontractor will 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.
- 8.8.5 Time of Repose and Waiver. In addition and notwithstanding, claims and invoices for work, equipment, services, or materials that are not submitted to Intermountain within one (1) year of Substantial Completion of the Project are completely void and unenforceable as against Intermountain. Contractor and all Subcontractors hereby waive all rights and claims against Intermountain attendant such claims and invoices, and Contractor will contractually obligate each Subcontractor to waive all rights and claims against Intermountain attendant such claims and invoices. This provision imposes an absolute cut off on the timing for submitting such claims and invoices; this provision does not lengthen any timing requirements in the Contract Documents.

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, ordinances, rules, regulations, resolutions or orders of public authorities having jurisdiction will be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by Intermountain in writing, Intermountain will contract for such tests, inspections and approvals with an independent entity, or with the appropriate public authority, and Intermountain will 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 will, at least two working days before the time of the desired inspection, and following the procedures established by Intermountain, request such inspection or approval to be performed. Contractor will give A/E timely notice of when and where tests and inspections are to be made so that A/E may observe such procedures.
- 9.1.2 Failure of An Inspector to Appear. Work will not proceed without any required inspection and the associated authorization by Intermountain to proceed unless the following procedures and requirements have been met:
- The inspection or approval was requested in a timely manner as provided in Paragraph 9.1.1;
 - Contractor received written confirmation from the inspection entity that the inspection was scheduled;
 - Contractor has contacted or attempted to contact the inspector to confirm that the inspector is unable to perform the inspection as scheduled;
 - If the inspector has confirmed that it is unable to perform the inspection as scheduled or if Contractor is unable to contact the inspector, Contractor will attempt to contact Intermountain Representative for instruction; and Contractor has documented the condition of the work before being covered through photos or other means.
- 9.1.3 Nonconforming Work. If such procedures for testing, inspection or approval under Paragraph 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, Contractor will bear all costs made necessary by such failure including those of repeated procedures and compensation for Intermountain's expenses, including the cost of retesting for verification of compliance if necessary, until Intermountain 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 will, unless otherwise required by the Contract Documents, be secured by Contractor and promptly delivered to A/E.
- 9.1.5 A/E Observing. If A/E is to observe tests, inspections or approvals required by the Contract Documents, A/E will 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 will be made promptly to avoid unreasonable delay in the Work.

9.2 Inspections: Substantial and Final.

- 9.2.1 Substantial Completion Inspection. Before requesting a substantial completion inspection, Contractor will prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by Intermountain and A/E to determine if the Project is ready for a substantial completion inspection. If Intermountain determines that the initial punchlist indicates that the Project is not substantially complete, the initial punchlist will be returned to Contractor with written comments. If Intermountain determines that the initial punchlist indicates that the Project may be substantially complete, A/E will promptly organize and perform a Substantial Completion inspection in the presence of Intermountain and all appropriate authorities.

- a. If A/E reasonably determines that the initial punchlist prepared by Contractor substantially understates the amount of the Work remaining to be completed and the Project is not substantially complete, A/E will report this promptly to Intermountain, and upon concurrence of Intermountain, Contractor will be assessed the costs of the inspection and punchlist preparation incurred by A/E and Intermountain.
- b. When the Work or designated portion thereof is Substantially Complete, A/E will prepare a Certificate of Substantial Completion which will establish the date of Substantial Completion; will establish responsibilities of Intermountain and Contractor for security, maintenance, heat, utilities, damage to the work and insurance; and will fix the time within which Contractor will finish all items on the punchlist accompanying the Certificate. The Certificate of Substantial Completion will require approval by Intermountain Representative. If there is a punchlist, Contractor will proceed promptly to complete and correct items on the list. 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.
- c. Warranties required by the Contract Documents will 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. Such warranty documents will state the length of the warranty, which must comply with the Contract Documents.
- d. The Certificate of Substantial Completion will be submitted by A/E to Intermountain and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.
- e. Except to the extent Intermountain Representative otherwise approves in advance and in writing, Contractor will submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete "as-built" Drawings. Contractor must also provide or obtain any required approvals for occupancy, and deliver "as-built" drawings to A/E sufficient to enable A/E to compile and provide a final set of Record Drawings for each completed phase and for each area for which a certificate of occupancy is issued within forty-five (45) Days of such issuance. Contractor is responsible for the guaranty of all Work, whether performed by it or by its Subcontractors at any tier.

9.2.2 Final Completion Inspection. Before requesting a final inspection, Contractor will verify all punchlist items are corrected/completed. Once all punchlist items are corrected/completed Contractor will notify Intermountain and request a final inspection. Intermountain will notify A/E and perform a final inspection. Two final inspections may be allowed due to required weather changes required to complete some items. When all punchlist items are completed a final pay request will be provided by Contractor, authorized by A/E and processed by Intermountain.

9.3 Uncovering of Work.

- 9.3.1 Uncover Uninspected Work. Except as provided in Paragraph 9.3.3, if a portion of the Work is covered before 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 Time.
- 9.3.2 Observation before Covering. Except as provided in Paragraph 9.3.3, if Intermountain or A/E has requested in writing to observe conditions before any Work being covered or if such observation is specified in the Contract Documents, and the Work is covered without such observation, Contractor will be required to uncover and appropriately replace the Work at Contractor's expense without change in the Contract Time. If Contractor requests an inspection and Intermountain or A/E, including any inspector of each, does not appear, Contractor will immediately notify Intermountain of such lack of appearance, but will not cover the Work without such inspection.

- 9.3.3 When an Inspector Fails to Appear Or A/E Or Intermountain Did Not Make Prior Request. If Work is performed by Contractor without an inspection as provided in Paragraph 9.1.2 or if a portion of the Work has been covered which A/E or Intermountain has not specifically requested to observe before its being covered or such observation is not specified by the Contract Documents, A/E or Intermountain may request to see such Work and it will be uncovered by Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, will, by appropriate Change Order, be charged to Intermountain. If such Work is not in accordance with the Contract Documents, Contractor will pay such costs unless the condition was caused by Intermountain or a separate contractor in which event Intermountain will be responsible for payment of such costs.

9.4 Correction of Work and Guaranty Period.

- 9.4.1 Contractor Correct the Work. Contractor will correct Work rejected by A/E, Inspector or Intermountain, 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 will bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for 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 Paragraph 9.2.1 or by terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, Contractor will correct it promptly after receipt of written notice from Intermountain to do so unless Intermountain has previously given Contractor a written acceptance of such condition. The period of one year will 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 Paragraph 9.4.2 will be operative notwithstanding the acceptance of the Work under the Contract, the final certificate of payment, partial or total occupancy and/or termination of the Contract. Intermountain will give notice of observed defects with reasonable promptness, however, failure to give such notice will not relieve Contractor of its obligation to correct the Work at the cost that Contractor would have incurred if Intermountain did so report with reasonable promptness. All corrected Work will be subject to a one-year guaranty period the same in all respects as the original Work, except that such guaranty period will commence from the time of Substantial Completion of the corrected Work. This guaranty period does not affect Intermountain's right to pursue any available remedies against Contractor.
- 9.4.3 Removal of Work.
- a. Contractor will promptly remove from the premises all Work that Intermountain and/or A/E determines as being in nonconformance with the Contract Documents, whether incorporated or not.
 - b. Contractor will promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to Intermountain.
 - c. Contractor will bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, of Intermountain or of other contractors destroyed or damaged by such removal or replacement.
 - d. If Contractor does not remove such rejected Work within a reasonable time, fixed by written notice, Intermountain may have the materials removed and stored at the expense of Contractor.

- e. If Contractor does not correct the nonconforming Work within a reasonable time, fixed by written notice, Intermountain may correct it in accordance with Paragraph 12.2.2 of these General Conditions.

9.4.4 Not Limit Other Obligations. Nothing contained in this Article 9.4 will be construed to establish a period of limitation with respect to other obligations which Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 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 will apply:

- a. Contractor warrants to Intermountain that materials and equipment furnished under the Contract will be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.
- b. Contractor also warrants to Intermountain that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered Defective at Intermountain's option.

9.5.2 Correction of Work.

- a. Contractor will promptly correct any portion of the Work which is rejected by A/E, the inspector, or Intermountain, or which fails 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 will bear the cost of correcting such rejected Work, including additional testing and inspection costs, compensation for A/E's services, and any other expenses made necessary thereby. Such costs will in no way be payable by Intermountain and will not increase the Contract Sum.
- b. Contractor will remedy any Defects due to faulty materials, equipment, or workmanship which appear within a period of one (1) year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents. Contractor will pay all costs of correcting faulty work, including additional A/E fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses when incurred. Such costs will in no way be payable by Intermountain and will not increase the Contract Sum.
- c. Nothing in the Contract Documents will be construed to establish a period of limitation within which Intermountain may enforce the obligation of Contractor to comply with the Contract Documents. The one (1) year period specified in paragraph 9.5.2(2) has no relationship to the time within which Intermountain may enforce compliance with the Contract Documents, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations.

9.5.3 Exclusion. Unless due to the negligent or intentional act or omission of Contractor or those under 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.

9.5.4 Furnish Evidence on Request. If requested by A/E or Intermountain, Contractor will furnish satisfactory evidence as to the type and quality of materials and equipment.

9.6 Acceptance of Nonconforming Work. If Intermountain prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Intermountain may do so in writing instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment will be effected whether or not final payment has been made. Without limitation, usage by Intermountain or A/E of mechanical devices, machinery, apparatus, equipment, or other work or materials supplied under the Contract Documents before written acceptance by Intermountain, will not constitute Intermountain's acceptance.

10. INSURANCE AND BONDS.

10.1 Insurance. To protect against liability, loss and/or expense arising in connection with the performance of services described under the Contract Documents, Contractor will obtain and maintain in force as set forth below in section 10.1.9 without interruption, the following stated insurance, in a form and content satisfactory to Intermountain, from insurance companies authorized to do business in the State in which the Project is located with an A.M. Best's Rating of A- or better and Class VII or better. Contractor will require all Subcontractors to have and maintain similarly required policies. All of the following listed insurance coverages will be provided by Contractor.

10.1.1 Contractor's Commercial General Liability Insurance. Contractor will maintain coverage, with ISO Form CG 00 01 or other policy form satisfactory to Intermountain, on an occurrence basis, including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury, and Broad-Formed Property Damage (including coverage for Explosion, Collapse, and Underground hazards), which will provide primary coverage to the additional insureds (Intermountain and the A/E) in the event of any occurrence, claim, or suit, with per occurrence and annual aggregate policy limits of at least as follows:

\$2,000,000	General Aggregate;
\$2,000,000	Products-Completed Operations Aggregate;
\$1,000,000	Personal and Advertising Injury;
\$1,000,000	Each Occurrence.

Intermountain reserves the right to require additional coverage limits of liability from that stated above. Intermountain also reserves the right to require project specific insurance, and if such right has been exercised it will be indicated in the Contract Documents.

10.1.2 Excess and Umbrella Liability Insurance. Contractor will maintain excess and liability insurance with coverage at least as broad as the underlying liability insurance described in this section, written on an occurrence basis with per occurrence and annual aggregate policy limits based on the following chart, unless modified by mutual agreement of the parties,

Small Project (\$2,000,000 or less)
Minimum Commercial General Liability Coverage
\$1,000,000 each occurrence,
\$3,000,000 general aggregate
Medium Project (\$2,000,001 to \$10,000,000)
Minimum Commercial General Liability Coverage
\$5,000,000 each occurrence,
\$10,000,000 general aggregate

Large Project (Greater than \$10,000,000)
Minimum Commercial General Liability Coverage
\$10,000,000 each occurrence,
\$20,000,000 general aggregate

For insurance purposes, the size of the Project will be specified in the Contractor's Agreement. Such excess or umbrella liability policy will follow form with the primary liability policies, and contain a drop-down provision in case of impairment of underlying limits.

- 10.1.3 Workers' Compensation Insurance and Employers' Liability Insurance. Worker's Compensation Insurance will cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by this jurisdiction's laws. Contractor will also maintain Employer's Liability Insurance with limits of at least \$1,000,000 each accident, \$1,000,000 for bodily injury by accident, and \$1,000,000 each employee for injury by disease. Contractor will collect and keep on-file evidence that Contractor and all tiers of Subcontractors have current certificates of this Workers Compensation Insurance (as required by State statute) as well as Employer's Liability Insurance, and will produce them upon request by Intermountain.
- 10.1.4 Automobile. Automobile liability insurance for claims arising from the ownership, maintenance, or use of a motor vehicle. The insurance will be written on an "occurrence" form and will apply to "any auto" and will cover all owned, non-owned, and hired automobiles used in connection with the work, with the following minimum limits of liability: \$1,000,000 – Combined Single Limit Bodily Injury and Property Damage per Occurrence.
- 10.1.5 Pollution Liability Insurance. Pollution Liability Insurance covering Contractor's or appropriate Subcontractor's liability for bodily injury, property damage and environmental damage resulting from sudden, accidental, and gradual pollution and related cleanup costs incurred by Contractor, all arising out of the goods delivered or Work and services performed (including transportation risk) under this Contract, is required with limits of at least \$1,000,000 per claim and \$1,000,000 annual aggregate.
- 10.1.6 Aircraft Use. Contractor using its own manned or unmanned aircraft, or employing manned or unmanned aircraft in connection with the work performed under the Contract Documents will maintain Aircraft Liability Insurance with a combined single limit of not less than \$1,000,000 per occurrence. This certificate will state that the policy required by this paragraph has been endorsed to name Intermountain as an Additional Insured.
- 10.1.7 Policy Aggregate(s). Unless project specific insurance is required by Intermountain, the above insurance coverages will be written or endorsed under a policy to have general, per occurrence, and aggregate limits of liability applicable to this project only.
- 10.1.8 Certificates. Before the Contract Documents are executed, Contractor will submit certificates in form and substance satisfactory to Intermountain as evidence of the insurance requirements of this Article 10. Contractor will obtain copies of Additional Insured (Ongoing and Completed Operations), Waiver of Subrogation, and Primary and Non-Contributory Endorsements and/or policy clauses. The certificates will contain provisions that no cancellation, or non-renewal will become effective except upon thirty (30) Days prior written notice by US Mail to Intermountain as evidenced by return receipt, certified mail sent to Intermountain. Contractor will notify Intermountain within thirty (30) Days of any claim(s) against Contractor which singly or in the aggregate exceed 20% of the applicable required insured limits and Contractor will, if requested by Intermountain, use its best efforts to reinstate the policy within the original limits and at a reasonable cost. Intermountain will be named as an additional insured party, as primary coverage and not contributing, on all the insurance policies required by this Article, except the professional liability and workers' compensation policies, by endorsements satisfactory to Intermountain -- using a combination of ISO forms CG 20 10 (07/04), Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization and CG 20 37 (07.04) Additional Insured – Owners, Lessees or Contractors – Completed Operations, or other

forms acceptable to Intermountain, naming Intermountain and A/E as additional insureds. Intermountain reserves the right to request Contractor to provide a loss report from its insurance carrier. Contractor will collect and keep on-file evidence that Contractor and each Subcontractor has current certificates of Commercial General Liability Insurance, Excess /Umbrella Liability Insurance, and other insurance required herein, and will produce them upon request by Intermountain.

- 10.1.9 Maintain throughout Contract Documents Term. Contractor will maintain, from commencement of the Work, insurance coverage required in Articles 10.1 and 10.2 as follows:
- a. Commercial General Liability Insurance through expiration of the statute of limitations/repose for completed operations, but in no event less than ten (10) years from completion of the Project; and
 - b. All other insurance through final payment.
- 10.1.10 Waivers of Subrogation. Contractor waives all rights against Intermountain and other additional insureds for recovery of damages to the extent the losses and damages are covered by existing insurance, including without limitation commercial general liability, commercial excess/umbrella liability, business auto liability, workers compensation or employer's liability insurance, and pollution liability insurance. Contractor will ensure that all insurance policies required herein will be endorsed to include waivers of subrogation in favor of Intermountain. Contractor hereby waives all rights of subrogation against Intermountain.
- 10.1.11 Excess Coverages. Any type of insurance or any increase of limits of liability not described in the Contract Documents which Contractor requires for its own protection or on account of any statute, rule or regulation, will be its own responsibility and at its own expense.
- 10.1.12 Not Relieve Contractor of Liability. The carrying of any insurance required by the Contract Documents will in no way be interpreted as relieving Contractor of any other responsibility or liability under the Contract Documents or any applicable law, statute, rule, regulation, or order.
- 10.1.13 Contractor Compliance with Policies. Contractor will not violate or permit to be violated any of the provisions of the insurance policies required under the Contract.
- 10.1.14 Deductible Liability. Any and all deductibles in the above described policies will be assumed by, for the account of, and at the sole risk of Contractor. The allowable deductible for any of the Contractor insurance policies required by these General Conditions shall be no less than \$1,000 or 0.1 percent of the Contract Amount, whichever is greater.

10.2 "Builder's Risk" Property Insurance.

- 10.2.1 In General. Intermountain will provide through Substantial Completion "Builder's Risk" property insurance for the cost of the Project. The policy will be written on an all risk basis, with exclusions standard for the insurance industry, on policy forms currently and commercially available, with insurance carriers selected by Intermountain.
- 10.2.2 Deductible. The above described "Builder's Risk" policies shall be subject to a total deductible of \$5,000 per loss occurrence, which deductible shall be assumed by Contractor or Subcontractors, in proportion to their share of the total amount of an insured loss occurrence.
- 10.2.3 Waiver. To the extent damages are covered by the above described "Builder's Risk" policies, Contractor, including all Subcontractors and Material Suppliers, and Intermountain hereby waive all rights against each other for damages caused by perils insured against under the "Builder's Risk" insurance provided. Contractor will require similar waivers from each of their contractors, subcontractors, material suppliers, sub-consultants and agents, at any tier.
- 10.2.4 Policy Terms. Intermountain will provide a copy of the terms and conditions of the builders risk policy to Contractor upon Contractor's request. Contractor will comply with terms, conditions, and

deadlines of the builders risk policy. The terms, conditions, and deadlines of the builders risk policy shall govern coverage. Contractor will cooperate with Intermountain and the builders risk commercial insurer in the investigation, documentation, and settlement of loss claims, including without limitation promptly responding to all requests for information and documentation from the builders risk commercial insurer and/or Intermountain.

- 10.2.5 Special Hazards. Intermountain will bear the risk of loss, delay and/or damage due to earthquake and/or flood and may either insure or self-insure that risk.

10.3 Performance Bond and Payment Bond. If required by the Contract Documents, Contractor will before commencement of the Work or within ten (10) Days after signing the Agreement, whichever is earlier, submit and maintain in full force and effect as required by law and the Contract Documents, as part of the Construction Costs for the Project, written on Form AIA Document A312 (1984) or on other forms provided by Intermountain, and include as part of the quoted total all costs involved in securing and furnishing, a performance bond and a labor and material payment bond the bonds listed below, based on the completed cost of the Contract and effective upon execution of the Contract. These bonds will be from a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds, have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. "Treasury List", and be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bonds on behalf of the surety.

- a. A full 100 percent performance bond covering the faithful execution of the Contract in accordance with the Contract Documents; and
- b. A full 100 percent payment bond covering payment of all obligations arising under the Contract Documents, for the protection of each person supplying labor, service, equipment, or material for the performance of the Work.

All Subcontractor performance and payment bonds will name Contractor and Intermountain as Obligees. Intermountain reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

10.4 Intermountain Self-Insurance. Intermountain may, at its option, satisfy any insurance requirements applicable to Intermountain through its self-insurance and risk management program.

11. MISCELLANEOUS PROVISIONS.

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

11.2 Successors and Assigns. Intermountain and Contractor respectively bind themselves, to the other party in respect to covenants, agreements and obligations contained in the Contract Documents. Contractor will not assign the Contract, or any of its rights or obligations under the Contract, without the prior written consent of Intermountain, nor will Contractor assign any amount due or to become due as well as any rights under the Contract, without prior written consent of Intermountain. Intermountain may assign the Contract to an institutional lender providing financing for the Project. In such event, the lender will assume Intermountain's rights and obligations under the Contract. Contractor will execute all consents reasonably required to facilitate such assignment.

11.3 Written Notice. Written notice will be deemed to have been duly served if (a) 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 (b) delivered at or sent by registered or certified mail, return receipt requested, or (c) deposited for

delivery with a nationally recognized overnight courier service, to the last business address known to the party giving notice.

11.4 Rights and Remedies.

- 11.4.1 **Not Limit.** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder will be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.
- 11.4.2 **Not Waiver.** Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by Intermountain, A/E or Contractor will constitute a waiver of a right or duty afforded them under the Contract Documents, nor will 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 will Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions unless agreed to in writing by Intermountain.

11.5 Use of Intermountain Forms. Unless otherwise specifically identified in the Contract, all references or requirements for use or submission of documents to Intermountain, to A/E, or to others must be on Intermountain's approved forms. These forms include, without limitation, pay application, requests for payment, proposed change orders, change orders, modifications, requests for information, continuation sheets, waiver and lien releases, verifications, and other project related documents. Notwithstanding, Intermountain may in its sole discretion accept alternate forms. However, Intermountain's acceptance of an alternate form in one instance does not waive or modify the requirements herein for subsequent submissions.

11.6 Governing Law, Jurisdiction and Venue. To the maximum extent permitted by law, Utah laws, excluding its conflict-of-law provisions, govern the Contract and both Intermountain and Contractor submit to the exclusive jurisdiction and venue of state and federal courts located in Salt Lake County, Utah.

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 the statement and appears in another is not intended to affect the interpretation of either statement.

11.8 Severability. The invalidity of any part, paragraph, subparagraph, phase, provision or aspect of the Contract documents will not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.

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

11.10 No Third-Party Rights. The Contract Documents will not be construed to create a contractual relationship of any kind (1) between A/E and Contractor, (2) between Intermountain and a Subcontractor or (3) between any persons or entities other than Intermountain and Contractor. Nothing contained herein will be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and A/E, or as between Intermountain, Contractor, or A/E on the one hand, and any other person or entity.

11.11 Change of Control. If a third party acquires a controlling interest (i.e., 50% ownership or more) of Contractor, then (a) Contractor will notify Intermountain within fifteen (15) Days of that acquisition, and (b) upon that acquisition, Intermountain may terminate for cause the Contract immediately upon written notice to Contractor.

- 11.12 Entire Agreement and Amendment Limitation.** The Contract represents the entire and integrated agreement between Intermountain and Contractor and supersedes all prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by (1) a written amendment executed by both Intermountain and Contractor, or (2) by a Modification.
- 11.13 Notices.** Any notice required by the Contract will be served upon the recipient's designated representative by hand delivery at the last known business address, or by mail or nationally recognized overnight courier service with "delivery confirmation" to the last known address.
- 11.14 No Publicity.** Without receiving prior written approval from an Intermountain vice president, Contractor will not distribute any publicity regarding the Contract.
- 11.15 Waivers.** No waiver by Intermountain or Contractor of any default will constitute a waiver of the same default at a later time or of a different default.
- 11.16 Waiver of Consequential Damages.** Intermountain and Contractor waive all claims against each other for any consequential damages that may arise out of or relate to the Contract. Intermountain waives damages including but not limited to is loss of use of the Project, any rental expenses incurred, loss of income, profit, or financing related to the Project, loss of business, the services of employees, or loss of reputation. Contractor waives damages including but not limited to the loss of business, loss of financing, principal office overhead and expenses, loss of profits not related to this Project, loss of bonding capacity or loss of reputation. This section may not be construed to preclude recovery of consequential damages when such damages are actually recovered from insurance policies required by the Contract Documents. The provisions of this section also apply to the termination of the Contract and survive such termination.
- 11.17 Compliance.**
- 11.17.1 Remuneration. Remuneration flowing between the parties is at fair market value for actual and necessary items furnished or services rendered, is based upon an arm's-length transaction, and does not take into account, directly or indirectly, the value or volume of any past or future referral or other business generated between the parties (or of any referral or business of any principal, affiliate, or immediate family member - as those terms may be defined by applicable laws - of either party).
- 11.17.2 Financial Relationships. To its knowledge, Contractor (a) is not a physician-owned entity and (b) has no prohibited financial relationship with any physician who is in a position to generate business for Intermountain, or with an immediate family member of that physician. Intermountain defines a "physician-owned entity" as any entity in which a physician, or immediate family member of a physician, holds an ownership, investment, or royalty interest (if royalties are paid on any purchase resulting from the royalty holder's order). The Code of Federal Regulations (CFR) defines "financial relationship" (in 42 CFR 411.354) and "immediate family member" (in 42 CFR 411.351).
- [Note: Physicians and their immediate family members may own investment securities of Contractor if that investment complies with 42 CFR 411.356(a) or (b), and may have a compensation arrangement that both complies with 42 CFR 411.357(p) and does not take into account the volume or value of referrals or other business generated for Intermountain by a physician or a physician's immediate family members.]
- 11.17.3 Exclusion or Sanction. Contractor warrants that neither it, or any of its affiliates or employees, excluded from participation in, or sanctioned under, any state or federal healthcare program, including those set forth in 42 U.S.C. §1320a 7b(f). Contractor will notify Intermountain immediately in writing if the warranty in the preceding sentence is, or becomes, inaccurate during the Term.
- 11.17.4 Access to Books and Records. Intermountain is a provider under Federal Medicare programs and is subject to Section 952 of the Omnibus Reconciliation Act of 1980. That law requires Intermountain, as a provider, to include the following provision in its agreements with suppliers who receive \$10,000 or

more under an agreement with Intermountain. If requested by the Secretary of HHS, by the U.S. Comptroller, or by an authorized representative of either of them, Contractor will make available to the requestor the Contract and Contractor's books, documents, and records to allow the requestor to certify the nature and extent of the charges for services provided under the Contract and charged to Medicare. Contractor will continue to make those items available for four years after Contractor furnishes the final products (or services) under the Contract. If Contractor contracts with another to carry out any of Contractor's duties under the Contract and the Subcontractor is to receive \$10,000 or more in value under that subcontract, then Contractor will obtain a written contractual commitment from the Subcontractor to comply with the obligations of this section of the Agreement. The obligations of this Section survive the expiration or other termination of the Contract.

11.17.5 Code of Ethics. In its dealings with Intermountain, Contractor has and will comply with all codes of ethics applicable to suppliers and their interactions with purchasers like Intermountain, including, without limitation, the AdvaMed Code of Ethics on Interactions with Health Care Professionals.

11.17.6 Facility Access Policy. All of Contractor's representative(s) entering any Intermountain facility must comply with Intermountain's Facility Access Policy. This policy requires each of these Contractor representatives to check in with Intermountain on each visit to an Intermountain facility to receive an identification badge; and as applicable, log onto: <https://intermountainhealthcare.org/supply-chain-organization/for-suppliers/for-current-suppliers/access-to-intermountain-facilities/> and complete the registration requirements. Please contact Intermountain representative with any questions.

11.17.7 Equal Opportunity. Affirmative Action. Intermountain is an equal opportunity employer and federal contractor. Consequently, the parties agree that, to the extent applicable, they will comply with the following, which are incorporated herein by reference: 41 CFR 60 1.4(a), 41 CFR 60 300.5(a), 41 CFR 60 741.5(a), and Executive Order 13496 (29 CFR Part 471, Appendix A to Subpart A), relating to the notice of employee rights under federal labor laws, specifically:

- a. Intermountain and Contractor will abide by the requirements of 41 CFR 60 300.5(a), as applicable. This regulation prohibits discrimination against qualified protected veterans, and requires affirmative action by covered prime contractors and Subcontractors to employ and advance in employment qualified protected veterans.
- b. Intermountain and Contractor will abide by the requirements of 41 CFR 60 741.5(a), as applicable. This regulation prohibits discrimination against qualified individuals on the basis of disability, and requires affirmative action by covered prime contractors and Subcontractors to employ and advance in employment qualified individuals with disabilities.

11.17.8 Remedies. If Contractor breaches any obligation of this section, Intermountain may immediately terminate for cause the Contract upon written notice to Contractor.

11.18 Work Restrictions / Drug Testing. Contractor will ensure that Contractor, its agents, employees, and all Subcontractors do not use or consume alcohol or cannabis, or illegally use drugs, upon Intermountain's property or enter upon or perform any work on Intermountain's property while under their influence. Contractor will obtain necessary consents and will conduct periodic inspections and drug testing to monitor and ensure compliance with these requirements. Contractor will bear the expenses of such inspections and drug testing and will hold Intermountain harmless from all claims arising out of or relative thereto. In addition, Contractor will ensure that Contractor and all Subcontractors do not smoke or vape anything upon Intermountain's property except and only within designated smoking areas approved by Intermountain.

11.19 Utah State Sales Tax. Contractors should be exempt on purchases of material installed or converted into real property to be used by Intermountain. The Contractor will furnish each vendor with Intermountain's Tax exemption number.

11.20 Notice of Intent to Obtain Final Completion. Contractor shall file with the Utah State Construction Registry, on its own behalf and/or on behalf of Intermountain, a notice of intent to obtain final completion at least forty-five (45) Days before the day on which Intermountain or Contractor files or could file a notice of completion under Utah statutes if: (1) the completion of performance time under the original contract for construction work is greater than one hundred twenty (120) Days; (2) the total original construction contract price exceeds \$500,000; and (3) neither Contractor nor Intermountain has obtained a payment bond in accordance with Utah Code Ann. Section 14-2-1.

11.21 Notice of Completion. Within five (5) Days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor shall file with the Utah State Construction Registry, and copy to Intermountain, a notice of completion which shall include, without limitation, the following:

- a. The name, address, telephone number, and email address of the person filing the notice of completion;
- b. The name of the county in which the Project and/or Project site is located;
- c. The date on which final completion is alleged to have occurred;
- d. The method used to determine final completion; and
- e. One of the following:
 1. The tax parcel identification number of each parcel included in the Project and/or Project site;
 2. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
 3. The entry number of the building permit issued for the Project.

Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Intermountain agree that any breach or failure to comply with this requirement by Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to Intermountain flowing from this breach.

11.22 Audit Rights. Contractor will keep, maintain and preserve complete, current and accurate books, records, and accounts of the transactions contemplated by this Agreement and such additional books, records and accounts as are necessary to establish and verify Contractor's compliance with the Contract. All these books, records and accounts will be available for inspection and audit by Intermountain and/or an independent third party designated by Intermountain and approved by Contractor at any time during the Term and for two (2) years thereafter, but only during reasonable business hours and upon reasonable notice. In addition:

- a. Intermountain agrees that its routine audits will not be conducted more frequently than once in any consecutive twelve (12) month period.
- b. If, after any audit of Contractor, Intermountain requires additional information regarding the transactions contemplated by the Contract, Contractor will furnish to Intermountain or to the third-party audit firm any additional information Intermountain specifies that relates to the audit period to establish and verify Contractor's compliance with the Contract Documents.
- c. Intermountain's right to inspect and audit is without prejudice to any other or additional rights or remedies of either party.
- d. Contractor agrees to not unreasonably withhold approval of any independent third-party audit firm.

- e. If an audit reveals an overcharge incurred by Intermountain on this Project, Contractor will provide a written response explanation, correct any error and remit any monies due within ten (10) Days after receiving notice of the error or overcharge.

Intermountain may audit applications for payments or any other aspect of the Services and Work of Contractor and of the Subcontractor or suppliers at any tier. Contractor will cooperate with Intermountain in providing all necessary information for any Intermountain audit.

12. TERMINATION OR SUSPENSION OF THE CONTRACT.

12.1 Termination by Contractor.

12.1.1 In General. If the Work is stopped for a period of ninety (90) Days through no act or fault of 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, Contractor, may terminate the Contract in accordance with 12.1.2 herein below for any of the following reasons:

- a. Because Intermountain has persistently failed to fulfill fundamental Intermountain's obligations under the Contract Documents with respect to matters important to the progress of the Work;
- b. Issuance of an order of a court or other public authority having jurisdiction which necessitates such termination, except that where Contractor has standing, Contractor must cooperate in efforts to stay and/or appeal such order;
- c. A governmental declaration of national emergency, making material unavailable; or
- d. Unavoidable casualties or other similar causes as listed in Paragraph 12.2.2(2) herein below.

12.1.2 Notice. If one of the reasons for termination in Paragraph 12.1.1 hereinabove exist, Contractor may, upon ten (10) additional Days' written notice to Intermountain and A/E, and such condition giving cause for termination still not cured, terminate the Contract and recover from Intermountain payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages associated only with work completed before the notice of termination.

12.2 Termination by Intermountain for Cause.

12.2.1 In General. Intermountain may terminate the Contract if Contractor fails to cure any of the following within a period of ten (10) Days (or longer if Intermountain so approves in writing) after receipt of notice from Intermountain specifying the cause for termination:

- a. Contractor refuses or fails to supply enough properly skilled workers or proper materials;
- b. Contractor fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between Contractor and the Subcontractors;
- c. Contractor disregards laws, ordinances, or rules, regulations, resolutions or orders of a public authority having jurisdiction; or
- d. Contractor fails to perform the Work within the time specified in the Contract Documents or any authorized extension thereof or Contractor fails to make progress with the Work as to endanger such compliance;
- e. Contractor fails to perform the Work or is otherwise in breach of a provision of the Contract Documents;
- f. Contractor fails to respond promptly to the financial responsibility inquiry herein;
- g. As permissible by law for a reason to terminate, Contractor is adjudged bankrupt;

- h. As permissible by law for a reason to terminate, Contractor should make a general assignment for the benefit to creditors;
 - i. As permissible by law for a reason to terminate, Contractor has or should have a receiver appointed on account of Contractor's insolvency; or
 - j. Contractor fails to follow the material 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 Intermountain's Right to Carry Out the Work. If Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10) Day period (or longer if approved by Intermountain in writing) after receipt of written notice from Intermountain to cure such default or neglect, Intermountain may without prejudice to other remedies Intermountain may have, correct such deficiencies, including taking over the Work and prosecuting the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the Work, such materials, appliances, and facilities as may be on the site of the Work as well as the site as necessary for its proper completion. In such case, Intermountain will offset from payments then or thereafter due Contractor the cost of correcting such deficiencies, including compensation for A/E, Intermountain's staff and legal counsel's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor will pay the difference to Intermountain. Contractor will continue performance of the Contract to the extent not terminated.
- 12.2.3 Items Required to Be Transferred or Delivered. Intermountain may require Contractor to transfer title and deliver to Intermountain, in the manner and to the extent directed by Intermountain:
- a. Any completed portion of the Work; and
 - b. Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction materials") as Contractor has specifically produced or specifically acquired for the performance of such part of this Contract as has been terminated; and Contractor will, upon direction of Intermountain, protect and preserve property in the possession of Contractor in which Intermountain has an interest.
- 12.2.4 Payment. When Intermountain terminates the Contract for one or more of the reasons stated in Paragraph 12.2.1, Intermountain may withhold payment and/or pursue all available remedies.
- 12.2.5 Intermountain Protection If Liable. When the subject property is lienable, Intermountain may withhold from amounts otherwise due Contractor for such completed Work or construction materials such sum as Intermountain determines to be necessary to protect Intermountain against loss because of outstanding liens or claims for former lien holders.
- 12.2.6 Credits and Deficits. If the unpaid balance of the Contract Sum exceeds the full cost of finishing the Work, including compensation for A/E's services and expenses made necessary thereby, such excess will be paid to Contractor. If such cost exceeds the unpaid balance, Contractor will pay the difference to Intermountain this obligation for payment will survive the termination of the Contract.
- 12.2.7 If Contractor Found Not in Default or Excusable. If, after notice of termination of the Contract under the provisions of this Article, it is determined for any reason that Contractor was not in default under the provisions of this Article, or that the default was excusable under the provisions of this Article, the rights and obligations of the parties will be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions.
- 12.2.8 Rights and Remedies Not Exclusive. The rights and remedies of Intermountain provided in this Article 12.2 will not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

12.3 Suspension, Delay or Interruption of Work by Intermountain for Convenience.

- 12.3.1 By Intermountain in Writing. Intermountain 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 Intermountain may determine to be appropriate for the convenience of Intermountain.
- 12.3.2 Adjustments. Any adjustment in Contract Sum and Contract Time will be in accordance with Articles 3, 4, and 7.

12.4 Termination for Convenience of Intermountain.

- 12.4.1 In General. The performance of Work under this Contract may be terminated by Intermountain in accordance with this Article 12.4 in whole, or from time to time, in part, whenever Intermountain will determine that such termination is in the best interest of Intermountain or any person for whom Intermountain is acting under this Contract. Any such termination will be effected by delivery to Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.
- 12.4.2 Contractor Obligations. After receipt of a notice of termination, and except as otherwise directed by Intermountain in writing, Contractor will:
 - a. Stop work under the Contract on the date and to the extent specified in the notice of termination;
 - b. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;
 - c. Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;
 - d. Assign to Intermountain in the manner, at the times, and to the extent directed by Intermountain, all of the right, title and interest of Contractor under the orders and subcontracts so terminated, in which case Intermountain will have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
 - e. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of Intermountain, which approval or ratification will be final for all the purposes of this Article 12.4;
 - f. Transfer title and deliver to Intermountain in the manner, at the times, and to the extent, if any, directed by Intermountain:
 - (i) 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
 - (ii) The completed or partially completed drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to Intermountain;
 - g. Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by Intermountain, any property of the types referred to in Paragraph 12.4.2.f above; provided, however, that Contractor:
 - (i) Will not be required to extend credit to any purchaser; and
 - (ii) May acquire any such property under the conditions prescribed by and at a price or prices approved by Intermountain; and provided further that the proceeds of any such transfer of

or disposition will be applied in reduction of any payments to be made by Intermountain to Contractor under this Contract or will otherwise be credited to the Contract Sum or paid in such other manner as Intermountain may direct;

- h. Complete performance of such part of the Work as will not have been terminated by the notice of termination; and
 - i. Take such action as may be necessary, or as Intermountain may direct, for the protection and preservation of the property related to this Contract which is in the possession of Contractor in which Intermountain has or may acquire an interest.
- 12.4.3 Agreed Upon Payment. Subject to the provisions of Paragraph 12.4.2 above, Contractor and Intermountain may agree upon the amount to be paid to Contractor by reason of the total or partial termination of Work pursuant to this Article 12.4.
- 12.4.4 Payment Not Agreed Upon. In the event of the failure of Contractor and Intermountain to agree, as provided in Paragraph 12.4.3, upon the whole amount to be paid to Contractor by reason of the termination of Work pursuant to this Article 12.4, Intermountain will pay to Contractor the portion of the Contract Sum requisite with the portion of the Work completed as determined by Intermountain as of the date of termination, subject to offsets if any.
- 12.4.5 Deductions. In arriving at the amount due Contractor under this Article 12.4, there will be deducted:
 - a. All unliquidated advance or other payments on account theretofore made to Contractor, applicable to the terminated portion of this Contract;
 - b. Any Claim which Intermountain may have against Contractor in connection with this Contract; and
 - c. 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 Article 12.4, and not otherwise recovered by or credited to Intermountain.
- 12.4.6 Partial Payments. Intermountain may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against cost incurred by Contractor in connection with the terminated portion of this Contract whenever, in the opinion of Intermountain the aggregate of such payments will be within the amount to which Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Article 12.4, such excess will be payable by Contractor to Intermountain upon demand, together with interest at a rate of five percent (5%) per annum for the period until the date such excess is repaid to Intermountain; provided, however, that no interest will 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 ten (10) Days after the date of such retention or disposition, or such later date as determined by Intermountain by reason of the circumstances.
- 12.4.7 Preserve and Make Available Records. Unless otherwise provided for in this Contract, or by applicable law, Contractor will, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to Intermountain at all reasonable times at the office of Contractor, but without direct charge to Intermountain, all books, records, documents and other evidence bearing on the costs and expenses of Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by Intermountain Representative, photographs, micrographs, or other authentic reproductions thereof.
- 12.4.8 Intermountain'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; Intermountain, by written order signed personally or by an agent specifically so

empowered by Intermountain 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 Intermountain to stop the Work will not give rise to a duty on the part of Intermountain to exercise this right for the benefit of Contractor or any other person or entity.

END OF DOCUMENT

SECTION 00 7300 – SUPPLEMENTARY CONDITIONS

PART 1 - GENERAL

1.1 GENERAL

- A. The Supplementary Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.
- B. The following paragraphs and subparagraphs take precedence over the General Conditions. Where any part of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered provisions remain in effect.
- C. Correlation and Intent of the Contract Documents:
 - 1. Sections of Division 01 - General Requirements govern the execution of all sections of the specifications.
 - 2. Summary paragraphs placed at the beginning of the Sections present a brief indication of the principal Work included in that Section, but do not limit Work to subject mentioned nor purport to itemize Work that may be included.
 - 3. The Relation of Specifications and Drawings shall be equal authority and priority. Should they disagree in themselves, or with each other, bids shall be based on the most expensive combination of quality and quantity of work indicated. The appropriate Work, in the event of the above mentioned disagreements, shall be determined by the Architect.
 - 4. Should the Drawings disagree themselves, figures shall govern over scaled measurements, large scaled Drawings shall govern over small scale Drawings, the greater quantity of work or materials shall be furnished and performed; the descriptive writings shall govern over legends indicating material or conditions and the Agreement takes precedence over all other Contract Documents.
 - 5. Failure to report a conflict in the Contract Documents shall be deemed evidence that the Contractor has elected to proceed in the more expensive manner.
 - 6. Instructions, directions and requirements as specified shall be considered to be followed by the phrase "unless otherwise specified or indicated".

1.2 INTERPRETATION

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

1.3 INFORMATIONAL SUBMITTALS

- A. Informational submittals may be so identified in the Contract Documents.

1.4 PROFESSIONAL CERTIFICATION

- A. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

PART 2 - (NOT USED)

PART 3 - (NOT USED)

END OF SECTION 00 7300

Infection Control Risk Assessment 2.0

Matrix of Precautions for Construction, Renovation and Operations

ICRA 2.0 Infection Control Risk Assessment and Permit	Project Name:		
	ICRA Number:		Requested by
Location of Work Activity		Project Start Date	
Company Performing Work		Est. Completion Date	
Contractor Superintendent		Phone	
Contractor Project Manager		Phone	
Intermountain Project Manager		Phone	
Industrial Hygiene		Phone	
Infection Preventionist		Phone	

1. Type of Activity	
☒	Type A: Inspection and non-invasive activities. Includes but is not limited to: - Removal of ceiling tile for visual inspection-limited to 1 tile per 50 square feet with limited exposure time. - Limited building system maintenance (e.g., pneumatic tube station, HVAC system, fire suppression system, electrical and carpentry work to include painting without sanding) that does not create dust or debris. - Clean plumbing activity limited in nature.
☐	Type B: Small-scale, short duration activities that create minimal dust and debris. Includes but is not limited to: - Work conducted above the ceiling (e.g., prolonged inspection or repair of firewalls and barriers, installation of conduit and/or cabling, and access to mechanical and/or electrical chase spaces). - Fan shutdown/startup. - Installation of electrical devices or new flooring that produces minimal dust and debris. - The removal of drywall where minimal dust and debris is created. - Controlled sanding activities (e.g., wet or dry sanding) that produce minimal dust and debris.
☐	Type C: Large-scale, longer duration activities that create a moderate amount of dust and debris. Includes but is not limited to: - Removal of preexisting floor covering, walls, casework or other building components. - New drywall placement. - Renovation work in a single room. - Non-existing cable pathway or invasive electrical work above ceilings. - The removal of drywall where a moderate amount of dust and debris is created. - Dry sanding where a moderate amount of dust and debris is created. - Work creating significant vibration and/or noise.
☐	Type D: Major demolition and construction activities. Includes but is not limited to: - Removal or replacement of building system component(s). - Removal/installation of drywall partitions. - Invasive large-scale new building construction. - Renovation work in two or more rooms.

2. Patient Risk Area			
☐ Low Risk	☐ Medium Risk	☒ High Risk	☐ Highest Risk
Non-patient care areas such as:	Patient care support areas such as:	Patient care areas such as:	Procedural, invasive, sterile support and highly compromised patient care areas such as:
- Public hallways and gathering areas not on clinical units. - Office areas not on clinical units. - Breakrooms not on clinical units. - Bathrooms or locker rooms not on clinical units. - Mechanical rooms not on clinical units. - EVS closets not on clinical units.	- Waiting areas. - Clinical engineering. - Materials management. - Sterile processing department - dirty side. - Kitchen, cafeteria, gift shop, coffee shop, and food kiosks. - Outpatient exam rooms (no procedures)	- Outpatient procedure rooms - All acute care units - Emergency department - Employee health - Pharmacy - general work zone - Medication rooms and clean utility rooms - Imaging suites: diagnostic imaging - Laboratory.	- All transplant and intensive care units. - All oncology units. - OR theaters and restricted areas. - Procedural suites. - Pharmacy compounding. - Sterile processing department - clean side. - Transfusion services. - Dedicated isolation wards/units. - Imaging suites: invasive imaging.

3. Class of Precautions					
Patient Risk	Activity Type				
	Type A	TYPE B	TYPE C	TYPE D	
Low	☒ I	☐ II	☐ II	☐ III*	☐ III*
Medium	☐ I	☐ II	☐ III*	☐ IV	☐ IV
High	☐ I	☐ III	☐ IV	☐ V	☐ V
Highest	☐ III	☐ IV	☐ V	☐ V	☐ V

Infection control permit and approval will be required when Class of Precautions III (Type C) and all Class of Precautions IV or V are necessary.

Environmental conditions that could affect human health, such as sewage, mold, asbestos, gray water and black water will require Class of Precautions IV for LOW and MEDIUM Risk Groups and Class of Precautions V for HIGH and HIGHEST Risk Groups.

*Type C [Medium Risk groups] and Type D [Low Risk Groups] work areas [Class III precautions] that cannot be sealed and completely isolated from occupied patient care spaces should be elevated to include negative air exhaust requirements as listed in Class IV Precautions.

4. Surrounding Area					
Unit	Below:	Above:	Lateral:	Behind:	In Front:
Risk group					
Contact					
Phone					
Controls	☐ Noise ☐ Vibration ☐ Dust ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust ☐ Ventilation ☐ Pressurization	☐ Noise ☐ Vibration ☐ Dust ☐ Ventilation ☐ Pressurization
Systems impacted:	☐ Data ☐ Mechanical ☐ Med Gas ☐ Hot/Cold Water ☐ Other	☐ Data ☐ Mechanical ☐ Med Gas ☐ Hot/Cold Water ☐ Other	☐ Data ☐ Mechanical ☐ Med Gas ☐ Hot/Cold Water ☐ Other	☐ Data ☐ Mechanical ☐ Med Gas ☐ Hot/Cold Water ☐ Other	☐ Data ☐ Mechanical ☐ Med Gas ☐ Hot/Cold Water ☐ Other

Were there discoveries in surrounding areas that would serve as cause to increase the class of precautions and necessitate additional controls? If so, please summarize.

5a. Required Infection Control Precautions by Class | Before and During Work Activity

Class of Precautions	Mitigation Activities (Performed Before and During Work Activity)
Class I	☐ Perform noninvasive work activity as to not block or interrupt patient care. ☐ Perform noninvasive work activities in areas that are not directly occupied with patients. ☐ Perform noninvasive work activity in a manner that does not create dust. ☐ Immediately replace any displaced ceiling tile before leaving the area and/or at end of noninvasive work activity.
Class II	☐ Perform only limited dust work and/or activities designed for basic facilities and engineering work. ☐ Perform limited dust and invasive work following standing precautions procedures approved by the organization. ☐ This Class of Precautions must never be used for construction or renovation activities.
Class III	☐ Provide active means to prevent airborne dust dispersion into the occupied areas. ☐ Means for controlling minimal dust dispersion may include hand-held HEPA vacuum devices, polyethylene plastic containment, or isolation of work area by closing room door. ☐ Remove or isolate return air diffusers to avoid dust from entering the HVAC system. ☐ Remove or isolate the supply air diffusers to avoid positive pressurization of the space, ☐ If work area is contained, then it must be neutrally to negatively pressurized at all times. ☐ Seal all doors with tape that will not leave residue. ☐ Contain all trash and debris in the work area. ☐ Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. ☐ Install an adhesive (dust collection) mat at entrance of contained work area based on facility policy. Adhesive mats must be changed routinely and when visibly soiled. ☐ Maintain clean surroundings when area is not contained by damp mopping or HEPA vacuuming surfaces.
Class IV	☐ Construct and complete critical barriers meeting NFPA 241 requirements including: Barriers must extend to the ceiling or, if ceiling tile is removed, to the deck above, and all penetrations through the barrier shall meet the appropriate fire rating requirements. ☐ All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to ground and ceiling and secure from movement or damage. Apply tape that will not leave a residue to seal gaps between barriers, ceiling or floor. ☐ Seal all penetrations in containment barriers, including floors and ceiling, using approved materials (UL schedule firestop if applicable for barrier type). ☐ Containment units or environmental containment units (ECUs) approved for Class IV precautions in small areas totally contained by the unit and that has HEPA-filtered exhaust air. ☐ Remove or isolate return air diffusers to avoid dust entering the HVAC system. ☐ Remove or isolate the supply air diffusers to avoid positive pressurization of the space. ☐ Negative airflow pattern must be maintained from the entry point to the anteroom and into the construction area. The airflow must cascade from outside to inside the construction area. The entire construction area must remain negatively pressurized. ☐ Maintain negative pressurization of the entire workspace by use of HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows does not require HEPA-filtered air. ☐ If exhaust is directed indoors, then the system must be HEPA filtered. ☐ Prior to start of work, HEPA filtration must be verified by particulate measurement and must not alter or change airflow/pressure relationships in other areas. ☐ Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (e.g., bathroom exhaust) is not acceptable.

	☐ Install device on exterior of work containment to continually monitor negative pressurization. To assure proper pressure is continuously maintained, it is recommended that the device(s) have a visual pressure indicator. ☐ Contain all trash and debris in the work area. ☐ Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. ☐ Worker clothing must be clean and free of visible dust before leaving the work area. HEPA vacuuming of clothing or use of cover suits is acceptable. ☐ Workers must wear shoe covers prior to entry into the work area. Shoe covers must be changed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be immediately changed. ☐ Install an adhesive (dust collection) mat at entrance of contained work area based on facility policy. Adhesive mats must be changed routinely and when visibly soiled. ☐ Consider collection of particulate data during work to monitor and ensure that contaminants do not enter the occupied spaces. Routine collection of particulate samples may be used to verify HEPA filtration efficiencies.
Class V	☐ Construct and complete critical barriers meeting NFPA 241 requirements including: Barriers must extend to the ceiling, or if ceiling tile is removed, to the deck above, and all penetrations through the barrier shall meet the appropriate fire rating requirements. ☐ All (plastic or hard) barrier construction activities must be completed in a manner that prevents dust release. Plastic barriers must be effectively affixed to ground and ceiling and secure from movement or damage. Apply tape that will not leave a residue to seal gaps between barriers, ceiling or floor. ☐ Seal all penetrations in containment barriers, anteroom barriers, including floors and ceiling using approved materials (UL schedule firestop if applicable for barrier type). ☐ Construct anteroom large enough for equipment staging, cart cleaning, workers. The anteroom must be constructed adjacent to entrance of construction work area. ☐ Workers will be required to wear disposable coveralls during demolition activities. Disposable coveralls must be removed before leaving the work area anteroom. ☐ Remove or isolate return air diffusers to avoid dust entering the HVAC system. ☐ Remove or isolate the supply air diffusers to avoid positive pressurization of the space. ☐ Negative airflow pattern must be maintained from the entry point to the anteroom and into the construction area. The airflow must cascade from outside to inside the construction area. The entire construction area must remain negatively pressurized. ☐ Maintain negative pressurization of the entire workspace using HEPA exhaust air systems directed outdoors. Exhaust discharged directly to the outdoors that is 25 feet or greater from entrances, air intakes and windows does not require HEPA-filtered air. ☐ If exhaust is directed indoors, then the system must be HEPA filtered. ☐ Prior to start of work, HEPA filtration must be verified by particulate measurement and must not alter or change airflow/pressure relationships in other areas. ☐ Exhaust into shared or recirculating HVAC systems, or other shared exhaust systems (bathroom exhaust) is <u>not acceptable</u>. ☐ Install device on exterior of work containment to continually monitor negative pressurization. To assure proper pressure is continuously maintained, it is recommended that the device(s) have a visual pressure indicator. ☐ Contain all trash and debris in the work area. ☐ Nonporous/smooth and cleanable containers (with a hard lid) must be used to transport trash and debris from the construction areas. These containers must be damp-wiped cleaned and free of visible dust/debris before leaving the contained work area. ☐ Worker clothing must be clean and free of visible dust before leaving the work area anteroom. ☐ Workers must wear shoe covers prior to entry into the work area. Shoe covers must be changed prior to exiting the anteroom to the occupied space (non-work area). Damaged shoe covers must be immediately changed. ☐ Install an adhesive (dust collection) mat at entrance of contained work area based on facility policy. Adhesive mats must be changed routinely and when visibly soiled. ☐ Consider collection of particulate data during work to monitor and ensure that contaminants do not enter the occupied spaces. Routine collection of particulate samples may be used to verify HEPA filtration efficiencies.

5b. Additional details (Controls, Specifications/Materials, Verification method/frequency)**Recommended Noise & Vibration Mitigation Strategies**

- Use diamond drills instead of powder-actuated fasteners.
- Schedule noise-making periods with adjacent spaces.
- Use beam clamps instead of shot.
- Prefab where possible.
- Use tin snips to cut metal studs instead of using a chop saw.
- Install metal decking with vent tabs, then use cellular floor deck hangers.
- Consider compression style fittings instead of soldering, brazing or welding.
- Wet core drill instead of dry core or percussion.
- Instead of jackhammering concrete, use wet diamond saws.
- Use HEPA vacuums instead of standard wet/dry vacuums.
- Use mechanical joining system sprinkler fittings instead of threaded.
- Where fumes are tolerated, use chemical adhesive remover (flooring glue) instead of mechanical.
- To remove flooring, consider abrasive blasting instead of using a floor scraper.
- Use electric sheers instead of reciprocating saw for ductwork cutting.
- Install exterior man/material lifts.

Recommended Ventilation & Pressurization Mitigation Strategies

- HEPA to exterior.
- Install temporary ductwork.
- Utilize temporary HVAC equipment.
- Vacate the area.
- Install temporary partitions.
- Use carbon filtration to filter odors.

Recommended Impact to Other Systems Mitigation Strategies

- Schedule outages.
- Provide temporary systems.
- Back-feed electricity or medical gases.

6. Minimum Required Infection Control Precautions | Upon Completion of Work Activity

Class of Precautions	Mitigation Activities (Performed upon Completion of Work Activity)
Classes I, II and III	Cleaning: 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. HVAC Systems: 1. Remove isolation of HVAC system in areas where work is being performed. Verify that HVAC systems are clean and operational. 2. <u>Verify the HVAC systems meet original airflow and air exchange design specifications.</u>
Classes III, IV and V	Class III (Type C Activities only), IV, and V precautions require inspection and documentation for downgraded ICRA precautions. Construction areas must be inspected by an infection preventionist or designee and engineering representative for discontinuation or downgrading of ICRA precautions. Work Area Cleaning: 1. Clean work areas including all environmental surfaces, high horizontal surfaces and flooring materials. 2. Check all supply and return air registers for dust accumulation on upper surfaces as well as air diffuser surfaces. Removal of Critical Barriers: 1. Critical barriers must remain in place during all work involving drywall removal, creation of dust and activities beyond simple touch-up work. The barrier may NOT be removed until a work area cleaning has been performed. 2. All (plastic or hard) barrier removal activities must be completed in a manner that prevents dust release. Use the following precautions when removing hard barriers: i. Carefully remove screws and painter tape. ii. If dust will be generated during screw removal, use hand-held HEPA vacuum. iii. Drywall cutting is prohibited during removal process. iv. Clean all stud tracks with HEPA vacuum before removing outer hard barrier. v. Use a plastic barrier to enclose area if dust could be generated. Negative Air Requirements: 1. The use of negative air must be designed to remove contaminants from the work area. 2. Negative air devices must remain operational at all times and in place for a period after completion of dust creating activities to remove contaminants from the work area and before removal of critical barriers. HVAC systems: 1. Upon removal of critical barriers, remove isolation of HVAC system in areas where work is being performed. 2. Verify that HVAC systems are clean and operational. 3. <u>Verify the HVAC systems meets original airflow and air exchange design specifications.</u>

Permit Approval

Please note that the IP signature below is approval of the work activity as described, assessed, and documented here. **Should the scope of work change or upon the discovery of additional toxic or biological substances, STOP WORK and seek additional approval and guidance before proceeding.**

Infection Preventionist
Signature

SERVICE CONTRACTOR/CONSTRUCTION ORIENTATION GUIDELINES

Project Name:	Project Name Address Address	Intermountain Project #:	Project ID #
Contractor:	Contractor Address Address	Superintendent / Foreman Contact:	Name Phone Email
Security Contact:	Name Phone Email	FM Contact:	Name Phone Email
Infection Preventionist Contact:	Name Phone Email	FD&C PM:	Name Phone Email
Preconstruction Meeting Date:	Enter Date	Proposed Construction Start Date:	Enter Date

The utmost care shall be taken when working inside an operational hospital or medical facility. All construction, maintenance, and service work are required to be performed in accordance to certain policies, procedures and precautions including local, State, and Federal laws including OSHA regulations. The following checklist is Intermountain Healthcare's current required policies, procedures and precautions that are to be observed and followed while conducting work within or external to Intermountain facilities

FACILITY PERMITS

- ABOVE CEILING WORK PERMITS
 - Prior to any work above a ceiling level, a Red **Above Ceiling Work** permit must be obtained. See attached procedure. Permits and log are in the Facilities Management department offices.
- ISOLATION LOCKOUT/TAG PERMITS
 - Any device, system, electrical breaker, valve or equipment that requires to be changed from its normal operating status will require an accompanied **Green Isolation Lock Out/Tag Out** and will be secured in compliance with OSHA Lockout/Tag Out standards. See attached procedure. Permits and log are in the Facility Management (FM) department offices.
- HOT WORK PERMITS

Prior to the use of any flame/ spark emitting, welding, or heating device:

 - A Yellow Hot Work Permit must be obtained at the Security Office and must be filled out by an Intermountain Security Officer.
 - An approved Class A-B-C Fire extinguisher must be present in the area of the work being performed.
 - An additional person is required to be used as a fire watch during hot work permit activities. This person must know how to properly use a fire extinguisher.
 - A person must remain in the immediate area of the work for 30 minutes after completion of hot work activities to act as a fire watch.

FACILITY ACCESS/PARKING

- IDENTIFICATION BADGES
 - All employees, contractors, and subcontractors are required to obtain a badge through the Security Department (steps 1-18 can be completed electronically, steps 19-20 need to be completed at the specific Intermountain Facility). If you have any questions or help with registration, please call 214-222-7484.

1. Visit RepTrax (<https://www.sec3ure.com/login>) and click on the register link by the sign in section
 2. Enter email, password, reenter password, and then click on 'Create My Profile'
 3. Enter personal information and click on 'Tell Us About Your Company'
 4. Enter company information, job title, select 'Building Operations-Maintenance' under the Primary Job Function drop down
 5. Make a 'YES' or 'NO' selection under the radiation equipment question, typically the response is 'NO'
 6. Check the box indicating that you agree to terms and conditions and click on 'Complete Registration'
 7. Select 'Utah' from the drop down menu
 8. Enter the Intermountain Facility in the search bar at the top right or scroll to locate the facility
 9. Select the Intermountain Facility and click on box to the left, then click on the 'Add Selected'
 10. You can sign up for the Sec³ure Passport Membership, otherwise select 'Not Right Now'
 11. Click on 'Facilities' on the far left menu
 12. Select 'Outstanding Requirements' under the Intermountain Facility
 13. Click on 'Complete Policies'
 14. Click on the '+' button on each policy to expand it
 15. Once expanded, click on 'Details', read the policies and click 'Accept', you will also be required to watch a short video and answer a short quiz regarding the video; repeat for each required policy until completed
 16. Once policies are completed, click on 'My Account' on the far left menu, and then click on 'Profile'
 17. Click on 'Change Photo' and upload a current photo (required) from your computer
 18. Once this step is complete, all requirements should be met, and you will be registered in the Intermountain system for the facilities associated with your account
 19. You must now go to the Materials Management office at the specific Intermountain Facility and have them verify your RepTrax registration, if approved, they will print off your paperwork for you to take to the FM office for signature
 20. Take the signed RepTrax paperwork to the Intermountain Facility Security office to receive your printed Identification Badge
 - Background checks may be required.
 - Immunizations may be required.
 - Identification Badges are always to be worn and visible when working at Intermountain Facilities.
 - Access to areas of the facilities is granted based on need.
 - Restricted areas include: Surgery, Emergency, Mom/Baby, Pediatrics, Labor and Delivery, Behavioral Health, Medical Records, Pharmacy, Human Resources or other information sensitive areas.
- FACILITY MANAGEMENT CHECK IN
 - All Service/Construction Contractors are required to notify FM every day prior to and upon completion of work unless prior arrangements are made.
 - PARKING
 - The loading dock is provided for unloading of material but is not to be used as parking.
 - All parking is by authorization only through FM and/or Security. Once approved, Service/Construction vehicles shall only park in approved areas.

HOURS OF OPERATION

- Intermountain Facility hours of normal operation are as follows
 - Monday thru Friday 07:00-15:30 (verify with each facility)
 - After hours work as required and must be coordinated
- Work to be performed outside the normal hours of operation must be approved in advance.

SAFETY/SECURITY

- Service/Construction Contractors must provide and manage their own Safety program that complies with guidelines of OSHA 29 CFR 1926 SUBPART C
- TOOL SECURITY/CLEAN UP
 - **No Tools are to be left unattended** in restrictive areas or uncontrolled areas open to public access and must always be in view of workers.
 - When leaving any job area all tools are to be secured in a lockable container within the secured job site, stored in secured FM area or a secured mechanical area.
 - Job site shall be maintained clean throughout the day and left clean at the end of each work day.

- EVACUATION PLAN
 - Contractor to provide maps showing stairwells and evacuation gathering points and post these in the job site.
- PPE
 - All Service/Construction Contractors will provide their own and use all PPE as required. PPE includes equipment, training, and maintaining PPE and equipment and ensuring it is in working order.
- HAZARDOUS MATERIAL HANDLING/CHEMICALS
 - Any chemical used in any Intermountain Facility must meet the following criteria:
 - Must be approved for use by the Facility Safety Chemical Officer
 - All chemicals must have accompanied Safety Data Sheets (SDS)
 - Stored in accordance of the manufacture's specifications
 - Stored in labeled container
 - All chemicals beyond "day use" must reside off-site to remain in compliance with NFPA 30 due to restrictions for healthcare occupancies
 - Comply with Intermountain's Hazardous Materials Policy (provided upon request)
 - All Service/Construction Contractors are responsible for the removal and disposal of any hazardous material in accordance to applicable laws and regulations or as designated by the Facility Safety Chemical Officer
 - All work performed by the contractor and subcontractors shall be in accordance with certain policies and procedures and all applicable regulations, codes, regulatory agencies, and applicable local, State, and Federal laws including OSHA regulations
- LIFE SAFETY /INTERIM LIFE SAFETY MEASURES (ILSM)
 - No construction or service shall be performed without the completion of the following
 - Interim Life Safety Measure (ILSM) Assessment
 - Infection Control Risk Assessment (ICRA)
 - Preconstruction Risk Assessment (PCRA) and Safety Checklist
 - Completion of the attached Preconstruction Risk Assessment and Safety Checklist is required to be completed, reviewed and approved on an annual basis or prior to the start of new work or a specific construction project
 - Utility Shut down process
 - Prior Approval is required
 - See SCHEDULING section for required notices
 - Additional requirement pertaining to Capital Construction Projects will be addressed in the Preconstruction meeting and subsequent OAC meeting.
- CODE RED/FIRE ALARM
 - If you are working in an area and you see and hear active Fire Alarm (Horns & Strobes) you are to do the following:
 - Secure your job site and tools to avoid any safety hazards for staff & patients
 - Evacuate the area
 - If facility evacuation is necessary, evacuate through the nearest path of egress including the nearest stairway and/or exit.

APPEARANCE/CONDUCT

- LANGUAGE
 - Remember that this is a healthcare facility and using offensive language or engaging in inappropriate topics of conversation are not permitted.
- DRESS ATTIRE
 - All clothing is to be clean and clear of offensive content
 - Shirts-Must cover the torso. Sleeves must cover shoulders and upper arm
 - Pants-Must be full length and worn above hip level.
 - Shoes-Must be close toed
 - Prohibited Attire:
 - Open toed shoes

- Sweat Pants
 - Nylon Clothing
 - Tank Tops/Muscle Shirts
 - Shorts
- TOBACCO / E-Cigarettes
 - All Tobacco products are prohibited at all Intermountain Healthcare Property.

CONFIDENTIALITY

Patients have an expectation of privacy from staff, visitors, and other on-site workers.

- Contractors are required by HIPAA to follow privacy practices, and to protect the confidentiality of the information. Contractors must familiarize their staff with these requirements.
- Contractors are expected to keep all information either seen or heard confidential while working at Intermountain Facilities. The identity of patients or their medical condition are to be held in the strictest confidence.
- It is strictly prohibited to photograph, video record, or audio record while on site; except for training videos that are for Intermountain purposes.
- It is strictly prohibited to post details of work or site operations on social media.
- Contractor must knock and ask permission before entering any patient room, clinic exam, etc., after first seeking approval from the nursing staff.

SCHEDULING

- 72 BUSINESS HOUR ADVANCED NOTICE MINIMUM, WRITTEN APPROVAL, AND SCHEDULING OF WORK IS REQUIRED BEFORE PERFORMING ANY NON-EMERGENCY SHUTDOWN OR IMPACTS IN ANY FACILITY. This can be done using a FM shutdown Scheduling Form obtained through the FM requesting the services or at the OAC meeting. This form will be or has been distributed to capital construction projects during the preconstruction meeting.
- For work associated with capital construction projects, contact the Design & Construction PM's.

MAPS *(section to be edited by FM at specific facility)*

- Attached in this packet are Maps (provided by FM team) that identify the following key locations:
 - GREEN CIRCLES-Stairwells
 - Evacuation Points
 - RED CIRCLES-Service Elevators
 - These elevators are the only elevators to be used by Engineering Service/Construction Contractors unless approval is given otherwise by Engineering Management.
 - BLUE CIRCLES-Engineering Evacuation Point
 - During an Evacuation Drill, Fire Drill, or actual evacuation events, this location serves as the gathering point for all Engineering Service/Construction Contractors. Return access to the building is only permitted after an "ALL CLEAR" has been issued.
 - PURPLE CIRCLES-Securable Mechanical Rooms
 - Data closets are not provided on maps. All contractors needing access are required to obtain an access badge through security.
 - Prior to hospital construction, contractor shall prepare and submit for approval, a Contractor's Access Map to include the entry points (service elevator) to each level of the facility and the corridor routes limited to contractor access.

PRECONSTRUCTION RISK ASSESSMENT AND SAFETY CHECKLIST

Project Name:	Project Name Address Address	Intermountain Project #:	Project ID #
Contractor:	Contractor Address Address	Superintendent / Foreman Contact:	Name Phone Email
Security Contact:	Name Phone Email	FM Contact:	Name Phone Email
Infection Preventionist Contact:	Name Phone Email	FD&C PM:	Name Phone Email
PreConstruction Meeting Date:	Enter Date	Proposed Construction Start Date:	Enter Date

This checklist serves as guide in assessing risk and minimum safety preparations required of the contractor and is not all-inclusive. As tasks change and new risks and hazards are introduced, the contractor may need to consider additional safeguards and corrective measures.

The contractor and subcontractor(s) must comply with all Occupational Safety and Health Administration (OSHA), National Fire Protection Agency (NFPA) 101 Life Safety Code, International Building Code (IBC), and The Joint Commission (TJC) regulations, codes, and applicable local, State, and Federal laws that pertain to the construction project. Each contractor/subcontractor must initiate and maintain an effective safety program that provides adequate systematic policies, procedures, and practices to protect employees, patients and visitors from job-related safety and health hazards.

The contractor will address the following items prior to and/or during the Preconstruction Meeting

(The Contractor or Contracting Representative must address these items):

- Has contractor prepared a Safety Plan that analyzes anticipated hazards of the project and indicates how the hazards will be controlled? Contractor must identify specific procedures for controlling hazardous operations such as crane use, scaffolding, excavation/trenching, hot work, welding, noise, vibration, dust control, and similar activities demonstrating compliance with applicable local, State, and Federal laws including OSHA regulations.
YES _____ NO _____
- Will contractor/subcontractor address the four leading hazards of construction work: falls, struck by, caught in/between and electrical?
YES _____ NO _____
- The "Designated Competent Person" (responsible for the project's safety and health performance) is knowledgeable in corrective measures, OSHA regulations, and is capable of identifying existing/predictable hazards and has the authority to prompt corrective measures?
YES _____ NO _____
- Do contractor and subcontractor employees know what to do in the event of an emergency (e.g. injury, fire, accident, hazardous material spill, etc.) with regard to the following actions?
 - Notification to Fire/EMS (911) and hospital dispatch (801-XXX-XXXX)
 - Means of communication with contact numbers (e.g. radio, cellular, pager, etc.).
 - Availability of first-aid/medically-trained contractor personnel with appropriate medical supplies.
 - Personnel (including subcontractors) knowledge of location for immediate aid (e.g., first-aid, etc.).
 - Evacuation routes, signals, and procedures are provided to all on-site personnel.
 - Safety and health information disseminated to all site personnel (e.g. contractor and subcontractor employees)
YES _____ NO _____

5. Has an Infection Control Risk Assessment (ICRA) been completed? YES_____ NO_____
- a. If yes, provide approved ICRA permit.
6. Will this work require a Noise or Vibration Risk Assessment? (Grinding, drilling, etc.) YES_____ NO_____
- a. Contractor to demonstrate plan and compliance with OSHA 29 CFR 1926 including applicable subsections
7. If any work is to be conducted as maintenance, repair, or testing on a Fire Alarm or Suppression Systems has the following been explained to contractor:
- a. Contact Facility Management prior to any work.
- b. Contact Facility Management once work is completed. YES_____ NO_____ N/A_____
8. If any contracted work includes work to be above the ceiling tiles an **"Above Ceiling Work Permit"** must be issued by Facilities Management and must be present at site of work. Discussed w/ contractor? YES_____ NO_____
9. If any contracted work will include the production of heat (e.g. welding, cutting, soldering, grinding, etc.) a **Hot Work Permit** will need to be issued by Facility Management prior to any work and follow all pre and post work requirements on permit. Discussed w/ contractor? YES_____ NO_____
10. Is contractor aware that they must ensure construction area is clearly delineated and posted with appropriate warning signs? (e.g., **"Hard Hat Area"**, **"Construction Site – CLOSED"**, **Area Closed to Public**, etc.), and that instructional signs and flagmen or barriers are required? YES_____ NO_____
11. EVS/Housekeeping: Is contractor/subcontractor aware that they must ensure that the following acceptable EVS/Housekeeping standards are practiced from project's start to finish?
- a. Form/scrap lumber with protruding nails and all other debris shall be kept clear from work areas.
- b. Combustible scrap and debris shall be removed at regular/frequent intervals.
- c. Materials shall be stored with regard to their fire characteristics with effective fire protection and prevention measures used.
- d. An enclosed chute shall be used whenever materials are dropped more than 5 feet to an exterior point of a building.
- e. Aisles, exits, and passageways (egress) shall be kept clear and in good repair. YES_____ NO_____
12. Is contractor aware of following Environmental and Personal standards?
- a. Potable water provided.
- b. Restroom facilities provided.
- c. Washing facility provided for employees engaged in operations involving harmful substances.
- d. Intoxicating beverages, controlled substances, and/or firearms are not permitted under any circumstances on the construction site
- e. Contractors will adhere to the Intermountain Healthcare Tobacco policy. YES_____ NO_____
13. Is contractor/subcontractor aware that following employee training considerations may need to be addressed?
- a. Confined Space.
- b. Scaffolding.
- c. Fall Protection.
- d. Hazard Communication.
- e. Lockout/Tagout.
- f. Respiratory Protection.
- g. First Aid. YES_____ NO_____ N/A_____
14. Contractor/subcontractor is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where the need is indicated for using such equipment to reduce the hazard to their employee(s). The contractor/subcontractor is also responsible for ensuring that personnel using protective equipment shall be trained and medically qualified to do so. Such personal protective equipment may include the following: [Discuss w/ contractor]
- a. Eye and face protection (safety goggles, safety glasses, welding goggles, face shields, etc.).
- b. Protective footwear (safety shoes, boots).
- c. Protective gloves (leather, rubber, insulated).
- d. Respirators (dust, half-face, full-face, etc.).
- e. Hearing protection (ear plugs, muffs, etc.).
- f. Fall protection equipment. YES_____ NO_____
15. Tools (hand, electric, pneumatic) Standards:
- a. Hand tools, power tools, and jacks are maintained in safe operating condition and used only for the purpose for which they were designed.
- b. Electric power-operated tools must be either approved double-insulated or be properly grounded (see Item#16 "Electrical" for additional considerations). YES_____ NO_____

16. Electrical Standards:

- a. Ground Fault Circuit Interrupters (GFCIs) or an assured equipment-grounding conductor program must be used to protect employees from ground-fault hazards.
- b. Electrical cords/insulation must be in good condition (not frayed or damaged).
- c. All ground plugs must be on electrical cords, if so designed by the manufacturer.
- d. Workspace, walkways, and similar locations shall be kept clear of electrical cords.
- e. All electrical extension cords must be of the three-wire type. Contractor/subcontractor must determine need and implement an appropriate Lock-out/Tag-out program. YES _____ NO _____

17. Will motor vehicles, cranes, and/or heavy equipment be used? (If no skip to #18)

- a. Crane and derrick use must comply with applicable standards and Life Flight teams to be notified.
- b. Rollover protection as required.
- c. Back-up alarms or observer signals as required.
- d. No crawler type vehicles are allowed on an improved road.
- e. All utilities must be located prior to excavating soil.
- f. Life Flight Coordination YES _____ NO _____

18. Excavating and trenching work? (If no, skip to #19)

- a. All excavating/trenching must be in accordance with applicable safety standards.
- b. All utilities must be located prior to excavating. YES _____ NO _____

19. Elevated Work? (If no, skip to #20)

- a. Ladders and their use must conform to standards.
- b. Aerial lift usage must meet applicable requirements.
- c. Fall protection needs must be assessed per standards.
- d. Scaffold work must conform to standards.
- e. Stair design, construction, and use must meet applicable requirements.
- f. Toe boards, when used to protect workers from falling objects, must be erected along the edge of the overhead walking/working surface.
- g. Safety net use must comply with standards.
- h. Railing must conform to standards. YES _____ NO _____

20. Contractor is aware of and understands the need to incorporate applicable requirements for concrete and masonry construction. YES _____ NO _____ N/A _____

21. Contractor is aware of and understands the need to incorporate welding and cutting operations that comply with applicable safety requirements (e.g., compressed gas cylinders are protected from vehicle traffic, valve caps secured, etc.) YES _____ NO _____ N/A _____

22. Contractor is aware of and understands the need to manage hazardous materials/waste appropriately (e.g. solvents, fuels, etc.) including the following:

- a. Use and storage of flammable/combustible liquids.
- b. Aboveground fuel storage tanks properly managed/contained.
- c. Compressed gases and cylinders managed correctly (e.g., secured and protected from damage, etc.).
- d. Procedures for managing use, storage, and disposal of hazardous materials properly established.
- e. Excess/waste product(s) and containers properly disposed of per environmental regulations.
- f. Hazards of product use and the need for protective measures (e.g. personal protective equipment, etc.) conveyed to Contractor and Subcontractors.
- g. Asbestos work conforms to applicable standards.
- h. Exposure to toxic gases, vapors, fumes, dusts, and mists managed correctly.
- i. Lead, laser, and any other hazardous components managed per the applicable standard.
- j. Contractor must maintain or have ability to produce Safety Data Sheets (SDS) for any material used for contracted work. YES _____ NO _____ N/A _____

23. Contractor has a copy of, has read, understands and agrees to comply with the Facility SERVICE CONTRACTOR & CONSTRUCTION ORIENTATION PACKET. YES _____ NO _____

24. Additional information or notes:

- a. Address Peds BH/ED Areas where tools cannot be left out and shadowing doesn't occur.
- b. Attire in Immuno-Compromised or Operating Room (OR) similar settings.

The contractor has the ultimate responsibility for safety on the project site at all times until final completion and acceptance of the project.

The contractor's signature below indicates the above information was discussed and understood.

Contractor signature: _____ **Date:** _____

Facility Management (FM) Representative: _____ **Date:** _____

Construction Negative Pressure Log

If pressure is > -.01, notify facilities or Infection Prevention immediately and document it

Month/Year:

Job:

AM

PM

Date	Initials	Pressure Reading	Initials	Pressure Reading	Comments
1					
2					
3					
4					
5					
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ILSM Assessment Form

Intermountain Healthcare

Life Safety Deficiency Description:													
Facility and Location:													
Initiated by:				Date Pre-Assessment Sent to Area Safety Management:									
INSTRUCTIONS The ILSM Assessment Form is to be completed when the Life Safety Code (LSC) is not being met during periods of construction or other events. <i>This form includes criteria for evaluating when and to what extent the hospital [or facility] implements ILSM's to compensate for increased life safety risk. (EP 1)</i> The Initiant (Construction, Facilities, etc.) initiates the need for an ILSM (yellow) and submits to Area Safety Management for review. If ILSM required, assessment form is completed by Area Safety Management (blue) and reviewed by initiant, local facility manager, and local security supervisor before ILSM implementation. Types and extent of impairments and deficiencies as identified in the LSC are listed below. ILSM's are identified to the right (numbers in parentheses refer to LS.01.02.01 EP's). Shaded cells in grid represent typical measures for corresponding impairments and deficiencies. ILSM's to be implemented are indicated by X's placed in cells. Actual selection of ILSM's may vary depending on factors such as duration, size, or scope of impairment, occupancy, or other life safety systems in place.				Pre-Assessment Do conditions of a deficiency / impairment exist? If yes, further assessment is required. Are deficiencies / impairments significant? If yes, complete ILSM assessment		ILSM Assessment Interim Life Safety Measures							
						1. Notify Fire Dept. etc. and document notification time (EP 2) 2. Initiate Fire Watch and document times (EP 2) 3. Post signage identifying alternative exits (EP 3) 4. Inspect exits in affected areas on a daily basis (EP 4) 5. Provide temp. but equiv. fire alarm / detection (EP 5) 6. Inspect/test temp. systems monthly & document (EP 12) 7. Provide additional fire fighting equipment (EP 6) 8. Use temporary non-combust. smoke barriers (EP 7) 9. Provide increased surveillance (EP 8) 10. Minimize flammable and combustible load (EP 9) 11. Provide additional training w/ firefighting equip. (EP 10) 12. Conduct one add'l fire drill per shift per quarter (EP 11) 13. Educate staff on deficiencies, hazards, and ILSM's (EP 13) 14. Train staff to compensate for impairments (EP 14) 15. Other ILSM (describe in comments at bottom) (EP 15)							
						YES	NO	YES	NO				
Exits / Barriers / Compartmentation													
Alter or compromise the integrity of exits or exit discharges													
Alter or compromise exit corridors, incl. length of travel													
Exit signs are blocked or inoperable													
Patient floor with < 2 smoke compartments (horizontal evac.)													
Removal or breach in fire or smoke barriers													
Removal or breach in floor slabs													
Removal or breach in corridor walls													
Corridor doors deficient (latching, labeling, gaps)													
Impaired fire or smoke damper													
Impaired sliding or rolling fire door													
Detail or Other:													
Fire Alarm, Detection, or Suppression System													
Fire alarm system out of service > 4 hrs in a 24 hr period													
Fire alarm system out of service > 24 hours													
Sprinkler/suppression system out of service > 4 hrs in 24 hours													
Sprinkler/suppression system out of service > 24 hours													
Covered fire detection in construction area													
Fire alarm or suppression out of service <4 hours													
Detail or Other:													
Construction / Hot Work													
Soldering, brazing, cutting or welding (follow Hot Work Policy)													
Exterior construction													
Work impacting emergency services access (ensure access)													
Detail or Other:													
Hazard Surveillance													
Detail or Other:													
Project Description: _____ Project # (if applicable): _____													
Estimated Project Start Date: _____ Estimated Project Completion Date: _____													

ILSM Assessment Form

Intermountain Healthcare

Area Safety Management :	Date ILSM Assessment Completed:
Initiant (Construction, Facilities, etc.):	Review Date:
Facility Manager:	Review Date:
Security Supervisor:	Review Date:

Required ILSM's [describe specific ILSM and responsible individual]

1. If fire alarm system or sprinkler system is out of service for a period greater than 4-hours in a 24-hour period in an **occupied building**, notify the following and document the notification time:
Local fire department notification date/time: _____
Utah Health Department (Utah Hospitals Only) 1-800-662-4157 date/time: _____
Idaho Health Department (Idaho Hospitals Only) 208-334-6626 date/time: _____
AIG Insurance (policy number 020413008) 1-877-705-7287 date/time: _____
2. Initiate fire watch and document times:
3. Post signage for alternative egress and remove signage of previous egress:
4. Daily inspection of alternative egress/ new signage:
5. Temporary fire protection system(s) and monthly inspection:
6. Additional fire fighting equipment:
7. Additional smoke barriers:
8. Increased surveillance (hazards) :
9. Remove storage/debris, minimize combustible load:
10. Additional fire prevention and response training for construction and/or affected caregivers:
11. Additional fire drills due to the impact of life safety features or existing life safety deficiencies:
12. Caregiver education and training:
13. Other ILSM(s) documentation:

Other:

Safety Contact	Clinic Type	Don't Count	PCMH	Depth	Clinic NPI	Clinic Name	Address	City	County	State	Zip	Clinic Phone	Fax	Region	Market	Clinic Open	Comments	
Alex	Uncat.	X			74262	182154872 McKay Dee Pediatric Hospitalist	4401 Harrison Blvd #2895	Ogden	Weber	UT	84403-3175			Taylor Hadley	Weber	Utah North	11/1/2016	
Alex	CL				74040	1215172093 McKay Dee Neurology	4403 Harrison Blvd #3855	Ogden	Weber	UT	84403-3349	(801) 387-7880	(801) 387-7880 Summer Patterson	Weber	Utah North	3/1/2013		
Alex	CL				74051	1720213383 Calton/Harrison Orthopedic & Sports Clinic - South Clinic	4403 Harrison Blvd #2400	Ogden	Weber	UT	84403-3297	(801) 387-2750	(801) 387-2755 Kim Lemmon	Weber	Utah North	4/10/2006		
Alex	Uncat.	X			74056	1720213383 Calton-Harrison Clinic - Trauma	4403 Harrison Blvd #2400	Ogden	Weber	UT	84403-3297	(801) 387-2750	(801) 387-2755 Kim Lemmon	Weber	Utah North	4/1/2006		
Alex	Uncat.	X			74241	1447669262 McKay Dee Sleep Center	4403 Harrison Blvd #2600	Ogden	Weber	UT	84403-3277	(801) 387-5650	(801) 387-5655 Ed Cosnyka	Weber	Utah North	10/1/2014		
Alex	CL				74059	1326355942 McKay Dee Wound and Hyperbaric	4403 Harrison Blvd #2600	Ogden	Weber	UT	84403-3255	(801) 387-4870	(801) 387-4875 Wendy Norton	Weber	Utah North	9/6/2010		
Alex	CL				74045	1053456764 North Utah Surgeons	4403 Harrison Blvd #2600	Ogden	Weber	UT	84403-3277	(801) 387-1450	(801) 387-1450	Weber	Utah North	1/2/2005		
Alex	CL				74055	15088952671 McKay Dee ENT Clinic	4403 Harrison Blvd #2645	Ogden	Weber	UT	84403-3278	(801) 387-2880	(801) 387-2885 Taylor Hadley	Weber	Utah North	12/7/2005		
Alex	CL				74057	1003946823 McKay Dee Foot & Ankle Clinic	4403 Harrison Blvd #2835	Ogden	Weber	UT	84403-3327	(801) 387-7945	(801) 387-7910 Kim Lemmon	Weber	Utah North	5/1/2006		
Alex	CL				74291	1770098204 Intermountain Cancer Center at McKay-Dee	4403 Harrison Blvd #2855	Ogden	Weber	UT	84403-2855	(801) 387-7150	(801) 387-3724 Suzanne Elison	Weber	Utah North	12/1/2017		
Alex	Uncat.				74054	1114055241 McKay Dee Cardiology South	4403 Harrison Blvd #3400	Ogden	Weber	UT	84403-3281	(801) 387-3400	(801) 387-3420 Laura Erbeia	Weber	Utah North	2/1/2011		
Alex	Uncat.	X			74249	1991296988 McKay Dee Heart Failure	4403 Harrison Blvd #3430	Ogden	Weber	UT	84403-3343	(801) 387-3880	(801) 387-3888 Laura Erbeia	Weber	Utah North	3/1/2015		
Alex	CL				74061	1457662584 McKay Dee Heart Rhythm Specialists	4403 Harrison Blvd #3430	Ogden	Weber	UT	84403-3343	(801) 387-3850	(801) 387-3854 Laura Erbeia	Weber	Utah North	9/1/2016		
Alex	CL				74054	1114055241 McKay Dee Cardiology	4403 Harrison Blvd #3400	Ogden	Weber	UT	84403-3284	(801) 387-2650	(801) 387-2655 Laura Erbeia	Weber	Utah North	10/1/2002		
Alex	CL				74046	1033249198 McKay Dee Endocrine & Diabetes Clinic	4403 Harrison Blvd #3630	Ogden	Weber	UT	84403-3287	(801) 387-7900	(801) 387-7910 Noreen Wynn	Weber	Utah North	5/1/1996		
Alex	CL				74065	1255607123 McKay Dee Infectious Disease	4403 Harrison Blvd #3630	Ogden	Weber	UT	84403-3287	(801) 387-7900	(801) 387-7910 Noreen Wynn	Weber	Utah North	4/16/2012		
Alex	Uncat.	X			74239	1033249198 McKay Dee Palliative Care	4403 Harrison Blvd #3630	Ogden	Weber	UT	84403-3287	(801) 387-7900	(801) 387-7910 Noreen Wynn	Weber	Utah North	7/1/2014		
Alex	CL				74052	1396773834 McKay Dee Rheumatology Clinic	4403 Harrison Blvd #3630	Ogden	Weber	UT	84403-3288	(801) 387-7125	(801) 387-7130 Noreen Wynn	Weber	Utah North	5/1/1997		
Alex	CL				74062	1487966768 McKay Dee Dermatology & Plastic Surgery	4403 Harrison Blvd #3680	Ogden	Weber	UT	84403-3289	(801) 387-4750	(801) 387-4755 Noreen Wynn	Weber	Utah North	7/1/2010		
Alex	CL				74242	1245649060 McKay Dee Gastroenterology Clinic	4403 Harrison Blvd #3815	Ogden	Weber	UT	84403-3330	(801) 387-5620	(801) 387-5625 Jake Holt	Weber	Utah North	10/1/2014		
Alex	CL				74048	1962547695 Ogden Cardiovascular Associates	4403 Harrison Blvd #3835	Ogden	Weber	UT	84403-3331	(801) 387-3475	(801) 387-3480 Laura Erbeia	Weber	Utah North	3/1/2003		
Alex	Uncat.	X			74320	1700446325 Kidney Services - McKay Dee	4403 Harrison Blvd #3875	Ogden	Weber	UT	84403-3332	(801) 507-2531	(801) 387-9125 Jennifer Bradley	Weber	Utah North	7/13/2006		
Alex	DDS				75002	1386207835 McKay Dee Dentistry	4403 Harrison Blvd #3875	Ogden	Weber	UT	84403-3332	(801) 387-7880	(801) 387-7885 Taylor Hadley	Dentistry	Utah North	6/10/2019		
Alex	CL				73023	1215067277 McKay Dee Internal Medicine Clinic	4403 Harrison Blvd #4815	Ogden	Weber	UT	84403-3333	(801) 387-7950	(801) 387-7955 Summer Patterson	Weber	Utah North	5/1/1987		
Alex	Uncat.	X			74247	1891998852 Wasatch Gym - McKay	4403 Harrison Blvd #4815	Ogden	Weber	UT	84403-3333	(801) 387-8350	(801) 779-6294 Paulette Hadley	Weber	Utah North	1/1/2015		
Alex	CL				74058	1891998852 Wasatch OB/Gyn	4403 Harrison Blvd #4815	Ogden	Weber	UT	84403-3333	(801) 387-8350	(801) 387-8355 Paulette Hadley	Weber	Utah North	6/1/2007		
Alex	CL				73018	1952446676 Northern Utah Pediatrics	4403 Harrison Blvd #4875	Ogden	Weber	UT	84403-3335	(801) 387-4500	(801) 387-4712 Taylor Hadley	Weber	Utah North	9/23/1996		
Alex	LWC				74322	1619570694 Live Well Center - Ogden	4421 Harrison Blvd Ste A6	Ogden	Weber	UT	84403-3174	(801) 387-8400	(801) 387-8400 Justin Jackson	North Salt Lake	Utah Central	12/1/2020		
Alex	Uncat.	X			74055	1467597065 McKay Dee ENT - Ogden Clinic	4650 Harrison Blvd	Ogden	Weber	UT	84403-4303	(801) 779-6200	(801) 779-6234 Taylor Hadley	Weber	Utah North	2/1/2013		
Alex	CL				74021	1093441873 Roy Clinic	1915 W 5950 S	Roy	Weber	UT	84067-8100	(801) 387-8100	(801) 387-8223 Colby Anderson	Weber	Utah North	1/2/2005		
Alex	IC				72008	1265556236 Roy InstCare	1915 W 5950 S	Roy	Weber	UT	84067-1454	(801) 387-8100	(801) 387-8223 Annika Kennington	Weber	Utah North	12/1/1995		
Alex	CL				73022	1922143643 South Ogden Clinic	975 E Chambers Ave	S Ogden	Weber	UT	84403-4591	(801) 387-6200	(801) 387-6234 Angie Furgerson	Weber	Utah North	12/16/1999		
Alex	OS					Kimberly Clark								On-site Clinic			RR on site - budgeted in Ogden WorkMed	
Alex	OS					ATK								On-site Clinic			RR on site - budgeted in Ogden WorkMed	
Jay	Uncat.	X			74089	1699800375 Cottonwood Endocrine & Diabetes Center	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-8110	(801) 314-4500	(801) 314-2900 Debbie Anderson	Central Salt Lake	Utah Central	8/1/2004		
Jay	CL				73036	1285760422 Cottonwood Family Medicine	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-0000	(801) 314-4266	(801) 293-7991 Julie Ann Christensen	Central Salt Lake	Utah Central	6/1/1997		
Jay	Uncat.	X			73082	1942462569 Cottonwood Head and Neck Oncology ENT	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-6771	(801) 314-7840	(801) 314-7840 Debbie Anderson	Central Salt Lake	Utah Central	7/1/2008		
Jay	Uncat.	X			74278	13466336432 Cottonwood Infusion	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-4872	(801) 314-4302	(801) 314-4302 Adam Pfaff	Central Salt Lake	Utah Central	4/1/2018		
Jay	IC				73013	1346486206 Cottonwood InstaCare	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-7211	(801) 639-5500	(801) 639-5556 Krystal Whitaker	Central Salt Lake	Utah Central	4/1/2009		
Jay	Uncat.	X			73037	1871623140 Cottonwood Internal Medicine	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-8111	(801) 314-4500	(801) 314-4555 Julie Ann Christensen	Central Salt Lake	Utah Central	9/3/1996		
Jay	Uncat.	X			74178	1538515649 Cottonwood Podiatry	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-0000	(801) 314-7130	(801) 314-7133 Debbie Anderson	Central Salt Lake	Utah Central	3/2/2016		
Jay	Uncat.	X			74251	1346634342 Cottonwood Rheumatology Clinic	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-4872	(801) 314-7800	(801) 314-7800 Debbie Anderson	Central Salt Lake	Utah Central	7/1/2015		
Jay	Uncat.	X			73052	1245519859 Intermountain Senior Clinic	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-0000	(801) 314-4544	(801) 314-4565 Julie Ann Christensen	Central Salt Lake	Utah Central	11/1/2011		
Jay	Uncat.	X			74071	1295866051 Orthopedic Specialty Group - TOSH DX	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-4872	(801) 314-4900	(801) 314-4900 Krystal Whitaker	North Salt Lake	Utah Central	7/26/2021		
Jay	KC				74074	1205963949 Memorial KidCare	181 E Medical Tower Dr	Murray	Salt Lake	UT	84107-6771	(801) 464-7788	(801) 464-7787 Jessica Bowman	North Salt Lake	Utah Central	11/1/1999		
Jay	OS				74118	1811321544 Intermountain Employee Clinic	181 East Medical Tower Drive	Murray	Salt Lake	UT	84107-4872	(801) 288-4090	(801) 288-4095 Michael Pellew	On-Site Clinic			9/2/2013 Provider on site	
Jay	WNF				77010	1881729085 Murray WorkMed	201 E 5900 S #100	Murray	Salt Lake	UT	84107-5429	(801) 288-4904	(801) 288-4905 Emily Draper	WorkMed			1/2/2010	
Jay	CL				74106	1831187539 Intermountain Obstetrics & Gynecology Specialists	5063 S Cottonwood St #120	Murray	Salt Lake	UT	84107-6772	(801) 507-1800	(801) 507-1825 Elizabeth O'Reilly	Central Salt Lake	Utah Central	10/29/2007		
Jay	CL				73045	1659569358 Hillcrest Pediatrics	5063 S Cottonwood St #160	Murray	Salt Lake	UT	84107-6773	(801) 507-1850	(801) 587-1875 Michael Pellew	Central Salt Lake	Utah Central	10/29/2007		
Jay	CL				74105	1154627206 Intermountain Nurse Midwives	5063 S Cottonwood St #170	Murray	Salt Lake	UT	84107-5701	(801) 507-7070	(801) 507-7080 Debbie MacDonald-Burgon	Central Salt Lake	Utah Central	4/1/2011		
Jay	Uncat.	X			73060	1669736278 IMC Palliative Care	5121 Cottonwood St	Murray	Salt Lake	UT	84107-5701	(385) 887-6000	(801) 887-6000 Dallas Astle	Palliative Care			5/1/2019	
Jay	CL				74265	1215644215 Medical Center O/Hospitalists	5121 S Cottonwood St	Murray	Salt Lake	UT	84107-5701	(801) 442-3034	(801) 442-3034 Philip Minton	North Salt Lake	Utah Central	7/1/2017		
Jay	Uncat.	X			74167	1164554069 Medical Center IM Hospitalists	5121 S Cottonwood St	Murray	Salt Lake	UT	84107-5701	(801) 507-4384	(801) 507-4398 Doug Philpot	North Salt Lake	Utah Central	10/29/2007		
Jay	Uncat.	X			74188	1972631042 Medical Center Radiation Oncology	5121 S Cottonwood St	Murray	Salt Lake	UT	84107-5701	(801) 507-3888	(801) 442-3263 Aaron Brammer	Radiation Oncology			2/1/2007	
Jay	SAT				74104	1649576661 INT MFM Specialists Diagnostic	5121 S Cottonwood St #100	Murray	Salt Lake	UT	84107-5701	(801) 507-7400	(801) 507-7493 Emily Evans	Central Salt Lake	Utah Central	5/1/2011		
Jay	CL				74104	1649576661 Maternal Fetal Medicine Specialists	5121 S Cottonwood St #130	Murray	Salt Lake	UT	84107-5701	(801) 507-7400	(801) 507-7493 Emily Evans	Central Salt Lake	Utah Central	5/1/2011	Shares space w/ Int Pls Surg	
Jay	CL				74123	1467932977 MED Campus Sleep Program	5121 S Cottonwood Street	Murray	Salt Lake	UT	84107-5701	(801) 314-2385	(801) 314-2385 Ian Humes	North Salt Lake	Utah Central	9/1/2011		
Jay	Uncat.	X			74080	1144355033 Intermountain Heart - Cardiac Care	5121 S Cottonwood Street	Murray	Salt Lake	UT	84107-4723	(801) 507-3625	(801) 507-3625 Teria Gentry	Central Salt Lake	Utah Central	3/19/2013		
Jay	SAT				74320	17000446325 Kidney Services - IMC	5169 Cottonwood St #300	Murray	Salt Lake	UT	84107-6768	(801) 507-2531	(801) 507-2531 Jeremy Bergeson	Central Salt Lake	Utah Central	9/1/2019		
Jay	CL				74205	1265786503 Intermountain Psychiatry and Counseling	5169 Cottonwood St #420	Murray	Salt Lake	UT	84107-6769	(801) 507-3472	(801) 507-3471 Cherish Keddington	North Salt Lake	Utah Central	1/1/2013		
Jay	SAT				74228	1992133284 IMED Trauma General Surgery	5169 S Cottonwood St #400	Murray	Salt Lake	UT	84107-6769	(801) 507-3460	(801) 507-3458 Michelle Beers	Central Salt Lake	Utah Central	9/1/2015		
Jay	CL				74101	1386777476 Intermountain Surgical Specialists	5169 S Cottonwood St #410	Murray	Salt Lake	UT	84107-6769	(801) 507-1600	(801) 507-1625 Michelle Beers	Central Salt Lake	Utah Central	9/1/2006		
Jay	CL				74095	1881721363 Intermountain Plastic Surgery Center	5169 S Cottonwood St #420	Murray	Salt Lake	UT	84107-6769	(801) 507-1600	(801) 507-1625 Michelle Beers	Central Salt Lake	Utah Central	10/1/2007		
Jay	CL				74107	1215130646 Orthopedic Specialty Group - Medical Center	5169 S Cottonwood St #430	Murray	Salt Lake	UT	84107-6774	(801) 507-3475	(801) 507-3499 Michelle Beers	North Salt Lake	Utah Central	5/1/2007		
Jay	Uncat.	X			74102	1215130646 Orthopedic Specialty Group - Trauma	5169 S Cottonwood St #430	Murray	Salt Lake	UT	84107-6774	(801) 507-3475	(801) 507-3499 Josh Spaulding	North Salt Lake	Utah Central	1/1/2010	Part of Ortho IMC	
Jay	CL				74088	1750417853 Intermountain Surgical Oncology	5169 S Cottonwood St #440	Murray	Salt Lake	UT	84107-6774	(801) 507-3915	(801) 507-3916 Michelle Beers	Central Salt Lake	Utah Central	1/1/2007	Shares space w/ Int Surg Spec.	
Jay	CL				74113	1669773461 Intermountain Heart Rhythm Specialists	5169 S Cottonwood St #510	Murray	Salt Lake	UT	84107-5701	(801) 507-3513	(801) 507-3584 Jennifer Nelson	Central Salt Lake	Utah Central	1/1/2011		
Jay	CL				74112	1862833398 Intermountain Heart Institute - Cardiology	5169 S Cottonwood St #520	Murray	Salt Lake	UT	84107-5701	(801) 507-3500	(801) 507-3505 Brenda Johnson	Central Salt Lake	Utah Central	8/1/2009		
Jay																		

Safety Count	Clinic Type	Don't Count	PCMH	Depth	Clinic NPI	Clinic Name	Address	City	County	State	Zip	Clinic Phone	Fax	Contact	Region	Market	Clinic Open	Comments
Jay	Uncat.	X			74115	1205064595 Park City Specialty Clinic	900 Round Valley Dr #200	Park City	Summit	UT	84060-7532	(435) 658-7400	(435) 658-7401	Katie Hansell	Central Salt Lake	Utah Central	8/1/2009	
Jay	SAT				74116	1770899072 Park City Hospitalists	900 Round Valley Drive	Park City	Summit	UT	84060-7552	(435) 658-7400	(435) 658-7401	Leslie Beattie	Central Salt Lake	Utah Central	9/16/2009	
Jay	SAT				74112	1982833398 Intermountain Heart Cardiology-Park City	900 Round Valley Drive, #200	Park City	Summit	UT	84060-7552	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	11/2/2009	
Jay	SAT				74073	1285993931 Park City Sleep Disorder Clinic	900 Round Valley Drive, #200	Park City	Summit	UT	84060-7549	(435) 658-6621	(801) 412-3160	Ian Humes	Central Salt Lake	Utah Central	6/1/2012	
Jay	CL				73111	1285219808 Tooele Family Medicine	2326 N 400 E, Bldg B	Tooele	Tooele	UT	84074-3430	(435) 228-1200		Phil Heywood	North Salt Lake	Utah Central	4/17/2011	
Jay	CL				74240	1396150656 Heber Valley Specialty Clinic	380 E 1500 South #202	Heber City	Wasatch	UT	84032-3942	(435) 657-4600	(435) 657-4617	Brian Peterson	Central Salt Lake	Utah Central	6/15/2014	
Jay	IC				72240	1225616698 Heber Valley Medical	454 E Medical Way	Heber City	Wasatch	UT	84032-1391	(435) 657-4500		Brian Peterson	Central Salt Lake	Utah Central	5/31/2018	
Jay	SAT				74112	1982833398 Intermountain Heart Cardiology-Heber	454 E Medical Way	Heber City	Wasatch	UT	84032-1391	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	6/1/2017	
Jay	CL				73067	1063616282 Heber Valley Clinic	454 E Medical Way	Heber City	Wasatch	UT	84032-1391	(435) 657-4400	(435) 657-4460	Brian Peterson	Central Salt Lake	Utah Central	7/1/2007	
Jay	Uncat.				74317	1548727290 Live Well Center - Park City	900 Round Valley Drive, #110	Park City	Wasatch	UT	84060-7552	(435) 658-6703		Michelle Best	North Salt Lake	Utah Central	5/1/2019	
Jay	OS	X			74189	Cottonwood Radiation Oncology								Aaron Brammer	North Salt Lake	Utah Central	5/1/2019	
Jay	CL					Presentia									On-site Clinic			
Jonathan	Uncat.	X			74141	1467588178 Legacy OB/Gyn Clinic	1159 E 200N #250	American Fork	Utah	UT	84003-2028	(801) 855-2980	(801) 855-2999	Jessica Bowman	Utah Valley	Utah South	1/1/2004	RN on site - budgeted in Ogden WorkMed
Jonathan	Uncat.	X			74147	1558491613 American Fork Hospitalists	170 N 1100 E	American Fork	Utah	UT	84003-2096	(801) 357-8310	(801) 855-3731	Santhi Martin	Utah Valley	Utah South	3/1/2006	
Jonathan	Uncat.	X			74297	1144796665 American Fork Neonatology	170 N 1100 E	American Fork	Utah	UT	84003-2098	(801) 357-7414		Conrad Jacobson	Utah Valley	Utah South	7/1/2018	
Jonathan	Uncat.	X			74150	1225165087 American Fork Pulmonary Critical Care	170 N 1100 E	American Fork	Utah	UT	84003-2096	(801) 357-7291	(801) 357-3854	Morgan Krulish	Utah Valley	Utah South	1/1/2009	
Jonathan	Uncat.	X			74182	1972631042 American Fork Radiation Oncology	170 N 1100 E	American Fork	Utah	UT	84003-2096	(801) 357-2480	(801) 442-3263	Jamie Stephens	Radiation Oncology		5/1/2006	
Jonathan	CL					American Fork MOB	98 N 1100 E	American Fork	Utah	UT	84003-2096				Utah Valley	Utah South		
Jonathan	SAT				74264	1699148197 Utah Valley Pain Management - American Fork	98 N 1100 E	American Fork	Utah	UT	84003-2935	(801) 235-7246		Elynn Daley	Utah Valley	Utah South	10/1/2018	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74204	1871847434 Utah Valley Psychiatry & Counseling - American Fork	98 N 1100 E	American Fork	Utah	UT	84003-2935	(801) 357-7525		Ashlee Whitcott	Utah Valley	Utah South	8/20/2018	All Part of the American Fork Specialty Clinic
Jonathan	IC				72023	1730217233 American Fork InstaCare	98 N 1100 E #101	American Fork	Utah	UT	84003-2940	(801) 492-2550	(801) 492-2576	Kaylenn Johnson	Utah Valley	Utah South	1/1/2007	
Jonathan	Uncat.	X			74234	1174949002 American Fork Physical Medicine and Rehab	98 N 1100 E #103	American Fork	Utah	UT	84003-2940	(801) 492-3330	(801) 492-2375	Conrad Jacobson	Utah Valley	Utah South	4/7/2014	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74138	1740515964 Utah Valley Orthopedics - North Valley	98 N 1100 E #103	American Fork	Utah	UT	84003-2940	(801) 492-2330	(801) 492-2375	Conrad Jacobson	Utah Valley	Utah South	10/1/2009	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74122	1477885409 Utah Valley Sports Medicine - North Valley	98 N 1100 E #101	American Fork	Utah	UT	84003-2940	(801) 492-2330	(801) 492-2375	Conrad Jacobson	Utah Valley	Utah South	7/1/2018	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.	X			73059	1427184142 North Valley Pediatrics	98 N 1100 E #201	American Fork	Utah	UT	84003-2941	(801) 492-2475	(801) 492-2506	Shaylee Woodward	Utah Valley	Utah South	3/1/1996	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.	X			74148	1710136742 American Fork Surgical Associates	98 N 1100 E #202	American Fork	Utah	UT	84003-2941	(801) 492-2510	(801) 492-2537	Suzanne Burdick	Utah Valley	Utah South	10/1/2008	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.	X			74237	158017072 Utah Valley Ear Nose & Throat - North Valley	98 N 1100 E #302	American Fork	Utah	UT	84003-2941	(801) 492-2445	(801) 492-2470	Morgan Krulish	Utah Valley	Utah South	7/11/2010	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.	X			74153	1689090516 American Fork Dermatology	98 N 1100 E #301	American Fork	Utah	UT	84003-2947	(801) 492-2328	(801) 492-2319	Kelsey Stanfill	Utah Valley	Utah South	4/7/2014	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.				73058	1225165418 American Fork Internal Medicine	98 N 1100 E #302	American Fork	Utah	UT	84003-2947	(801) 492-2328	(801) 492-2319	Kelsey Stanfill	Utah Valley	Utah South	1/24/2006	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74149	1225165087 American Fork Pulmonary Critical Care	98 N 1100 E #302	American Fork	Utah	UT	84003-2947	(801) 492-2270	(801) 492-2272	Morgan Krulish	Utah Valley	Utah South	2/1/2006	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74235	1437576212 American Fork Wound Care	98 N 1100 E #302	American Fork	Utah	UT	84003-2947	(801) 492-2260	(801) 492-2286	Kelsey Stanfill	Utah Valley	Utah South	4/7/2014	All Part of the American Fork Specialty Clinic
Jonathan	SAT				74351	1660999735 Heart Institute - American Fork	98 N 1100 E #302	American Fork	Utah	UT	84003-2941	(801) 357-7081		Morgan Krulish	Utah Valley	Utah South	9/1/2020	
Jonathan	Uncat.	X			74159	1508165648 American Fork Maternal Fetal Medicine	98 N 1100 E #402	American Fork	Utah	UT	84003-2951	(801) 492-2425	(801) 492-2441	Veronica Henicksmann	Utah Valley	Utah South	5/1/2011	All Part of the American Fork Specialty Clinic
Jonathan	Uncat.	X			74144	1730356538 Utah Valley Vascular Surgery - AF	98 N 1100 E Ste 302	American Fork	Utah	UT	84000-2947	(801) 357-1620		Morgan Krulish	Utah Valley	Utah South	12/1/2020	
Jonathan	CL				73061	1083742589 Highland Clinic	10968 N Alpine Hwy	Highland	Utah	UT	84003-8874	(801) 763-2920		Morgan Krulish	Utah Valley	Utah South	2/1/2005	
Jonathan	CL				73103	1114422672 Lehi Clinic	3249 North 1200 West	Lehi	Utah	UT	84043-9772	(801) 753-4310		Michelle Jensen	Utah Valley	Utah South	7/1/2018	
Jonathan	IC				72078	1114422672 Lehi InstaCare	3249 North 1200 West	Lehi	Utah	UT	84043-9772	(801) 753-4310		Michelle Jensen	Utah Valley	Utah South	7/1/2018	
Jonathan	SAT				74264	1699148197 Utah Valley Pain Management - Nephi	48 W 1500 N	Nephi	Utah	UT	84648-8900			Elynn Daley	Utah Valley	Utah South	5/1/2017	
Jonathan	SAT				74139	1649304445 Utah Valley Sports Med-UVSC	1165 W 800 S	Orem	Utah	UT	84058-6753	(801) 357-7129	(801) 357-2176	Conrad Jacobson	Utah Valley	Utah South	1/12/2005	
Jonathan	CL				72053	1285982308 Utah Valley Sports Medicine - Provo	1378 S 1600 N#1	Orem	Utah	UT	84058-6931	(801) 357-7129		Conrad Jacobson	Utah Valley	Utah South	7/1/2005	Provider on site
Jonathan	CL				73056	1942336649 North Orem Clinic	1975 N State St	Orem	Utah	UT	84057-2028	(801) 714-5500	(801) 714-5511	Shaylee Woodward	Utah Valley	Utah South	6/29/1998	
Jonathan	CL				74264	1699148197 Utah Valley Pain Management	412 W 800 N	Orem	Utah	UT	84057-3728			Elynn Daley	Utah Valley	Utah South	5/1/2017	
Jonathan	CL				73076	1578699286 Central Orem Clinic	505 W 1400 N	Orem	Utah	UT	84057-1950	(801) 714-3450	(801) 714-3420	Shaylee Woodward	Utah Valley	Utah South	8/26/1998	
Jonathan	Uncat.	X			73101	199221145 Central Orem Pediatrics	505 W 1400 N	Orem	Utah	UT	84057-1950	(801) 714-3440	(801) 714-3420	Shaylee Woodward	Utah Valley	Utah South	3/1/2018	
Jonathan	Uncat.	X			74191	192351550 Summit OB/GYN	505 W 400 N	Orem	Utah	UT	84057-1950	(801) 714-3422	(801) 714-3424	Veronica Henicksmann	Utah Valley	Utah South	1/1/2013	
Jonathan	WMF				73008	1760516629 WorkMed	830 N 980 W	Orem	Utah	UT	84031-9801	(801) 724-4000		WorkMed	Utah Valley	Utah South	7/1/2005	
Jonathan	Uncat.	X			74140	1134259294 Utah Valley Hospitalists	1034 N 500 W	Provo	Utah	UT	84604-5569	(801) 357-8310	(801) 357-3854	Santhi Martin	Utah Valley	Utah South	11/1/2004	
Jonathan	Uncat.	X			74325	1871847434 Utah Valley Inpatient Psychiatry	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-7850		Ashlee Whitcott	Utah Valley	Utah South	12/1/2019	
Jonathan	Uncat.	X			74288	1265630693 Utah Valley Inpatient Rehab	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-8818		Conrad Jacobson	Utah Valley	Utah South	1/1/2021	
Jonathan	Uncat.	X			74161	1740581545 Utah Valley Maternal Fetal Medicine	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-7706	(801) 357-8131	Veronica Henicksmann	Utah Valley	Utah South	5/1/2011	All Part of the Utah Valley Specialty Clinic
Jonathan	Uncat.	X			74162	1144512348 Utah Valley Neonatology	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-7707	(801) 370-9061	Conrad Jacobson	Utah Valley	Utah South	10/1/2010	
Jonathan	Uncat.	X			74151	1497076533 Utah Valley Pediatric Hospitalists	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-8411	(801) 357-8412	Veronica Henicksmann	Utah Valley	Utah South	7/1/2005	
Jonathan	Uncat.	X			74310	1174039614 Utah Valley Pediatric Intensivists	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-8089		Santhi Martin	Utah Valley	Utah South	9/1/2018	
Jonathan	Uncat.	X			74156	1295862951 Utah Valley Pulmonary - Critical Care	1034 N 500 W	Provo	Utah	UT	84604-3380	(801) 357-7291	(801) 357-7919	Morgan Krulish	Utah Valley	Utah South	9/11/2006	
Jonathan	Uncat.	X			74191	1923251550 Central Orem OB/GYN - PIC	1134 North 500 West #102	Provo	Utah	UT	84604-5569	(801) 714-3422	(801) 714-3424	Conrad Jacobson	Utah Valley	Utah South	1/1/2014	
Jonathan	CL				74137	1750415840 Utah Valley Orthopedics - Provo	1157 N 300 W #201	Provo	Utah	UT	84604-6124	(801) 357-1200	(801) 357-1239	Conrad Jacobson	Utah Valley	Utah South	6/1/2004	
Jonathan	SAT				74139	1649304445 Utah Valley Sports Medicine - Provo	1157 N 300 W #201	Provo	Utah	UT	84604-6124	(801) 357-1200	(801) 357-1239	Conrad Jacobson	Utah Valley	Utah South	7/1/2005	
Jonathan	CL				73062	1992831218 Utah Valley Family Medicine	395 W Cougar Blvd, #8	Provo	Utah	UT	84604-4331	(801) 373-3300		Ashlee Whitcott	Utah Valley	Utah South	6/1/1999	
Jonathan	SAT				74351	1660999735 Heart Institute - Utah Valley	395 W Bulldog Blvd	Provo	Utah	UT	84604-3311	(801) 357-7081		Morgan Krulish	Utah Valley	Utah South	9/1/2020	
Jonathan	LWC				74318	1427515170 Live Well Center - Utah Valley	395 W Cougar Blvd	Provo	Utah	UT	84604-3311	(801) 357-4141		Suzanne Walton	North Salt Lake	Utah Central	5/1/2019	
Jonathan	CL					Utah Valley MOB	395 W Cougar Blvd	Provo	Utah	UT	84604-3317				Utah Valley	Utah South	2/12/2018	
Jonathan	Uncat.	X			74158	1104127901 Utah Valley Wound and Hyperbaric	395 W Cougar Blvd #101	Provo	Utah	UT	84604-3317	(801) 357-8156	(801) 357-3400	Kyle Wilson	Utah Valley	Utah South	4/1/2011	All Part of the Utah Valley Specialty Clinic
Jonathan	Uncat.	X			74250	1580555111 Utah Valley Palliative Care Clinic	395 W Cougar Blvd #102	Provo	Utah	UT	84604-3317	(801) 357-8586	(801) 357-7788	Dallas Asta	Utah Valley	Utah South	8/1/2015	All Part of the Utah Valley Specialty Clinic
Jonathan	IC				72024	1396982203 Utah Valley InstaCare	395 W Cougar Blvd #205	Provo	Utah	UT	84604-3317	(801) 357-1770	(801) 357-1779	Kaylenn Johnson	Utah Valley	Utah South	3/1/2009	All Part of the Utah Valley Specialty Clinic
Jonathan	Uncat.	X			74146	1801055934 Utah Valley Neurological	395 W Cougar Blvd #502	Provo	Utah	UT	84604-3317	(801) 357-4070	(801) 357-4090	Conrad Jacobson	Utah Valley	Utah South	7/15/2008	All Part of the Utah Valley Specialty Clinic
Jonathan	Uncat.	X			74154	1265630693 Utah Valley Physical Medicine and Rehab	395 W Cougar Blvd #502	Provo	Utah	UT	84604-3317	(801) 357-8818	(801) 357-8817	Conrad Jacobson	Utah Valley	Utah South	6/18/2007	All Part of the Utah Valley Specialty Clinic
Jonathan	Uncat.	X			74153	1225165988 Utah Valley Heart Lung Vein	395 W Cougar Blvd #503	Provo	Utah	UT	84604-3317	(801) 357-708						

Safety Contact	Clinic Type	Don't Count	PCMH	Depth	Clinic NPI	Clinic Name	Address	City	County	State	Zip	Clinic Phone	Fax	Contact	Region	Market	Clinic Open	Comments
Kevin E	CL				74193	1053664680 Intermountain Pediatric Imaging - Riverton	3741 W 12605 S	Riverton	Salt Lake	UT	84065-7215	(801) 487-0451	(801) 487-2463	Tiffany Parry	Imaging		1/1/2013	
Kevin E	SAT				74112	1982833398 Intermountain Heart Cardiology-Riverton	3741 W 12605 S, #120	Riverton	Salt Lake	UT	84065-7215	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	12/1/2009	
Kevin E	CL		FM		73051	1407116742 Rose Canyon Clinic	5541 W 13400 S	Riverton	Salt Lake	UT	84066-5640	(801) 871-4700	(801) 871-4799	Deanna Zdunich	South Salt Lake	Utah Central	8/15/2012	
Kevin E	IS				74193	1053664680 Intermountain Pediatric Imaging	100366 Capecchi Dr	Salt Lake City	Salt Lake	UT	84113-1103	(801) 487-0451	(801) 487-2463	Tiffany Parry	Imaging		1/1/2013	
Kevin E	SAT				74112	1982833398 Intermountain Heart Cardiology-AVH	9450 S 1300 E	Sandy	Salt Lake	UT	84094-3740	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	8/1/2009	
Kevin E	Uncat.	X			73099	1164558847 Alta View Adult Mental Health Integration	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2100	(801) 501-2107	Dan Bates	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74266	1659865182 Redrock Digestive Health	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2100	(801) 501-2107	Dan Bates	South Salt Lake	Utah Central	7/1/2017	
Kevin E	Uncat.	X			74282	1164558847 Alta View Clinic Allergy	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2100	(801) 501-2107	Dan Bates	South Salt Lake	Utah Central	1/1/2008	
Kevin E	Uncat.	X			74275	1902126204 Alta View Clinic Dermatology	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Erin Thompson	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74283	1164558847 Alta View Clinic Endocrinology	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2100	(801) 501-2107	Justin Turner	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74285	1902126204 Alta View Clinic ENT	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Melanie Ostler	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74284	1902126204 Alta View Clinic Eye Care	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Justin Turner	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74287	1902126204 Alta View Clinic Gastroenterology	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Justin Turner	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X			74286	1902126204 Alta View Clinic General Surgery	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Melanie Ostler	South Salt Lake	Utah Central	1/1/2018	
Kevin E	Uncat.	X	IM		73040	1578697470 Alta View Clinic Internal Medicine	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2140	(801) 572-1497	Dan Bates	South Salt Lake	Utah Central	7/1/1997	
Kevin E	CL		Peds		73098	1699802348 Alta View Clinic Pediatrics	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 571-7061	(801) 571-1689	Dan Bates	South Salt Lake	Utah Central	8/1/1997	
Kevin E	Uncat.	X			74292	1841543477 Alta View Clinic Plastic Surgery	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6250	(801) 501-6260	Melanie Ostler	South Salt Lake	Utah Central	1/1/2013	
Kevin E	Uncat.	X			74281	1902126204 Alta View Clinic Pulmonary	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 501-6210	Erin Thompson	South Salt Lake	Utah Central	1/1/2009	
Kevin E	Uncat.	X	IM		73193	1508145111 Alta View Clinic Senior Center	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2025	(801) 501-4099	Justin Turner	South Salt Lake	Utah Central	11/1/2011	
Kevin E	Uncat.	X	FM		73094	1497284681 Alta View Family Medicine	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6500		Dan Bates	South Salt Lake	Utah Central	9/5/2017	
Kevin E	IC				72014	1578693750 Alta View InstaCare	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 576-0176	(801) 523-2657	Teresa Aiono	South Salt Lake	Utah Central	12/26/1996	
Kevin E	KC				74014	1790816973 Alta View KidsCare	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-9933	(801) 571-1689	Teresa Aiono	South Salt Lake	Utah Central	11/1/1999	
Kevin E	CL				74173	1902126204 Alta View Specialty Clinic	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-6333	(801) 502-5225	Justin Turner	South Salt Lake	Utah Central	6/14/2010	
Kevin E	Uncat.	X			74238	1316357157 Alta View Urology	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2951	(801) 501-2951	Melanie Ostler	South Salt Lake	Utah Central	9/1/2014	
Kevin E	Uncat.	X			74097	1992835268 Alta View Women's Specialists	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5555	(801) 501-2160	(801) 501-2107	Teresa Michels	South Salt Lake	Utah Central	9/15/1997	
Kevin E	Uncat.	X			74076	1457482234 Orthopedic Specialty Group - Alta View	9450 S 1300 E	Sandy	Salt Lake	UT	84094-5559	(801) 501-2113	(801) 501-6161	Melanie Ostler	North Salt Lake	Utah Central	3/29/2006 Part of AV Specialty Clinic	
Kevin E	CL		FM		73042	1992830103 South Sandy Clinic	955 E 11400 S	Sandy	Salt Lake	UT	84094-6946	(801) 571-0030	(801) 553-3160	Travis Lessing	South Salt Lake	Utah Central	6/2/1997	
Kevin E	Uncat.	X			74111	1275897324 Alta View Nurse Midwives	9600 S 1300 E #310	Sandy	Salt Lake	UT	84094-3766	(801) 501-3300	(801) 501-3310	Teresa Michels	South Salt Lake	Utah Central	10/1/2012	
Kevin E	Uncat.	X			73075	1164558847 Alta View Sleep Disorder	9600 S 1300 E #310	Sandy	Salt Lake	UT	84094-3766	(801) 501-3300	(801) 501-3310	Teresa Michels	South Salt Lake	Utah Central	7/8/2008	
Kevin E	Uncat.	X			74103	1164554069 Alta View Hospitalists	9660 S 1300 E	Sandy	Salt Lake	UT	84094-3766	(801) 501-2656	(801) 507-3007	Doug Philpot	North Salt Lake	Utah Central	7/1/2011	
Kevin E	SAT				74120	1699074732 Alta View Maternal Fetal Medicine	9660 S 1300 E	Sandy	Salt Lake	UT	84094-3762	(801) 501-2332	(801) 501-2078	Justin Turner	Central Salt Lake	Utah Central	5/1/2011	
Kevin E	SAT				74124	1659659191 Alta View Sleep Program	9660 S 1300 E	Sandy	Salt Lake	UT	84094-3762	(801) 314-2400	(801) 314-2385	Jan Humes	North Salt Lake	Utah Central	9/1/2011	
Kevin E	Uncat.	X			74256	1912367780 Leone Peak Orthopedics	9844 S 1300 E #275	Sandy	Salt Lake	UT	84094-4692	(801) 571-7061	(801) 571-9277	Melanie Ostler	North Salt Lake	Utah Central	5/1/2016	
Kevin E	CL		FM		73044	1913340359 Taylorsville Clinic	3845 W 4700 S	Taylorsville	Salt Lake	UT	84129-3454	(801) 840-2000	(801) 840-2178	Ashley McDonagh	Central Salt Lake	Utah Central	7/1/2002	
Kevin E	IC				72015	1902394008 Taylorsville InstaCare	3845 W 4700 S	Taylorsville	Salt Lake	UT	84129-3454	(801) 840-3200	(801) 840-2178	Ashley McDonagh	Central Salt Lake	Utah Central	7/1/2002	
Kevin E	KC				72066	1295865517 Taylorsville KidsCare	3845 W 4700 S	Taylorsville	Salt Lake	UT	84129-3454	(801) 840-2101	(801) 840-2049	Ashley McDonagh	Central Salt Lake	Utah Central	7/1/2002	
Kevin E	Uncat.	X			74256	1710384367 Taylorsville Specialty Clinic	3845 W 4700 S	Taylorsville	Salt Lake	UT	84129-3454	(801) 840-8444	(801) 840-2127	Ashley McDonagh	Central Salt Lake	Utah Central	1/1/2015	
Kevin G	SAT				74231	1982035531 Southern Utah Ortho Sports Med - Garfield	200 N 400 E	Panguitch	Garfield	UT	84759-0389	(435) 586-6962		Katie Grundy	Southwest	Utah South	8/29/2016	
Kevin G	SAT				74029	1922132729 Valley View Heart - Garfield	200 N 400 E	Panguitch	Garfield	UT	84759-0389	(435) 868-5570	(435) 868-5575	Shay Grossen	Southwest	Utah South	9/15/2011	
Kevin G	CL		IM, Peds and FM		73071	1922132828 Cedar City Clinic - PNC	1303 N Main Street	Cedar City	Iron	UT	84720-9746	(435) 868-5500	(435) 868-5500	Shay Grossen	Southwest	Utah South	2/16/1999	
Kevin G	SAT				74029	1922132729 Cedar City Heart Clinic	1303 N Main Street	Cedar City	Iron	UT	84720-9746	(435) 868-5500	(435) 868-5504	Shay Grossen	Southwest	Utah South	3/1/2004	
Kevin G	SAT				74308	1326173394 Vascular and Vein - Cedar City	1303 N Main Street	Cedar City	Iron	UT	84721-9746	(435) 251-2500	(435) 251-3501	Shay Grossen	Southwest	Utah South	5/1/1999	
Kevin G	SAT				74005	1469413303 Southern Utah Neuro - Cedar	1303 N Main St	Cedar City	Iron	UT	84720-9746	(435) 251-6800	(435) 251-3701	Kristy Little	Southwest	Utah South	9/11/2009	
Kevin G	SAT				74030	1447420401 Southwest Regional Cancer-Cedar City	1303 N Main St	Cedar City	Iron	UT	84720-9746	(435) 868-5690	(435) 634-9852	Amber Espin	Southwest	Utah South	3/3/2008	
Kevin G	Uncat.	X			74263	1508399915 Cedar City Hospitalists	1303 N Main Street	Cedar City	Iron	UT	84721-9746	(435) 868-5667		Casey Caldwell	Southwest	Utah South	12/1/2016	
Kevin G	Uncat.	X			74006	1679865182 Redrock Digestive Health - Cedar City	1303 N Main Street	Cedar City	Iron	UT	84721-9746	(435) 251-3800		Becky Johnson	Southwest	Utah South	9/1/2001	
Kevin G	CL		FM		73078	1811240435 Valley View Family Medicine	1333 N Main St	Cedar City	Iron	UT	84721-9314	(435) 868-5500	(435) 865-5297	Sharon Mitchell	Southwest	Utah South	1/1/2013	
Kevin G	CL				74197	1245675453 Cedar City Wound Clinic	1333 N Main St, #3	Cedar City	Iron	UT	84721-9314	(435) 868-5656	(435) 868-5695		Southwest	Utah South	4/29/2013	
Kevin G	Uncat.	X			74194	1972611042 Cedar City Radiation Oncology	1333 N Main Street	Cedar City	Iron	UT	84721-9746	(435) 688-4175	(801) 442-3263	Brad Bott	Radiation Oncology		5/1/2006	
Kevin G	CL				74231	1982035531 Southern Utah Ortho Sports Med	166 W 1325 N #150	Cedar City	Iron	UT	84721-7797	(435) 586-6962	(435) 867-1663	Katie Grundy	Southwest	Utah South	1/1/2014	
Kevin G	CL				74028	1730211387 Southern Utah Ortho - Cedar City	166 W 1325 N #150	Cedar City	Iron	UT	84720-9746	(435) 586-6962	(435) 867-1663	Katie Grundy	Southwest	Utah South	8/1/2005	
Kevin G	ICF				72003	1225168610 Cedar City InstaCare	962 S Sage Dr	Cedar City	Iron	UT	84720-1885	(435) 865-3440	(435) 865-3472	Kate Garfield	WorkMed	Utah South	6/26/2006	
Kevin G	Uncat.	X			77002	1376744086 Cedar City WorkMed	962 S Sage Dr	Cedar City	Iron	UT	84720-1885	(435) 865-3460	(435) 865-3465	Kate Garfield	WorkMed	Utah South	1/1/2012 Co-located with InstaCare	
Kevin G	CL		FM		73015	1447380589 Canyon View	15 E 400 N	Parowan	Iron	UT	84761-0000	(435) 477-3317	(435) 477-9805	Keri Abbott	Southwest	Utah South	8/1/1998	
Kevin G	CL				73079	1023456589 White Sage Family Medicine Clinic	130 White Sage Avenue	Delta	Millard	UT	84624-8928	(435) 864-2708	(435) 864-2588	Melanie Spendlove	Rural	Utah South	8/1/2013	
Kevin G	CL		FM		73077	1023159381 Fillmore Clinic	700 S Hwy 99 #3	Fillmore	Millard	UT	84631-5137	(435) 743-5555	(435) 743-5764	Melanie Spendlove	Rural	Utah South	5/1/2001	
Kevin G	CL				73068	1012058988 Fillmore Clinic	525 N Main Street	Fillmore	Millard	UT	84632-1155	(435) 743-5555	(435) 743-5764	Melanie Spendlove	Rural	Utah South	9/1/2001	
Kevin G	SAT				74194	1396872073 Sevier Valley Orthopedics - Gunnison	65 E 1000 W	Gunnison	Sanpete	UT	84634-0119	(435) 893-0800		Rosallyn Dalley	Rural	Utah South	9/7/2016	
Kevin G	CL		FM		73003	1356485411 Manti Family Clinic	159 N Main Street	Manti	Sanpete	UT	84642-1257	(435) 835-3344	(435) 835-3081	Tressa Hansen	Rural	Utah South	9/1/2001	
Kevin G	CL		FM		73004	1225266901 Moroni Clinic	51 E Main St	Moroni	Sanpete	UT	84646-0810	(435) 436-5250	(435) 436-5262	Mike Gladding	Rural	Utah South	8/27/2009	
Kevin G	Uncat.	X			74259	1164871471 Sanpete Hospitalist Program	1100 S Medical Dr	Mount Pleasant	Sanpete	UT	84647-2222			Mike Gladding	Rural	Utah South	6/1/2016	
Kevin G	CL		FM		73002	1750425815 Mt. Pleasant Clinic	1100 S Medical Dr	Mt Pleasant	Sanpete	UT	84647-2222	(435) 462-3471	(435) 462-3524	Mike Gladding	Rural	Utah South	9/1/2001	
Kevin G	SAT				74138	1740515984 Utah Valley Ortho - HV Mt. Pleasant	1100 S Medical Dr	Mount Pleasant	Sanpete	UT	84647-2222	(801) 855-2663	(801) 855-4663	Corral Jacobson	Utah Valley	Utah South	9/1/2011	
Kevin G	SAT				74194	1396872073 Sevier Valley Orthopedics - Beaver	1059 N 100 W	Beaver	Sevier	UT	84713	(435) 893-0800		Rosallyn Dalley	Rural	Utah South	12/1/2018	
Kevin G	CL		FM		73007	1912256611 South Sevier Clinic	539 S Main St	Monroe	Sevier	UT	84754-4623	(435) 527-8865	(435) 527-9217	Kathy Rasmussen	Rural	Utah South	8/1/2012	
Kevin G	Uncat.	X			73008	12655176326 Sevier Valley												

Safety Contact	Clinic Type	Don't Count	PCMH	Depth	Clinic NPI	Clinic Name	Address	City	County	State	Zip	Clinic Phone	Fax	Contact	Region	Market	Clinic Open	Comments
Kevin G	CL				74035	1285815059 Southern Utah Plastic Surgery	652 S Medical Center Dr #300	St George	Washington	UT	84790-2766	(435) 251-3670	(435) 251-3671	Becky Johnson	Southwest	Utah South	8/16/2007	
Kevin G	CL				74003	1306081187 Southwest Neurology Associates	652 S Medical Center Dr #320	St George	Washington	UT	84790-2766	(435) 251-3950	(435) 251-3951	Kristy Little	Southwest	Utah South	2/17/2009	
Kevin G	CL				74030	1104953652 Zion Orthopaedics & Sports Medicine	652 S Medical Center Dr #400	St George	Washington	UT	84790-7017	(435) 251-2650	(435) 251-2668		Southwest	Utah South		
Kevin G	CL				74005	1649413303 Southern Utah Neurosciences Institute	652 S Medical Center Dr #420	St George	Washington	UT	84790-7049	(435) 251-3700	(435) 251-3701	Kristy Little	Southwest	Utah South	4/20/2009	
Kevin G	CL				74183	1225319411 St. George Sleep Disorders Center	652 S Medical Center Dr, #310	St George	Washington	UT	84790-7017	(435) 251-3940	(435) 251-3941	Sharon Ramirez	Southwest	Utah South	11/1/2011	
Kevin G	LWC				74316	1932666781 Live Well Center - St George	652 S Medical Center Drive	St George	Washington	UT	84790-7049	(435) 251-3793		Allen Christensen	North Salt Lake	Utah Central	5/1/2019	
Kevin G	SAT				74194	13986872073 Sevier Valley Orthopedics - Wayne	130 S 300 W	Bicknell	Wayne	UT	84715-0303	(435) 893-0800		Rosalyn Dailey	Rural	Utah South	2/15/2017	
Kevin G	Uncat.	X			74184	Valley View Radiation Oncology								Stephen Miller	Radiation Oncology			
Nick	SAT				74113	1669773461 Heart Rhythm Specialists Casper	1233 E 2nd St	Casper	Natrona	WY	82601-2926	(801) 507-3513	(801) 507-3584	Jenny Chapman	Central Salt Lake	Utah Central	1/1/2011	
Nick	CC				73028	1659630457 Liberty Elementary	1108 South 300 East	Salt Lake City	Salt Lake	UT	84111-4638	(801) 408-3585	(801) 531-1815	Jamie Jones	North Salt Lake	Utah Central	6/1/2012	
Nick	CC				73029	1386903185 Rose Park Elementry Clinic	1075 West 1000 North	Salt Lake City	Salt Lake	UT	84116-2135	(801) 364-2434	(801) 364-2436	Jamie Jones	North Salt Lake	Utah Central	6/1/2012	
Nick	CL				73074	1508904947 Memorial Clinic	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7500	(801) 464-7876	Jeremy Bergeson	North Salt Lake	Utah Central	9/3/1996	
Nick	Uncat.	X			74306	1508904947 Memorial Dermatology	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7852		Jeremy Bergeson	North Salt Lake	Utah Central	1/1/2019	
Nick	Uncat.	X		IM	73108	1508904947 Memorial Internal Medicine	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7852		Jennifer Delobel	North Salt Lake	Utah Central	1/1/2019	
Nick	Uncat.	X		Peds	73107	1508904947 Memorial Pediatrics	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7852		Jennifer Delobel	North Salt Lake	Utah Central	1/1/2019	
Nick	Uncat.	X			73132	1508904947 Memorial Radiology	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7852		Jeremy Bergeson	North Salt Lake	Utah Central	1/1/2019	
Nick	Uncat.	X			74307	1508904947 Memorial Specialty	2000 S 900 E	Salt Lake City	Salt Lake	UT	84105-3208	(801) 464-7852		Jeremy Bergeson	North Salt Lake	Utah Central	1/1/2019	
Nick	Uncat.	X			74078	1508907380 Orthopaedic Specialty Group - LDS Campus	324 10th Ave #100	Salt Lake City	Salt Lake	UT	84103-2870	(801) 408-8700	(801) 408-8732	Michelle Beers	North Salt Lake	Utah Central	12/28/1999	Part of Avenues Specialty Clinic
Nick	SAT				74131	1922570266 Behavioral Health Access Center - LDSH	324 10th Ave #178	Salt Lake City	Salt Lake	UT	84103-2885	(801) 408-8502		Cherish Keddlington	North Salt Lake	Utah Central	1/1/2019	
Nick	CL				74130	1689709859 Avenues Specialty Clinic	324 10th Ave #200	Salt Lake City	Salt Lake	UT	84103-2870	(801) 408-7500	(801) 408-2886	Aaron Fanello	North Salt Lake	Utah Central	7/19/2010	
Nick	Uncat.	X			74198	1063941250 Avenue Urology	324 10th Avenue #100	Salt Lake City	Salt Lake	UT	84103-2870	(801) 408-7500		Veronic Hermansen	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X			74077	1174776348 Avenues Gastroenterology	324 10th Avenue #100	Salt Lake City	Salt Lake	UT	84103-2853	(801) 408-7500	(801) 408-8698	Krista Salaz-Dennis	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X		IM	73045	1982118485 Avenues Internal Medicine	324 10th Avenue #100	Salt Lake City	Salt Lake	UT	84103-2870	(801) 408-7500		Veronic Hermansen	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X			74090	1336302040 Avenues Obstetrics and Gynecology	324 10th Avenue #100	Salt Lake City	Salt Lake	UT	84103-2861	(801) 408-1440	(801) 408-1441	Stephanie Morley	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X			74314	1487124624 LDS Pulmonary Clinic	324 10th Avenue #170	Salt Lake City	Salt Lake	UT	84103-2853	(801) 408-6131		Stephanie Morley	North Salt Lake	Utah Central	3/1/2019	
Nick	Uncat.	X			74090	1568715092 Avenues Psychiatry and Counseling	324 10th Avenue #178	Salt Lake City	Salt Lake	UT	84103-2885	(801) 408-8500	(801) 408-8510	Cherish Keddlington	North Salt Lake	Utah Central	1/1/2013	
Nick	Uncat.	X			74196	1336672727 Avenues General Surgery	324 10th Avenue #200	Salt Lake City	Salt Lake	UT	84103-2853	(801) 408-7500		Krista Salaz-Dennis	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X			74132	1316216921 Avenues Neurology	324 10th Avenue #200	Salt Lake City	Salt Lake	UT	84103-2180	(801) 408-2233	(801) 408-2870	Krista Salaz-Dennis	North Salt Lake	Utah Central	1/1/2018	
Nick	Uncat.	X			74227	1659701670 Avenues Women's Center	370 9th Avenue #205	Salt Lake City	Salt Lake	UT	84103-2184	(801) 408-6100	(801) 355-0958	Stephanie Morley	North Salt Lake	Utah Central	6/1/2014	
Nick	CL			IM and FM	73080	1629107305 Salt Lake Clinic- Family and Internal Medicine	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2600	(385) 282-2601	Jared Cowley	North Salt Lake	Utah Central	12/1/2013	
Nick	LWC				74121	1073808085 Live Well Center - Salt Lake City	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2700	(385) 282-2701	Preston Cook	North Salt Lake	Utah Central	9/1/2011	
Nick	Uncat.	X			74224	1629107305 Salt Lake Clinic - Allergy	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74213	1629107305 Salt Lake Clinic - Anticoagulation Clinic	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2600	(385) 282-2601	Preston Cook	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74211	1629107305 Salt Lake Clinic - Cardiology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2600	(385) 282-2601	Preston Cook	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74218	1629107305 Salt Lake Clinic - Dermatology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2825	(385) 282-2826	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74217	1629107305 Salt Lake Clinic - Endocrinology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2550	(385) 282-2551	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74226	1629107305 Salt Lake Clinic - ENT	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2550	(385) 282-2551	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74232	1629107305 Salt Lake Clinic - Infusion	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Larry Ruiz	North Salt Lake	Utah Central	1/1/2014	
Nick	Uncat.	X			74175	1457481939 Salt Lake Clinic - Laboratory	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	385-282-2375	385-282-2376	Nicole Naffziger	North Salt Lake	Utah Central	4/1/1995	
Nick	Uncat.	X			74212	1629107305 Salt Lake Clinic - MHI	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2600	(385) 282-2601	Preston Cook	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74215	1629107305 Salt Lake Clinic - Neurology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74219	1629107305 Salt Lake Clinic - OB/Gyn	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2800	(385) 282-2801	Stephanie Morley	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74219	1629107305 Salt Lake Clinic - Ophthalmology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2550	(385) 282-2551	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74219	1629107305 Salt Lake Clinic - Orthopedics	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2450	(385) 282-2451	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X		Peds	73081	1629107305 Salt Lake Clinic - Pediatrics	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2325	(385) 282-2326	Jared Cowley	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74223	1629107305 Salt Lake Clinic - Physical Medicine	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2450	(385) 282-2451	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74222	1629107305 Salt Lake Clinic - Podiatry	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2450	(385) 282-2451	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74135	1073642757 Salt Lake Clinic - Radiology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(801) 535-8206	(801) 535-8349	Jessica Gabriel	North Salt Lake	Utah Central	4/1/1995	
Nick	Uncat.	X			74214	1629107305 Salt Lake Clinic - Rheumatology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Larry Ruiz	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74248	169107305 Salt Lake Clinic - Spine Program	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2450	(358) 282-2451	Deborah Jackson	North Salt Lake	Utah Central	3/1/2015	
Nick	Uncat.	X			74216	1629107305 Salt Lake Clinic - Surgical Specialists	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	Uncat.	X			74225	1629107305 Salt Lake Clinic - Urology	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2750	(385) 282-2751	Deborah Jackson	North Salt Lake	Utah Central	12/1/2013	
Nick	IC				72035	1912250549 Salt Lake InstaCare	389 S 900 E	Salt Lake City	Salt Lake	UT	84102-2310	(385) 282-2400	385-282-2400	Jared Cowley	North Salt Lake	Utah Central	12/17/2012	
Nick	Uncat.	X			74112	1982833398 Int Heart-Cardiology-SL Clinic	389 South 900 East	Salt Lake City	Salt Lake	UT	84102-2310	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	8/1/2013	
Nick	SAT				74083	1265727275 LDS Campus Sleep - Avenues	440 D Street, #200	Salt Lake City	Salt Lake	UT	84103-2827	(801) 408-3617	(801) 408-5110	Ian Humes	North Salt Lake	Utah Central	9/1/2011	
Nick	CC				73030	1194084996 North Temple Urgent Care Clinic	54 North 800 West	Salt Lake City	Salt Lake	UT	84116-3526	(801) 408-8654	(801) 359-0928	Jamie Jones	North Salt Lake	Utah Central	6/1/2012	
Nick	OS					L3 Technologies	640 2200 W	Salt Lake City	Salt Lake	UT	84116				On-site Clinic			Provider on site
Nick	Uncat.	X			74083	1972631042 LDS Hospital Radiation Oncology	8th Ave & C St	Salt Lake City	Salt Lake	UT	84143-0002	(801) 408-1146	(801) 442-3263	Aaron Brammer	Radiation Oncology			4/1/2006
Nick	CL				74122	126572725 Intermountain Sleep Program	8th Ave and C St	Salt Lake City	Salt Lake	UT	84143-0001	(801) 408-3604	(801) 408-5110	Ian Humes	North Salt Lake	Utah Central	9/1/2011	
Nick	Uncat.	X			74313	1373016618 LDS Critical Care	8th Ave and C St	Salt Lake City	Salt Lake	UT	84143-0001	(801) 408-6131		Stephanie Morley	North Salt Lake	Utah Central	3/1/2019	
Nick	SAT				74083	1053610196 LDS Maternal Fetal Medicine	8th Ave and C St	Salt Lake City	Salt Lake	UT	84143-0001	(801) 408-3446	(801) 4088758	Emily Evans	Central Salt Lake	Utah Central	5/1/2011	
Nick	CL				74131	1679867477 Blood and Marrow Transplant/Leukemia Program	8th Ave C St	Salt Lake City	Salt Lake	UT	84143-0001	(801) 408-3729	(801) 408-8453	Linda Meaux	North Salt Lake	Utah Central	3/7/2011	
Nick	SAT				74112	1982833398 Intermountain Heart Cardiology-LDSH	8th Ave C St, 7th Floor	Salt Lake City	Salt Lake	UT	84143-0001	(801) 507-3500	(801) 507-3505	Brenda Johnson	Central Salt Lake	Utah Central	8/1/2009	
Nick	Uncat.	X			74328	158715092 Avenues Inpatient Psychiatry	8th Avenue & C Street	Salt Lake City	Salt Lake	UT	84143-0001	(801) 408-8500		Cherish Keddlington	North Salt Lake	Utah Central	12/1/2019	
Nick	Uncat.	X			74083	1164554069 LDS Hospital Hospitalists	8th Avenue & C Street	Salt Lake City	Salt Lake	UT	84143-0001	(801) 507-4384	(801) 507-4398	Doug Philpot	North Salt Lake	Utah Central	9/1/1997	
Nick	Uncat.	X			74126	1275815565 Snowbird Clinic	Highway 210, Little Cottonwood Ca	Snowbird	Salt Lake	UT	84092-0000	(877) 359-3948	(877) 359-3949	Heather Hing	South Salt Lake	Utah Central	10/15/2011	
Nick	Uncat.	X			73091	1306394929 Park City Mountain Medical Clinic - Urgent Care Ski Clinic	1493 Lowell Ave	Park City	Summit	UT	84060-5116	(435) 645-6020	(435) 645-6057	Brandon Mayhew				

Hot Work Permit



Facility Name:

Requestor Name:

Company/Dept:

Contact Phone:

Permit No.:

Project No.:

Start Date:

End Date:

Work / PO No.:

Start Time:

End Time:

Exact Location of Work:

Description of Work:

Heat Sources

☐ Gas Torch ☐ Grinder ☐ Arc Welder ☐ Drill ☐ Chemical
☐ Other -

Will work require disabling fire detection or suppression systems? ☐ Yes ☐ No

Will systems be disabled longer than 4 hours in any 24 hours? ☐ Yes ☐ No

Will work generate smoke, odors or fumes? ☐ Yes ☐ No

Establishing The Work Area

☐ 35' space clear of combustibles	☐ Appropriate fire extinguishers on hand
☐ Fire blankets or protective mats in place	☐ Confined space permit on hand or not needed
☐ Space is well-ventilated	☐ Atmosphere tested non-explosive
☐ Signage and barricades in place	☐ Welding shields are in place as needed
☐ Safety observer on hand	☐ Fire watch arranged for
☐ Other precautions:	

Intermountain Point of Contact: POC Phone:

Emergency Phone Number:

Upon Conclusion of Work

Name of Fire Watch Personnel: Supervisor:

☐ Fire watch was kept for 60 minutes after hot work was complete
☐ No sign of smoke or fire was detected during fire watch

Notes or Observations (if any):

Intermountain Review and Approval of Work

Intermountain Point of Contact: Date:

Why do we have to do this?

Because more people die of smoke inhalation in fires than die of fires in fires.
Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

Above Ceiling Work Permit

****Standards Referenced: NFPA 101 2012; NFPA 30 2012; NFPA 45 2011; NFPA 99 2012**

Facility Name:
Requestor Name:
Company/Dept:
Contact Phone:

Permit No.:
Project No.:
Work/PO No.:

Start Date: Start Time:
End Date: End Time:

Exact Location of Work:

Description of Work:

Will ANY penetrations be made in walls, roof, floor or ceilings?

☐ Yes ☐ No

Will wiring or data cabling be installed or modified?

☐ Yes ☐ No

Type of Wiring

☐ Communication
☐ Door Control
☐ Low or High Voltage Electrical
☐ Fiber Optic
☐ Fire Alarm

☐ HVAC
☐ Security
☐ Telephone
☐ Television
☐ Other -

Will fixtures, appliances, duct work or equipment be installed?

☐ Yes ☐ No

How will the work be supported?

☐ Fastened to deck or structure
☐ Fastened to wall
☐ Existing cable tray
☐ Existing pipe rack or conduit rack

☐ New cable tray
☐ New pipe rack or conduit rack
☐ Other -

Intermountain Point of Contact:
Print Name Clearly

POC Phone:

Site Pre-Inspection

Intermountain Representative:
Print Name Clearly

Requestor:
Print Name Clearly

Notes or Observations (if any):

Site Post-Inspection

Intermountain Representative:
Print Name Clearly

Requestor:
Print Name Clearly

☐ No unsealed penetrations observed ☐ All installations properly supported

Notes or Observations (if any):

Intermountain Review and Approval of Work

Intermountain Representative:
Signature

Date:

Why do we have to do this?

Because more people die of smoke inhalation in fires than die of fires in fires.
Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

Project Detailed Shutdown Plan				Timeline	GC Logo	
Date	Time	Responsible	Duration	Tasks	Items Needed	Notes
6/24/2013	6:00 AM	GC		Saw cut for all trenches needs to be done at this time (green line)		GC to block off area
6/24/2013	6:00 AM	Sub	1 day	(yellow) block off parking and trench, drill pole bases		GC to block off area
6/25/2013	6:00 AM	Sub	1 day	(light blue) block off parking and trench, drill pole bases		GC to block off area
6/26/2013	6:00 AM	Sub	1 day	(gray/ light purple) block off parking and trench, drill pole bases		GC to block off area
6/27/2013	5:00 AM	Sub	3.5 hrs	(blue circle) block off parking and trench, drill pole bases		GC to block off area
6/27/2013	8:00 AM	Sub	1 day	(dark purple) block off parking and trench drill pole bases		GC to block off area
6/28/2013	6:00 AM	Sub	1 day	(gree) block off parking and trench, drill pole bases		GC to block off area
6/29/2013	6:00 AM	Sub	4 hrs	(black circles) if necessary pour remaining bases (if ready pour 6-28-13)		GC to block off area

Project Shutdown Contact Sheet (Facility, GC, Subs, etc.)

Company	Contact	Number	Title

UTILITIES SHUTDOWN REQUEST (Utilities & Emergency Egress, Etc.)

Project Name:	Project Name Address Address	Contractor:	Contractor Contact Name Phone Number
Owner:	IHC Health Services, Inc.	Contractor(s)/ Subcontractor(s) Performing Work:	Contractor Contact Name Phone Number
FD&C PM:	PM Name		
Start of Impairment:	Date Time	End of Impairment:	Date Time

IMPAIRMENT REQUIREMENTS

The Utilities Shutdown Request **MUST** be approved by Facility Management 3 working days (min.) before work begins.

Facility Management **MUST** be notified when work is ready to begin and when work is complete.

Facility Management and Contractor(s) will reactivate system(s) at approved times and **MUST** be notified if impairments need to be extended.

SECTION 1 – IMPAIRED INFORMATION TO BE COMPLETED BY CONTRACTOR

AREA(S) AFFECTED (Building, Floor, Area/Department, Users, Devices, etc.)

Text

TYPE OF SHUTDOWN (CHECK ALL THAT APPLY)

☐ Electrical	☐ Emergency Power* ☐ Main Switch Gear* ☐ Individual Panel	☐ Single Breaker ☐ Fire Alarm System* ☐ _____
☐ Plumbing	☐ Sewer Stock ☐ Vent ☐ Hot Water Domestic	☐ Cold Water Domestic ☐ Steam Line ☐ _____
☐ Sprinkler	☐ Riser* ☐ Individual Heat ☐ Horizontal Mains/Areas	☐ Valves* ☐ _____
☐ Medical Gas	☐ Compressed Air ☐ Oxygen ☐ Nitrous Oxide	☐ Vacuum ☐ Special Mix Gas ☐ Zone Valve Boxes

☐ **Mechanical**
☐ Chilled Water
☐ Steam
☐ Glycol

☐ Hot Water
☐ Compressor
☐ Condenser

☐ VAV's
☐ Electrical Disconnects
☐ _____

* Requires Fire Alarm & Security Coordination

FACILITY PERMITS
☐ **** Above Ceiling**
☐ **** Hot Work**
☐ **** Infection Control Risk Control (ICRA)**
☐ **** Other** _____

** Completed forms must be attached

PERCENT OF IMPAIRMENT (For partial impairment, attach a list showing the area, smoke head, fire suppression system etc. that will be impaired)

Text

REASON FOR IMPAIRMENT

Text

COMMENTS

Text

ATTACHMENTS

1. *3_Pre-Construction GC Detailed Shutdown Plan_Template.xlsx*
2. *Facility Site Area Floor Plan*

SECTION 2 – TO BE COMPLETED BY FACILITY MANAGEMENT

1. Will fire alarm be taken off line for any amount of time? Yes _____ No _____
If Yes, Facility Management must review and sign. _____
2. Will this impairment extend more than 4 hours? Yes _____ No _____
If Yes, a fire watch must be implemented, Intermountain Healthcare Safety Officer and Insurance Provider must be notified.
3. Department Managers of impaired areas notified:
Facility Management: _____ Date: _____
FD&C Project Manager: _____ Date: _____

Emergency After Hours Contact List

PROJECT ID | NAME:

DATE:

TIME:

LOCATION:

NAME	COMPANY DEPARTMENT	PHONE NO.	EMAIL
1.	Dispatch	801-507-3333	
2.	Security Supervisor		
3.	Facilities Manager		
4.	Intermountain Safety and Security		
5.	Facility Supervisor		
6.	Intermountain Infection Preventionist		
7.	Intermountain Project Manager		
8.	Intermountain EVS Manager		
9.	Contractor Project Manager		
10.	Contractor Superintendent		
11.	Contractor Superintendent		
12.			
13.			

NAME	COMPANY	DEPARTMENT	PHONE NO.	EMAIL
14.				
15.				
16.				
17.				
18.				
19.				
20.				
21.				
22.				
23.				
24.				
25.				
26.				
27.				
28.				
29.				
30.				

SECTION 01 0000 – GENERAL 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.
- B. Section 00 7200 “General Conditions” and Document 00 7200 “Intermountain General Conditions”.

1.2 SUMMARY

- A. This Section includes general requirements that are to apply to all Work throughout the Project. Requirements included in this Section are to apply to all other specification Sections.
- B. Bidding contractors are to attend a Pre-Bid Meeting with the Architect and Owner’s Representative to review project requirements and clarify questions about scope prior to bid.

1.3 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. “Center of...”: Indicates a specific single point at the exact center of the tile, panel, or other surface indicated.
- D. “Conforms”: When used to convey Architect's action on Contractor's submittals, applications, and requests, “conforms” is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- E. “Contractor”: The General Contractor unless otherwise stated.
- F. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- G. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

- H. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- I. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- J. "Project Manager": The Contractor's project manager.
- K. "Project Representative": The Owner's project representative(s).
- L. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- M. "Provide": Furnish and install, complete and ready for the intended use.
- N. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- O. "Related Sections": Related Sections articles are included herein as a courtesy to assist in the locating of items in the specifications that the reader might expect to find in the Section but that are specified elsewhere. The list of sections may or may not be complete. 'Related Sections' articles do not relieve the Contractor of the contractual obligation to perform to all the Contract Documents or to coordinate who does what amongst the team of subcontractors.
- P. Submitted: The terms "submitted", "reported", "satisfactory" and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.5 SITE INSPECTION

- A. Examine the premises and site and compare them with the drawings and specifications.
- B. Become familiar with existing conditions such as obstructive areas, excavating or filling, and any problems related to construction. No allowances will subsequently be made by reason of failure to examine the site.

1.6 SCOPE OF THE WORK

- A. See Section 01 1000 "Summary" for an overall general summary of the Work.
- B. Unless otherwise provided, all materials, labor, equipment, tools, transportation, and utilities necessary for the successful completion of the Project shall be provided at the expense of the Contractor.
- C. Requirements of the Work are contained in the Contract Documents, and include cross-references herein to published information, which is not necessarily bound therewith.
- D. Provide, as part of the Bid and without additional charge, all incidental items required for completion of the Work, even if not specifically indicated.
 - 1. Install all Work so that its several component parts function together as a complete and workable system, and with all equipment properly adjusted and in working order.
- E. Conform to highest quality standards for materials and workmanship to execute Work that is indicated or specified and that is necessary to fully satisfy the Contract Document requirements for a complete, finished, acceptable installation regardless of whether indicated or specified or not.
- F. Responsibilities of the Contractor includes the responsibility to verify all field measurements of actual building conditions so that all Work fits properly in the locations indicated and specified. Protect existing structures, improvements, trees, and other items from physical damage, unless identified to be removed.
- G. Any existing surfaces, furniture or equipment that are damaged by the Contractor are to be restored to their original condition, or better, to the satisfaction of the Owner.
- H. Restore roads, utilities, walks, curbs, gutters or other improvements belonging to the Owner, to the same condition as they existed prior to commencement of construction. Where said improvements are damaged, they shall be replaced by new Work to match existing adjacent Work, or repaired if acceptable to Project Representative, at no cost to Owner.

1.7 WORKERS

- A. Enforce strict discipline and good order among his/her employees at all times and shall not employ on the Project any unfit person or anyone not skilled in the Work assigned to him/her.

- B. Consumption of alcohol or any other controlled, non-medically prescribed substance will not be allowed on the Project.
- C. Rectify behavior unacceptable to the Owner or Owner's Project Representative by strict enforcement of discipline. Owner reserves the right to request dismissal of individual workers for failure to comply with standards of behavior communicated to the Contractor.

1.8 TAXES

- A. The Contractor shall pay sales, use, payroll, unemployment, old age pension, or surtax applicable to this project.
- B. The Owner shall pay taxes and assessments on real property comprising the site of this project.

1.9 MANUFACTURER'S DIRECTIONS

- A. Manufactured articles, materials, or equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned in accordance with the Manufacturer's printed directions unless otherwise indicated in the Contract Documents.

1.10 FASTENERS

- A. Unless noted otherwise, the trade requiring the fastening of its Work to any substrate or support is responsible for provision and installation of requisite fasteners.

1.11 PENETRATIONS

- A. The sealing of all penetrations in fire-rated, acoustically-rated or structural partitions and separations is the responsibility of the trade making or requiring the penetration.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 0000

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. Work under separate contracts.
 - 4. Purchase contracts.
 - 5. Owner-furnished, Owner-installed (OFOI) products.
 - 6. Owner-furnished, Contractor-installed (OFICI) products.
 - 7. Contractor-furnished, Contractor-installed (CFCI) products.
 - 8. Worker conduct and appearance – work rules.
 - 9. Access to site.
 - 10. Coordination with occupants.
 - 11. Work restrictions.
 - 12. Specification and drawing conventions.
 - 13. Responsibility Matrix.
- B. Related Requirements:
 - 1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
 - 2. Section 01 7300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

- A. Project Identification:
 - 1. Intermountain Healthcare; Bear River Valley Hospital – MRI Replacement
 - a. Project Location: 905 N 1000 W, Tremonton, UT 84337.
- B. Owner: Intermountain Healthcare.
 - 1. Owner's Representative: Milt White.

- C. Architect: FFKR Architects, 730 Pacific Avenue, Salt Lake City, Utah 84104, (801) 521-6186.
 - 1. Architect's Representative: Nicole Lyman.
 - 2. FFKR Project Number: 25018
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
 - 1. Refer to the cover sheet for consultant information
 - a. Structural Engineers: Structural Design Studio.
 - b. Mechanical Engineers: Resolut Group.
 - c. Electrical Engineers: Spectrum Engineers.
- E. Project Web Site: A project Web site administered by Owner will be used for purposes of managing communication and documents during the construction stage.
 - 1. See Division 01 Section "Project Management and Coordination" for requirements for establishing, administering, and using the Project Web site.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
 - 1. Replacement of current MRI Equipment with New Equipment, and other Work indicated in the Contract Documents.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.6 PURCHASE CONTRACTS

- A. Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum unless otherwise indicated.
 - 1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

B. Purchase Contracts Information:

1. Resilient Flooring: See Section 09 6516 "Resilient Sheet Flooring."
 - a. Purchase Contract Firm and Representative: Tarkett.
 - b. Purchase Contract Scope: Resilient Flooring.
 - c. Purchase Status: Price negotiated by Owner, to be incorporated in the Contract Sum by Contractor.

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

- A. The Owner will furnish and install products indicated. The specific product is not in this contract, and actual installation of the product will be by the Owner.
- B. Products will be indicated as follows:
 1. Product prefixed with "Space for"
 2. N.I.C
 3. Owner Furnished – Owner Installed
 4. Product noted as "Future"
 5. Refer to "Responsibility Matrix" at the end of this spec section.
- C. Roughing-in for Owner Furnished, Owner Installed Products is provided by applicable Sections governing the type of work. Obtain rough-in requirements from Owner.

1.8 OWNER-FURNISHED, CONTRACTOR-INSTALLED (OFCI) PRODUCTS

- A. Owner-Furnished, Contractor-Installed (OFCI) Products: Items include, but are not limited to, the following:
 1. "Owner Furnished, Contractor Installed"
 2. "Reuse"
 3. "Relocate"
 4. Refer to "Responsibility Matrix" at the end of this spec section.
- B. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:
 1. Provide to Contractor Owner-reviewed Product Data, Shop Drawings, and Samples.
 2. Upon delivery, inspect, with Contractor present, delivered items.
 - a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.
 3. Obtain manufacturer's inspections, service, and warranties.
 4. Inform Contractor of earliest available date for delivering Owner-furnished products.

- C. Contractor's Responsibilities: Provide labor, transportation, materials, tools, appliances and utilities necessary for the following:
1. Relocated Products:
 - a. Removing installed product from the Owner's existing facility, as required.
 - b. Transportation of product from Owner's facility to the job site.
 2. Receiving and storage of Owner furnished, Contractor installed product, as required.
 3. Providing materials and components for the product as necessary to install in an operating condition, but not including repairing of existing damages to the product.
 4. Modification of product only as specified under the particular item.
 5. Installation of product in this project, complete and in operating condition, including the adjusting and calibration of the product as necessary for proper operation.
 6. Testing of product.
 7. Paying of fees, licenses, and taxes in conjunction with the installation of the product.
 8. Roughing-in and final utility connections for the Owner furnished, Contractor installed product remains the work of Sections governing the specific utility.
 9. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
 10. Repair or replace Owner-furnished products damaged following receipt.

1.9 CONTRACTOR-FURNISHED/CONTRACTOR-INSTALLED (CFCI) PRODUCTS

- A. Contractor-Furnished/Contractor-Installed (CFCI) Products: Items include, but are not limited to, the following:
1. Refer to "Responsibility Matrix" at the end of this spec section.

1.10 WORKER CONDUCT AND APPEARANCE – WORK RULES

- A. General: The conduct and appearance of each worker at the jobsite is of paramount importance. Owner reserves the right to require any worker to be reassigned to work outside the Owner's property.
1. Privacy: Where applicable, conduct work of the Contract with the maximum effort to maintain the privacy of the Owner's operations, staff, and clientele. Do not permit workers to peer into other areas of the building visible from the work area. Invasion of privacy is a major infraction of the work rules.
 2. Conduct and Demeanor: Construction workers shall treat other construction workers, Owner's staff, clientele, and visitors (as applicable) professionally with respect and courtesy.
 3. Physical Appearance: Require each worker to dress appropriately in a clean, neat, and professional manner.
 4. Radios and Television: The use of entertainment devices, including personal devices with headphones or earphones, is prohibited at all times. Control the volume of communication radios and loudspeakers to avoid creating a nuisance.
 5. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is prohibited.

6. Language: The use of foul language is prohibited.
 7. Loud Conduct: Screaming, yelling, and unnecessary loud conduct is prohibited.
 8. Physical Actions: Running, horseplay, fighting, and other unprofessional conduct is prohibited. Fighting is a major infraction of the work rules.
 9. Stealing: Stealing of any material, objects, furnishings, equipment, fixtures, supplies, clothing, or other items is prohibited and a major infraction.
 10. Sexual Harassment: All forms of physical and verbal sexual harassment including, without limitation: touching; whistling; sexually explicit stories, jokes, drawings, photos, and representations; exhibitionism; and all other sexually oriented offensive behavior is prohibited.
 11. Roaming: Construction personnel shall not be allowed to roam, or wander about, the existing facilities.
 12. Eating: Construction personnel are granted use of the existing Dining Area for breakfast, lunch, or dinner.
 13. Parking: Construction personnel shall only park in designated areas reserved for construction parking.
- B. Penalties: First infraction of the work rules shall result in a verbal warning from the Owner. Second infractions shall result in being requested to leave the Owner's property. Owner's decision in such matters shall be final with no exceptions.
1. Warnings and Dismissal: For minor infraction of the rules, the Owner may issue a warning. Only one warning will be allowed per worker, and a second infraction shall result in immediate dismissal of the worker from the Owner's property. For major infractions such as invasion of privacy, the worker shall be dismissed immediately without warning and possibly subject to criminal prosecution.
 2. Notification of Workers: Clearly notify and educate each worker about these Work Rules and the requirements for worker conduct and appearance.
- C. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- D. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
1. Maintain list of approved screened personnel with Owner's representative.
- 1.11 HEALTHCARE FACILITY RENOVATION WORK
- A. Interim Life Safety Measures (ILSM): The following Interim Life Safety Measures (ILSM) as established by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) shall be implemented, documented and enforced in and adjacent to all construction areas:
1. Ensure that exits provide free and unobstructed egress. Personnel shall receive training, and the Hospital shall be notified if alternative exits must be designated. Buildings/areas under construction must maintain escape facilities for construction workers at all times. Means of egress in construction areas must be inspected daily.
 2. Ensure free and unobstructed access to emergency department/service and for emergency forces.

3. Ensure that fire alarm, detection, and suppression systems are not impaired. A temporary, but equivalent, system shall be provided, and the Hospital shall be notified, when any fire system is impaired. Temporary systems must be inspected and tested monthly.
4. Ensure temporary construction partitions are smoke tight and built of non-combustible or limited combustible materials that will not contribute to the development or spread of fire.
5. Provide additional fire-fighting equipment and use training for personnel.
6. Prohibit smoking in or adjacent to all construction areas.
7. Develop and enforce storage, housekeeping, and debris-removal practices that reduce the flammable and combustible fire load of the building to lowest level necessary for daily operations.
8. Conduct a minimum of two fire drills per shift per quarter.
9. Increase hazard surveillance of buildings, grounds, and equipment with special attention to excavations, construction areas, construction storage, and field offices.
10. Train personnel, and notify the Hospital, when structural or compartmentation features of fire safety are compromised.
11. Conduct organization wide safety education programs to assure awareness of deficiencies, construction hazards, and these ILSM.

1.12 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: 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.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Confine constructions operations to work in areas indicated on drawings.
 2. Allow for Owner occupancy of site and use by the public.
 3. Keep driveways and entrances serving the premises clear and available to Owner, Owner's employees, and emergency vehicles at all times.
 4. Do not use drives and entrances for parking or storage of materials.
 5. Schedule deliveries to minimize use of driveways and entrances.
 6. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
 7. Coordinate use of premises under direction of Owner.
 8. Assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.
 9. Move any stored Products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
 10. Obtain and pay for the use of additional storage or work areas needed for operations.

- D. 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.

1.13 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.
- B. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
 - 3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.14 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of Monday through Friday, unless otherwise indicated, or agreed by the Owner
 - 1. Weekend Hours: To be worked out with the Owner
 - 2. Early Morning Hours: To be worked out with the Owner
 - 3. Hours for Utility Shutdowns: To be worked out with the Owner

4. Hours for noisy activities: To be worked out with the Owner
- C. On-Site Work Hours: Coordinate the limitations relative to working hours in the existing building with Owner.
- D. Existing Utility Interruptions: Refer to Division 01 Section "Execution" for requirements.
- E. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 1. Notify Owner not less than 72 hours in advance of proposed disruptive operations.
 2. Obtain Owner's written permission before proceeding with disruptive operations.

1.15 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
 3. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

RESPONSIBILITY MATRIX

Updated February 13, 2023

The following list identifies the majority of the items that are to be included in the capital project build-out. All Owner items need to be coordinated with A/E (Design Team), Contractor, and Owner (Facility Design & Construction and Supply Chain Facility Equipment Planners). For OFOI or OFCI items, Contractor is required to track equipment on construction schedule and to notify Owner of required delivery times taking into account for equipment lead times.

ITEM	OWNER/VENDOR	NOTES	ADDITIONAL NOTES		
OFOI - (Owner Furnished / Owner Installed)	(Coordinate location of items with Owner and track within construction schedule)		Data	Power	Backing
Art	Owner / Owner (Alpine Art)	All artwork to be coordinated with Dan Kohler. Provide power and backing to required artwork.			
Audio/Video (A/V)	Owner / Owner	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). Refer to CFCI section for Contractor requirements. A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and cabling (from wall side back).	Yes	Yes	
Brochure Racks	Owner / Owner	Contractor to provide proper backing.			Yes
Cash (Manual) Drawer	Owner / Owner	Identify locations and coordinate with point-of-sale equipment vendor.			Yes
Chart Racks	Owner / Owner (Midwest)	Contractor to provide proper backing.			Yes
Clinical Garbage Cans (Clinical, Office, PT, Etc.)	Owner / Owner				
Computers, Printers, Scanners, Keyboards, Mice, etc.	Owner / Owner	In-ceiling & wall mounts, conduits and boxes mounted by Contractor. Computers to be All-in-One, typ. in IMG exam rooms.	Yes	Yes	Yes
Copiers, fax	Owner / Owner	A/E to locate where copy/fax/printer is not visual clutter.	Yes	Yes	
Cup Dispensers	Owner / Owner				
Emergency Evacuation Medical Sled (Med Sled)	Owner / Owner	A/E to coordinate location with Owner.			
Exam Tables	Owner / Owner			Yes	
Infant/Pediatric Security System	Owner / Owner (Totguard)	A/E to identify locations on drawings. This system is to be coordianted with Owner, Women's and Children's Operations, Clinical Programs and Security.	Yes	Yes	
IV Hangar	Owner / Owner	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Keyboard Trays	Owner / Owner				
Magnetic Marker Boards, Cork Boards, Huddle Boards, Idea Tracking Boards, etc.	Owner / Owner (Midwest)	A/E to coordinate location with Owner.			Yes
Moveable Metal Shelving	Owner / Owner				
Nurse Notification Call (NNC) System & Devices (Hospital Campus)*	Owner / Owner (Hillrom)	Hospital local facility team to work with Supply Chain Facility Equipment Planning team to contract directly with Nurse Notification Call (NNC) system vendor (Hillrom) for devices, equipment, monitors, etc. A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinted and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, room devices, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
PACS	Owner / Owner				
Patient Monitoring System & Devices (Hospital Campus)	Owner / Owner	Hospital local facilities to work with Supply Chain Facility Equipment Planning team to contract directly with Patient Monitoring vendors for devices, equipment, monitors, etc. (from wall side out). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/TDR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	
Radiology Equipment	Owner / Owner (See subject matter expert list)	A/E responsible to coordinate final site equipment drawings into Construction Documents from Owner's Vendor.	Yes	Yes	
Receptionist Desk	Owner / Owner (Midwest & Steelcase)				
Recliners / Draw Chairs	Owner / Owner				
Sharps Disposal Container	Owner / Owner (Stericycle)	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Signage - Exterior	Owner / Owner (KB Signs, Trademark, YESCO)	Provide power and data to required exterior signage. Provide circuits for above ceiling signs. Coordinate thru-wall conduit sleeves with weather barrier. A/E to coordinate traffic signage and Contractor to install. Intermountain Logo Signs - (2) 20A Circuits - May vary. InstaCare and other Signs - (1) 20 A Circuits - May vary.	Yes	Yes	Yes
Signage - Interior (including Code Signage)	Owner / Owner (Intermountain Sign Shop, Scribbley, Hightech)	Provide power to required signage. Contractor to track in schedule and notify Owner for when Code Required signage is required to be installed.			

Staff Assist Notification Call System & Devices (Medical Group Clinics on hospital campuses to match NNC system)*	Owner / Owner (Hillrom)	Hospital local facility/IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification system to be coordinated with Hospital Campus NNC system, as applicable, Medical Group Strategic Planner, and IMG Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
Staff Assist Notification Call System & Devices (Stand-alone Medical Group Clinics)*	Owner / Owner (Hillrom)	IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification Call system to be coordinated with Medical Group Strategic Planner and Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
Supply Area Panels	Owner / Owner	Contractor to provide proper backing, coordinate with Owner.			Yes
Systems Furniture (including demountable partitions)	Owner / Owner (Midwest & Steelcase)	Coordinate modesty panels with elec. outlets. Sit/Stand desks to have modesty panel on front. Attention to be given to cord management. A/E to coordinate data and power with Midwest.	Yes	Yes	
Televisions, Digital Projectors, similar devices, etc.	Owner / Owner	These items to be provided by Owner, but A/E to coordinate locations and infrastructure. Contractor to refer to OFCI section.	Yes	Yes	Yes
OFCI - (Owner Furnished / Contractor Installed)					
(Coordinate location of items with Owner and track within construction schedule)			Data	Power	Backlog
Alertus - Mass Notification System (Public Areas)	Owner (Alertus) / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	
Apron Hooks/Rack (Heavy Duty in Radiology)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Automated External Defibrillator (AED)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner, A/E to coordinate recess, semi-recessed, or surface mount options with Owner.			Yes
Bio Safety Cabinet	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.		Yes	
Boom and Injector Ceiling Mounting Plates (Equipment, Lighting, Anesthesia, Injection, etc.)	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify boom locations on drawings, coordinate with Owner; A/E to coordinate the design of the boom support structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner and install boom support structure and boom mounting plates. Contractor to coordinate with Owner for ordering and install of boom mounting plates.	Yes	Yes	Yes
Building Alarms / Medication Refrigerator Alarm / Pharmacy Alarm System	Owner / Contractor	A/E to identify locations and infrastructure on drawings, coordinate with Owner. Contractor to provide conduit and infrastructure into accessible ceiling for access from equipment and/or devices. Local Facility to contract with alarm company for alarm, wire, and monitoring.		Yes	
Chain Hoist Industrial Lift	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Clinical Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.		Yes	Yes
Clinical Storage Cabinet (Flammable Items)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Cubicle Curtains & Tracks	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.			
Diagnostic Board including Wall Mount Replacable Tips (Otoscope / Ophthalmoscope)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Diaper Changing Station	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Digital Projector Mounts, TV Mounts, & Computer Mounts (Ergotron Brackets/Mounts, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination. In-ceiling & wall mounts, conduits and boxes provide and installed by Contractor A/E to coordinate A/V requirements. Contractor to pull required A/V cabling.	Yes	Yes	Yes
Distributed Antenna System (DAS) including Public Safety	Owner (DAS vendor selected and managed by Intermountain CTIS/Telecom) / Contractor	A/E to locate infrastructure on drawings to simplify the DAS install. Contractor to track on construction schedule and coordinate DAS install with Owner's Vendor.			
Exercise Rack Wall Rack	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Face Mask Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Grossing Workstation	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.	Yes	Yes	Yes
Hand Sanitizer Dispensers (Avagard)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			

Hoods (Chemical Soak Station, Ranges, Horizontal Laminar Flow, and similar Hoods)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	Yes
Ice Machine Dispenser (Undercounter, Countertop, etc.)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	
iCentra Tracking Boards	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	Yes
IV Track	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			Yes
Kitchen Range (Electric)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	
Laundry Dryer, Washer (single, stacked, disinfectant)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	
Medication Return Bin	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. This is a pass-thru unit for medication return accessed from public corridor into a secured locked room.			Yes
OR Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.	Yes	Yes	Yes
Paper Towel Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Pass-thru Cleanroom Chamber	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner. Perimeter of each pass-thru unit must be sealed to maintain space pressurization.		Yes	Yes
Patient Lifts	Owner (Liko, subsidiary of Hillrom) / Contractor	A/E to identify locations on drawings, coordinate with Owner. A/E to design required support structure for Contractor to install for necessary Liko patient lift connections (e.g. pendant / rails / etc). Contractor to coordinate shop drawings and installation requirements prior with Liko. Connect to equipment branch if provided.		Yes	
Personal Protection Dispensers (gloves, gowns, masks, shoe covers, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Pharmaceutical Pass-thru Refrigerator	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner. Perimeter of each pass-thru unit must be sealed to maintain space pressurization.		Yes	
Pharmacy Dispensing Water Treatment System	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	Yes
Procedure Lights	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify locations on drawings, coordinate with Owner; A/E to coordinate the design of the procedure light support structure into drawings. Contractor to provide and install procedure light support structure.		Yes	Yes
Radiation Protection Calculations and Certification	Owner / Contractor	A/E to coordinate with Owner in the design phase for coordinating with Medical Physicists Consultants or others, when required. Contractor to coordinate prior to Gyp. Bd. install.			Yes
Sanitary Napkin Dispensers/Receptacles	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Scrub Brush Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Scrub Sinks & Carriers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and for install coordination.			Yes
Shower Curtains & Rods	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.			
Soap Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Stadiometers, Recessed Scales	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner; coordinate power and floor recesses.		Yes	
Time Clocks	Owner / Contractor	Conduit and boxes by Contractor, Coordinate location with Owner.	Yes	Yes	
Tissue Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Toilet Paper Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Undercounter Dishwasher	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.		Yes	
UPS (MRI, Data Room, CPU, or other similar equipment)	Owner / Contractor	A/E to identify equipment locations on drawings, coordinate with Owner.	Yes	Yes	Yes
Wall Mount Basket for Cuff	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Bracket for Clinical Monitor (sizes vary)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Wall Mount Bracket for Disinfectant Wipes	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Bracket for Emesis Bags	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Bracket for Eyewear/Eyeshield Dispenser	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Bracket for Patient Transfer Device, Patient Evacuation Device (Med Sled)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Bracket for Suction Canister	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount for Area Radiation Monitor	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Wall Mount for Mops, Brooms, etc.	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount for Phlebotomy Station (Infant)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mount Hair Dryer	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Wall Mounted Chemical Spill Kit	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mounted Modular Storage Shelving	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mounted Shelving	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Wall Mounted Thermometer (Temporal Artery, Digital, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Zip Line Exciser Kit	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
CFCI - (Contractor Furnished / Contractor Installed) (Coordinate location of items with A/E Design Team and track within construction schedule)			Data	Power	Backing
Access Control, Card Readers (Lenel)	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	
Audio/Video (A/V)	Contractor / Contractor	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and misc. cabling (from wall side back).	Yes	Yes	
Blinds/Shades (manual and powered)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	
Coat Hooks (Rest rooms>Showers, Exam rooms, Offices/Workstations only)	Contractor / Contractor	A/E to identify locations on drawings.			Yes
Communication Boards (e.g. Patient Rooms)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. If boards are electronic, then data and power should also be provided.			Yes
Communication Cabling	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. See Intermountain Design Guidelines and Construction Standards for additional information.			
Emergency Phones, Kiosks - Exterior	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Conduit and boxes by Contractor.	Yes	Yes	Yes
Emergency Shower Station / Eye Wash Station	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. These shall meet ANSI and Owner requirements.			Yes
Fire Extinguishers	Contractor / Contractor	A/E to identify types and locations on drawings, coordinate with Owner. 10 lbs. minimum - refer to Intermountain Design Guidelines & Construction Standards.			Yes
Grab Bars (Rest rooms, Radiology, Exam rooms, etc.)	Contractor / Contractor	A/E to identify locations on drawings.			Yes
Intrusion Detection	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Med Gas Certification	Contractor / Contractor	Contractor to coordinate Vendor with Owner			

Mirrors (Rest rooms, Exams, Radiology, Rehab, etc.)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Nurse Notification Call (NNC) System - Low Voltage Cabling (Hospital Campus)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Patient Monitoring System & Devices (Hospital Campus)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/TDR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	Yes
Plumbing Shrouds	Contractor / Contractor				
Pneumatic Tube Systems	Contractor / Contractor (SwissLog, Atreo Group, or other approved)	A/E to identify locations on drawings, coordinate with Owner. If SwissLog, verify pricing is per Intalere (Amerinet) Contract Agreement. Design assistance fees are included in this agreement.	Yes	Yes	
Radiation Protection (Lead) Installation - (ex. Cath Lab, CT Scanner, X-Ray)	Contractor / Contractor	A/E to identify locations on drawings and coordinate with Owner's Vendor on the required shielding thicknesses.			Yes
Radiofrequency/Magnetic (RF) Shielding Installation - MRI	Contractor / Contractor	A/E to coordinate with Owner in the design phase and coordinate appropriate shielding.			Yes
Security Cameras, Video Surveillance	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.	Yes		
Staff Assist Notification Call System - Low Voltage Cabling (Medical Group Clinics on hospital campuses to match NNC system)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Staff Assist Notification Call System - Low Voltage Cabling (Stand-alone Medical Group Clinics)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom. *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Support Bracing/Structure for Radiology and similar equipment	Contractor / Contractor	A/E to coordinate with Owner and Owner's selected Radiology equipment Vendor; A/E to coordinate the design of the support bracing/structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner for install of support structure.	Yes	Yes	Yes
TV System Distribution	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Voice/Data Cabling (all horizontal cabling)	Contractor / Contractor (Cache Valley Elec., IES Commercial, Data Tech Professionals, Hunt Electric, and others listed in Intermountain Div. 27)	Refer to Division 27 in the Intermountain Design Guidelines and Construction Standards. Coordinate with Owner/User on connections, pairs of fiber/copper, conduits, inner-ducts, etc.	Yes		
Wall Protection (Incl. Bumper and Corner Guards)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Backing should be included where heavy use/damage may occur.			

SECTION 01 2300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate or breakout into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Alternate Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Remove and replace ceiling. Alternate layout includes gypsum soffit in addition to ceiling tile.
 - 1. Base bid: Remove and replace ceiling. New layout includes ceiling tile only as indicated on drawings.
 - 2. Alternate: Remove and replace ceiling. New layout includes gypsum soffit in addition to ceiling tile as indicated on drawings.

END OF SECTION 01 2300

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. Document 00 2600 "Procurement Substitution Procedures" for requirements for substitution requests prior to award of Contract.
 - 2. 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.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit documentation identifying product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use form acceptable to Architect.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

- a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
 - b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
 - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2500

SECTION 01 2600 - CONTRACT MODIFICATION 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 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.
 - 2. Section 01 3100 "Project Management and Coordination" for requirements for forms for contract modifications provided as part of Newforma web-based Project management software.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Owner-provided Form HKS-710 "Architect's Supplemental Instructions".

1.4 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 using on Owner-provided Form HKS-709 "Proposed Change". If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposed Changes issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposed Change or 20 days, when not otherwise specified, after receipt of Proposed Change, 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. Include updated Submittal Schedule showing effect of the change.
- 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 using Architect's Standard Form.
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: Use form acceptable to Architect.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposed Change, Architect will issue a Change Order for signatures of Owner and Contractor on Owner-provided Form HKS-701 "Change Order".

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on Owner-provided Form HKS-714 "Construction Change Directive". 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 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 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.

1.3 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.

1.4 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.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Owner's name.
 - c. Name of Architect.
 - d. Architect's Project number.
 - e. Contractor's name and address.
 - f. Date of submittal.
2. Arrange the schedule of values in tabular form, in format acceptable to Architect, with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts, where appropriate.
4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance or bonded warehousing.
5. 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.
6. Change Orders: Provide a separate line item in the schedule of values for each change order.
7. Purchase Contracts: When applicable, provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
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.

1.5 ARCHITECTS COST DATA

- A. In addition to the Schedule of Values, submit itemized cost data reporting on Owner-provided Form HKS-757 "Project Cost Summary". Initial submission shall be included with contractors first Application for Payment. Final updated submission shall be included with contractors final Application for Payment.

1.6 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.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 1. If the Agreement does not state payment dates, establish dates at preconstruction conference.
 2. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Unless directed otherwise by Owner, use AIA Document G702 and AIA Document G703 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: If accepted by Owner, 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 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall 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 lien from General Contractor, 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. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. 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. Products list (preliminary if not final).
 5. Submittal schedule (preliminary if not final).
 6. List of Contractor's staff assignments.

7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 - a. Complete administrative actions, submittals, and Work preceding this application, as described in Section 01 7700 "Closeout Procedures."
 2. When applicable, this application shall reflect Certificate(s) of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Certification of completion of final punch list items.
 3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 4. Updated final statement, accounting for final changes to the Contract Sum.
 5. AIA Document G706.
 6. AIA Document G706A.
 7. AIA Document G707.
 8. Evidence that claims have been settled.
 9. 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.
 10. Final liquidated damages settlement statement, if applicable.
 11. Proof that taxes, fees, and similar obligations are paid.
 12. Waivers and releases.

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Intermountain Healthcare

Construction Documents

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 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 provisions for coordinating construction operations on Project, including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. RFIs.
 - 3. Project Transfer Website (Newforma).
 - 4. Project meetings.
- B. 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.

1.3 DEFINITIONS

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

1.4 PROJECT COMMUNICATIONS DOCUMENTS

- A. Project communications documents: As follows:
 - 1. Letters.
 - 2. Memoranda.
 - 3. E-Mail Communications/Internet Communications/Project Management Software Communications.
 - 4. RFI (Request for Information - Contractor).
 - 5. RFI-A (Request for Information - Architect).

B. Format:

1. Letters and Memoranda: Submit in formats acceptable to the Architect.
2. E-Mail Communications/Internet Communications/Project Management Software Communications: Submit in forms and formats acceptable to and as approved by the Architect.
3. RFI (Request for Information - Contractor): Submit on forms furnished by the Architect, or on other forms as approved by the Architect. Unless otherwise approved use on Owner-provided Form HKS-750, "Request for Information".
4. RFI-A (Request for Information - Architect), will be submitted by Architect to Contractor on Architects standard form.

C. Submit Letters and Memoranda documents in a timely manner so as to facilitate project delivery and coordination. Route communications as established in the Contract, the Contract Documents and the Pre-Construction Conference. Transmit or forward communications documents in a manner consistent with the schedule and progress of the Work.

D. Use E-Mail Communications, Internet Communications, and Project Management Software programs that are compatible with the Architect's and Owner's computer systems and equipment. Contractor is responsible for all costs for management of these systems, including, but not limited to, licensing, onsite training or other training necessary for the proper operation of such systems. Keep written records and hard file copies of all electronic communications. Failure of the Contractor to keep such records shall waive the Contractor's right to rely on such communications and such communications shall be deemed to have not taken place.

E. RFI (Request for Information - Contractor) is defined and limited to a request from the Contractor seeking interpretation or clarification of the requirements of the Contract Documents. Assure that requests comply with the following requirements:

1. Submit RFI requests in a timely manner, well in advance of related work, and allow sufficient time for the resolution of issues relating to the request for interpretation or clarification. Schedule the submit RFI's to moderate and manage the flow of RFI requests. Submit RFI's in a manner consistent with the schedule and progress of the Work, and do not submit in a sporadic or excessive manner.
2. Number RFI requests sequentially and contain a detailed description of the areas of work requiring interpretation or clarification. Include drawing and specification references, sketches, technical data, brochures, or other supporting data as deemed necessary by the Architect, for the Architect to provide the interpretations and clarifications requested.
 - a. Include a "Proposed Solution" to the issue requiring interpretation or clarification.
3. Review RFI's submitted to the Contractor by Sub-Contractors, vendors, suppliers, or other parties to the Work prior to submission to Architect. If Architect deems that RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action. Sub-Contractor's RFI shall contain a "Proposed Solution".
4. Do not include, in RFI requests, submittals, substitutions requests, routine communications, correspondence, memos, claims, or any information required by other

- areas of the Contract Documents. RFI requests containing such information will be returned to the Contractor without action by the Architect.
5. Limit RFI requests to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect do not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect's response to an RFI gives cause for a change in the Contract or the Contract Documents, promptly, within 5 working days, give written notice to the Architect of request for adjustments. Submit requests for adjustments to the Contract in a manner consistent with the terms and conditions of the Contract Documents.
 6. If the Architect, after review, determines that a submitted RFI is incomplete, is unnecessary, or does not otherwise comply with the requirements of this Section, the RFI will be returned without action to the Contractor. Delete the original submittal date from the RFI log and enter a new submittal date at the time of re-submittal.
 7. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use software log that is part of Project Web site. Software log with not less than the following:
 - a. Project name.
 - b. Name and address of Contractor.
 - c. Name and address of Architect.
 - d. RFI number including RFIs that were returned without action or withdrawn.
 - e. RFI description.
 - f. Date the RFI was submitted.
 - g. Date Architect's response was received.
 8. 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.
 - a. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
- F. An RFI-A (Request for Information - Architect) is a request by the Architect for information relating to the obligations of the Contractor under the Contract.
1. After receipt of an RFI-A, provide a written response to the Architect within 5 working days. Provide responses that are thorough, complete and contain all information requested by the Architect.
 2. Limit an RFI-A to a request by the Architect for information related to the project. Do not construe an RFI-A as authorizing or directing a change in the Contract or the Contract Documents.
- G. Revisions to Construction Documents: Responses to requests for information (RFI) are not Construction Documents; and do not incorporate RFI responses into construction of the Project, unless answers bear the seal and signature of a licensed design professional.

1.5 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses, 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 on Project website. Keep list current at all times.

1.6 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results, where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities 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.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1.7 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination 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 PDF format.
 3. BIM File Incorporation: When applicable, develop and incorporate coordination drawing files into BIM established for Project.

- a. Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
4. 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 Autodesk Revit and/or Autocad; and compatible with Microsoft Windows operating system.
 - c. Contractor shall execute a data licensing agreement in the form of AIA Document C106.

1.8 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use Architect's Project Web site implementing Architect's electronic project management software system for purposes of managing project communication and documentation until Final Completion.
- B. Contractor, subcontractors, and other parties granted access to Project Web site shall execute a data licensing agreement in the form of AIA Document C106.
- C. Web-Based Project Management Software Package: Use Architect's web-based Project management software package (Newforma) for purposes of hosting and managing Project communication and documentation until Final Completion.
 1. Web-based Project management software includes, at a minimum, the following features:
 - a. Compilation of Project data, including Contractor, subcontractors, Architect, Architect's consultants, Owner, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Project communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each Project communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.

- j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.
 - 2. Provide up to seven Project management software user licenses for use of Owner, Architect, and Architect's consultants. Provide eight hours of software training at Architect's office for web-based Project software users.
 - 3. At completion of Project, provide digital archive in format that is readable by common desktop software applications in format acceptable to Architect. Provide data in locked format to prevent further changes.
 - 4. Provide the following Project management software packages under their current published licensing agreements:
 - a. Newforma, Inc.
- D. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
- 1. Assemble complete submittal package into a single indexed file, incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 - 2. Name file with submittal number or other unique identifier, including revision identifier.
 - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.
 - 4. Attendance: Document attendance of all participants.
- B. Preconstruction Conference: Architect will 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. Responsibilities and personnel assignments.
- b. Tentative construction schedule.
- c. Critical work sequencing and long lead items.
- d. Designation of key personnel and their duties.
- e. Lines of communications.
- f. Use of web-based Project software.
- g. Procedures for processing field decisions and Change Orders.
- h. Procedures for RFIs.
- i. Procedures for testing and inspecting.
- j. Procedures for processing Applications for Payment.
- k. Distribution of the Contract Documents.
- l. Submittal procedures.
- m. Preparation of Record Documents.
- n. Use of the premises.
- o. Work restrictions.
- p. Working hours.
- q. Owner's occupancy requirements.
- r. Responsibility for temporary facilities and controls.
- s. Procedures for moisture and mold control.
- t. Construction waste management.
- u. Parking availability.
- v. Office, work, and storage areas.
- w. Equipment deliveries and priorities.
- x. First aid.
- y. Security.
- z. 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 when required by other Sections and when required for 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. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.
- 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Preparation of Record Documents.
 - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - c. Submittal of written warranties.
 - d. Requirements for preparing operations and maintenance data.
 - e. Requirements for delivery of material samples, attic stock, and spare parts.

- f. Requirements for demonstration and training.
 - g. Preparation of Contractor's punch list.
 - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
 - i. Submittal procedures.
 - j. Owner's partial occupancy requirements.
 - k. Installation of Owner's furniture, fixtures, and equipment.
 - l. Responsibility for removing temporary facilities and controls.
- 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. 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 use.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Status of correction of deficient items.
 - 14) Field observations.
 - 15) Status of RFIs.

- 16) Status of Proposal Requests.
 - 17) Pending changes.
 - 18) Status of Change Orders.
 - 19) Pending claims and disputes.
 - 20) 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

2.1 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. General: To expedite electronic review process, process all documents through a web-based software service. Send documents via email. FTP or paper will not be accepted.
 1. Basis of Design (Product Standard):
 - a. Newforma, Inc.; Newforma Project Cloud, web-based software.
 - 1) Website: www.NewformaProjectCloud.com
 - 2) E-mail: projectcloud@newforma.com
 - 3) Phone: (800) 303-4650
- B. Performance Requirements:
 1. Project License:
 - a. Cloud based (no hardware required).
 - b. Unlimited user accounts.
 - c. Functionality to support subcontractors, contractors, architects and consultants.
 - d. Provide access to data for all project team members at no cost to the individual users.
 2. Training and Support:
 - a. Dedicated project training.
 - b. Phone support.
 3. Archive:
 - a. Export all data to an offline archive at the completion of the project.
 - b. Provide archive to architect, contractor and owner.

- c. Archive shall include all attachments, meta data, review comments and time stamp history.
- 4. Submittals and RFIs:
 - a. Customizable logs and reporting accessible by all users.
 - b. Logs shall automatically update as submittals and RFIs are processed.
 - c. Automated routing of submittals and RFIs to design team based on trade.
 - d. Automated email notifications when submittal or RFI has been assigned or returned to a user.
 - e. Automated weekly email to design team users of overdue items.
 - f. Automatic sequential numbering per spec section for submittals.
 - g. Two sets of due dates - one overall due date and a consultant due date.
 - h. Built-in web-based markup tools to support a concurrent review of submittal and RFI.
- 5. Submittal Register:
 - a. Software vendor shall take specifications and build the required list of submittals and import into the software.
- 6. Drawing Management:
 - a. Provide current set of drawings and specifications through a centralized index.
 - b. Automated association of PDFs to the centralized index.
 - c. Manage drawing revisions with customizable review states.
 - d. Drawings shall be accessible offline via mobile devices.
- 7. File Sharing:
 - a. Integrated file sharing tool (FTP) to transfer any miscellaneous files such as BIM and CAD files.
 - b. Access permissions (view/edit) at a folder level.
- 8. Punch List and other Field Task Management:
 - a. Unlimited customizable field task types including punch list.
 - b. Locate and assign tasks from a mobile device.
 - c. No additional fees to individual users to access mobile apps.
 - d. Data shall be accessible offline on mobile devices.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

SECTION 01 3200 - CONSTRUCTION PROGRESS 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 documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's Construction Schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Unusual event reports.
- B. Related Requirements:
 - 1. Section 01 4000 "Quality Requirements" for schedule of tests and inspections.
 - 2. Section 01 2900 "Payment Procedures" for schedule of values and requirements for use of cost-loaded schedule for Applications for Payment.

1.3 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. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- C. Event: The starting or ending point of an activity.

- D. 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.
- E. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- F. Major Area: A story of construction, a separate building, or a similar significant construction element.
- G. Milestone: A key or critical point in time for reference or measurement.
- H. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF file.
- B. Startup construction schedule.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working digital copy of schedule, using software indicated, and labeled to comply with requirements for submittals.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.
- I. Unusual Event Reports: Submit at time of unusual event.

1.5 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.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- B. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting, using CPM scheduling.
 - 1. In-House Option: Owner may waive requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- C. Time Frame: Extend schedule from date established for commencement of the Work 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.
- D. Activities: Treat each floor or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
 - 2. Temporary Facilities: Indicate start and completion dates for the following as applicable:
 - a. Securing of approvals and permits required for performance of the Work.
 - b. Temporary facilities.
 - c. Construction of mock-ups, prototypes and samples.
 - d. Owner interfaces and furnishing of items.
 - e. Regulatory agency approvals.
 - f. Punch list.
 - 3. Procurement Activities: Include procurement process activities for the following long lead-time items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.

4. Submittal Review Time: Include review and resubmittal times indicated in Section 01 3300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 5. Startup and Testing Time: Include no fewer than 7 days for startup and testing.
 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 7. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and Final Completion.
- E. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule (where applicable), and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 1000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 5. 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.
 6. 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.

7. 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.
8. Other Constraints include but are not limited to the following:
 - a. Roads.
 - b. Parking.
 - c. Landscape.
- F. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion, and the following interim milestones:
 1. Temporary enclosure and space conditioning.
- G. 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.
- 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, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 1. Post copies in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 STARTUP CONSTRUCTION SCHEDULE

- A. Bar (Gantt)-Chart Startup Schedule: Submit startup, horizontal, Bar (Gantt)-chart-type construction schedule within 14 days of date established for the Notice of Award.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Startup Network Diagram may be submitted in lieu of Bar-Chart Schedule.
- D. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Bar (Gantt)-chart - type, Contractor's Construction Schedule within 30 days of date established for the Notice of Award.
 - 1. Base schedule on the startup construction schedule and additional information received since the start of Project.
- E. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

1.8 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. Approximate count of personnel at Project site.
 - 3. Equipment at Project site.
 - 4. Material deliveries.
 - 5. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 6. Testing and inspection.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events.
 - 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. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
 2. Material stored prior to previous report and since removed from storage and installed.
 3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.
- D. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.
1. Submit unusual event reports directly to Owner within 1 day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 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. Concealed Work photographs.
 - 2. Periodic construction photographs.
 - 3. 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 3 days of taking photographs.
 - 1. Submit photos by uploading to web-based Project management software site. Include copy of key plan indicating each photograph's location and direction.
 - 2. Identification: Provide the following information with each image description in web-based Project management software site:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of location, vantage point, and direction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.4 FORMATS AND MEDIA

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor resolution of 4 megapixels, and at an image resolution of not less than 4288 by 2848 pixels..
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- A. File Names: Name media files with date and sequential numbering suffix.
 - 1. Image File Naming Convention (separate by an underscore _):
 - a. Project Job Number / Year-Month-Day / Image Number. file extension.

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. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Concealed Work Photographs: Before proceeding with installing work that will conceal other work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work, including, but not limited to, the following:
 - 1. Underground utilities.
 - 2. Underslab services.
 - 3. Piping.
 - 4. Electrical conduit.
 - 5. Waterproofing and weather-resistant barriers.
- D. 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.
- E. Final Completion Construction Photographs: Take 8 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp unless directed otherwise by Architect.
- F. 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.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs shall be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

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 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. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

- B. Related Requirements:

- 1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for Intermountain's web-based Project tracking software.
 - 3. Section 01 3200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 4. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
 - 5. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
 - 6. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 7. Section 01 7839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 8. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with

requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL SCHEDULE

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

1.5 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
 2. Date.
 3. Name of Architect.
 4. Name of Contractor.
 5. Name of firm or entity that prepared submittal.
 6. Names of subcontractor, manufacturer, and supplier.
 7. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier and alphanumeric suffix for resubmittals.
 8. Category and type of submittal.
 9. Submittal purpose and description.

10. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 11. Drawing number and detail references, as appropriate.
 12. Indication of full or partial submittal.
 13. Location(s) where product is to be installed, as appropriate.
 14. Other necessary identification.
 15. Remarks.
 16. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Electronic Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- E. Submittals Utilizing Web-Based Project Software: Prepare submittals as PDF files or other format indicated by Project management software.

1.6 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Email: Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 - a. Architect will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.
 2. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project management software website. Enter required data in web-based software site to fully identify submittal.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections, so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block, and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.7 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.

- c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrently with Samples.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
- C. Samples: Submit Samples for review of type, color, pattern, and texture for a check of these characteristics with other materials.
 1. Transmit Samples that contain multiple, related components, such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 3. Web-Based Project Management Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.

4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units, showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. 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.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.

- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
 - 2. Installer Certificates: Submit written statements on manufacturer's letterhead, certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 - 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead, certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 - 4. Material Certificates: Submit written statements on manufacturer's letterhead, certifying that material complies with requirements in the Contract Documents.
 - 5. Product Certificates: Submit written statements on manufacturer's letterhead, certifying that product complies with requirements in the Contract Documents.
 - 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of AWS B2.1/B2.1M on AWS forms. Include names of firms and personnel certified.
- H. Test and Research Reports:
 - 1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for substrate preparation and primers required.
 - 2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
 - 3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
 - 4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
 - 5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.8 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 insufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

1.9 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.10 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return where required by Contract Documents.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
 - 1) "No Exceptions": Architect has no exceptions to submittal.
 - 2) "Revise and Resubmit": Architect requires submittal to be revised and resubmitted.
 - 3) Provide as Noted: Architect has no exceptions to submittal as revised by Architect's notes indicated on submittal.
 - 4) "Returned Without Action": Architect returns submittal without action because submittal was not required by the Contract Documents.
 - 2. Submittals by Web-Based Project Management Software: Architect will indicate, on Project management software website, the appropriate action.
 - a. Actions taken by indication on Project management software website have the following meanings:
 - 1) "No Exceptions": Architect has no exceptions to submittal.
 - 2) "Revise and Resubmit": Architect requires submittal to be revised and resubmitted.
 - 3) Provide as Noted: Architect has no exceptions to submittal as revised by Architect's notes indicated on submittal.
 - 4) "Returned Without Action": Architect returns submittal without action because submittal was not required by the Contract Documents.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Architect will return without review, or discard submittals received from sources other than Contractor.
- F. Submittals not required by the Contract Documents will be returned by Architect without action.

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced," unless otherwise further described, means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction and with the qualification requirements of individual specification section governing their work.
- B. Field Quality-Control Tests and Inspections: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a 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).
- D. Mockups: Full-size physical assemblies that are constructed either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and 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 and tested at testing facility to verify performance characteristics.
 2. Product Mockups: Mockups that may include multiple products, materials, or systems specified in a single Section.
 3. In-Place Mockups: Mockups constructed on-site in their actual final location as part of permanent construction.
- 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. Unless otherwise indicated, copies of reports of tests or inspections performed for other than the Project do not meet this definition.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. 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.
- H. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work, to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Architect.
- I. Source Quality-Control Tests and Inspections: Tests and inspections that are performed at the source (e.g., plant, mill, factory, or shop).
- J. Testing Agency: An entity engaged to perform specific tests, inspections, or both. The term "testing laboratory" shall have the same meaning as the term "testing agency."

1.4 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

1.5 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements is specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, inform the Architect regarding the conflict and obtain clarification prior to proceeding with the Work. Refer conflicting requirements that are different, but apparently equal, to Architect for clarification before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified 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.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data: For Contractor's quality-control personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the Statement of Special Inspections.
 - 2. Primary wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.

- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.
- F. Reports: Prepare and submit certified written reports and documents as specified.
- G. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice of Award, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 - a. Project quality-control manager may also serve as Project superintendent or be an individual with no other Project responsibilities, as accepted by the Architect.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
 - 1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and

- inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
 - 2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
 - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.8 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
- 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample-taking and testing and inspection.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
- 1. Name, address, telephone number, and email address of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.
 - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.

5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement of whether conditions, products, and installation will affect warranty.
 7. Statement whether conditions, products, and installation exceed manufacturer's statements.
 8. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, telephone number, and email address of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement of whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

1.9 QUALITY ASSURANCE

- A. Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that is similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged in the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing and Inspecting Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented in accordance with ASTM E329, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
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.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect, demonstrate, repair, and perform service on installations of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following Contractor's responsibilities, including the following:
1. Provide test specimens representative of proposed products and construction.
 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 3. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
 4. Build site-assembled test assemblies and mockups, using installers who will perform same tasks for Project.
 5. Build laboratory mockups at testing facility, using personnel, products, and methods of construction indicated for the completed Work.
 6. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 7. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mock-up to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
 2. Build mockups in location indicated or, if not indicated, as directed by Architect. Contractor shall provide structural support framework.
 - a. Show typical components, attachments to building structure, and requirements of installation.
 3. Clean exposed faces of mockup.
 4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
 5. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
 6. Demonstrate the proposed range of aesthetic effects and workmanship.
 7. Obtain Architect's approval of mockups before starting corresponding Work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
 8. Promptly correct unsatisfactory conditions noted by Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
 9. Protect accepted mockup from the elements with weather-resistant membrane.
 10. Approval of mockups by the Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 11. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 12. Demolish and remove mockups when directed unless otherwise indicated.
- L. Exterior Wall Assembly Mockups: Provide mockups to demonstrate exterior wall assemblies for appropriate construction means and methods. Also illustrate in mockup construction, color, texture and finish, as required for materials being provided.
- M. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Specification Sections.

1.10 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 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, and the Contract Sum will be adjusted by Change Order.
 3. Owner will contract with a vendor to provide the third-party testing and inspection of the following:

- a. Soil density/moisture relationships, gradation, and Atterberg limits.
 - b. Concrete compressive strength testing.
 - c. Asphalt tests (Marshall).
 - d. Fireproofing thickness/adhesion, density.
 - e. Structural steel magnetic particle testing, ultrasonic inspection, field welding, high strength bolt/metal decking inspection, radiographic inspection.
 - f. Radiation protection shielding.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspection will be performed.
 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- D. Testing Agency Responsibilities: Cooperate with Architect 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 locations from which test samples will be taken and in which in-situ tests are conducted.
 3. Conduct and interpret tests and inspections, and state in each report whether tested and inspected Work complies with or deviates from requirements.
 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 6. Do not perform duties of Contractor.

- E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 3300 "Submittal Procedures."
- F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- G. Contractor's Associated Requirements and Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspection equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's Construction Schedule. Update and submit with each Application for Payment.
 - 1. Schedule Contents: Include tests, inspections, and quality-control services, including Contractor- and Owner-retained services, and other Project-required services paid for by other entities.
 - 2. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.
 - a. Prepare in tabular form and include the following:
 - 1) Specification Section number and title.
 - 2) Entity responsible for performing tests and inspections.
 - 3) Description of test and inspection.

- 4) Identification of applicable standards.
- 5) Identification of test and inspection methods.
- 6) Number of tests and inspections required.
- 7) Time schedule or time span for tests and inspections.
- 8) Requirements for obtaining samples.
- 9) Unique characteristics of each quality-control service.

1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures, and reviewing the completeness and adequacy of those procedures to perform the Work.
 2. Notifying Architect 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.

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 and authorities' having jurisdiction reference during normal working hours.
1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample-taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 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 4200 - REFERENCES

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 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.
 - 1. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org (909) 472-4100.
 - 2. ICC - International Code Council; www.iccsafe.org (888) 422-7233.
 - 3. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org (800) 423-6587.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.
 - 1. COE - Army Corps of Engineers; www.usace.army.mil (202) 761-0011.
 - 2. CPSC - Consumer Product Safety Commission; www.cpsc.gov (800) 638-2772.
 - 3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov (202) 482-2000.
 - 4. DOD - Department of Defense; www.quicksearch.dla.mil (215) 697-6257.
 - 5. DOE - Department of Energy; www.energy.gov (202) 586-9220.
 - 6. EPA - Environmental Protection Agency; www.epa.gov (202) 272-0167.
 - 7. FAA - Federal Aviation Administration; www.faa.gov (866) 835-5322.
 - 8. FCC - Federal Communications Commission; www.fcc.gov (888) 225-5322.
 - 9. FDA - Food and Drug Administration; www.fda.gov (888) 463-6332.
 - 10. GSA - General Services Administration; www.gsa.gov (800) 488-3111.
 - 11. HUD - Department of Housing and Urban Development; www.hud.gov (202) 708-1112.
 - 12. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov (510) 486-4000.
 - 13. NCHRP - National Cooperative Highway Research Program.
 - 14. NIST - National Institute of Standards and Technology www.nist.gov (301) 975-6478.

15. OSHA - Occupational Safety & Health Administration; www.osha.gov (800) 321-6742.
16. PHS - Office of Public Health and Science; www.osophs.dhhs.gov/ophs (202) 690-7694.
17. RUS - Rural Utilities Service; (202) 720-9540.
18. State Department - www.state.gov; (202) 647-4000.
19. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org (202) 334-2934.
20. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov (202) 720-2791.
21. USPS - United States Postal Service; www.usps.com (202) 268-2000.

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. ADAAG - Americans with Disabilities Act (ADA); (800) 872-2253.
 - a. Architectural Barriers Act (ABA); (202) 272-0080.
 - b. Accessibility Guidelines for Buildings and Facilities.
 - c. Available from U.S. Access Board; www.access-board.gov.
2. CFR - Code of Federal Regulations; Available from Government Printing Office; www.govinfo.gov (866) 512-1800.
 - a. Available from Government Printing Office.
3. DOD - Department of Defense Military Specifications and Standards; <http://dodssp.daps.dla.mil> (215) 697-2664.
 - a. Available from Department of Defense Single Stock Point
4. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov (202) 619-8925.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org (202) 289-7800.
5. MILSPEC - Military Specification and Standards; (See DOD).
6. USAB - United States Access Board; www.access-board.gov.
7. UFAS - Uniform Federal Accessibility Standards; www.access-board.gov (800) 872-2253.
 - a. Available from Access Board; (202) 272-0080.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 4200

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

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 requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

- A. Installation, removal, and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
 - 1. Cost or use charges for temporary facilities are not chargeable to Owner or Architect.
- B. Sewer Service: Pay sewer-service use charges for sewer usage, indicated by utility company meter readings, by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used, indicated by utility company meter readings, by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used, indicated by utility company meter readings, by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.
- B. Implementation and Termination Schedule: Within 15 days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

- C. Moisture- and Mold-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage and mold. Describe delivery, handling, storage, installation, and protection provisions for materials subject to water absorption or water damage.
 - 1. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and requirements for replacing water-damaged Work.
 - 2. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
 - 3. Indicate methods to be used to avoid trapping water in finished work.
- 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 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. Temporary Utility Reports: Make available on request, reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.5 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6 "Requirements for Demolition Operations", NECA's "Temporary Electrical Facilities," and NFPA 241 "Standard for Safeguarding Construction, Alteration, and Demolition Operations".
 - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- D. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
 - 1. Building Code requirements.
 - 2. Health and safety regulations.

3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.
6. City ordinances and regulations.

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. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.
- C. Portable 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 and bottom rails. Provide concrete or galvanized-steel bases for supporting posts.
- D. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less in accordance with ASTM E84 and passing NFPA 701 Test Method 2.
 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; SAFE-FLEX ICRA Awareness Barrier.
- E. Dust Containment Barrier for Doors: reinforced, fire-resistive polyethylene sheet, 10 mil (0.25 mm) minimum thickness with Class B flame-spread rating per ASTM E 84 and designed to be used for securing temporary construction doors so as to minimize and mitigate particle control during construction.
 1. Basis of Design (Product Standard): Abatement Technologies, Inc.; Aire Guardian Door Guard Reusable Barrier.
- F. Dust-Control Adhesive-Surface Walk-Off Mats: Provide mats, minimum 36 by 60 inches.

- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

- A. Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: 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 10 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. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - 5. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. 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.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- B. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- C. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- D. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 2. Heating, Cooling, and Dehumidifying Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. 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 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
1. Locate facilities to limit site disturbance as specified in Section 01 1000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide

drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.

1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
 2. Connect temporary sewers to municipal system as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Sterilize temporary water piping before use in accordance with requirements of authorities having jurisdiction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, safety shower and eyewash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
1. Use of Permanent Toilets: Use of Owner's existing or new toilet facilities is not permitted.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. 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.
- G. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install land-based telephone lines for each field office.
- J. Electronic Communication Service: Provide secure WiFi wireless connection to internet with provisions for access by Architect and Owner.

- K. Project Computer: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
1. Processor: Intel Core i5 or i7.
 2. Memory: 16 gigabyte.
 3. Disk Storage: 1 -terabyte hard-disk drive and combination DVD-RW/CD-RW drive.
 4. Display: 24-inch LCD monitor with 256-Mb dedicated video RAM.
 5. Full-size keyboard and mouse.
 6. Network Connectivity: 10/100BaseT Ethernet.
 7. Operating System: Microsoft Windows 10 Professional.
 8. Productivity Software:
 - a. Microsoft Office Professional, 2013 or higher, including Word, Excel, and Outlook.
 - b. Adobe Reader DC.
 - c. WinZip 10.0 or higher.
 9. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
 10. Internet Service: Broadband modem, router, and ISP, equipped with hardware firewall, providing minimum 10.0 -Mbps upload and 15 -Mbps download speeds at each computer.
 11. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
 12. Backup: External hard drive, minimum 2 terrabytes, with automated backup software providing daily backups.

3.4 SUPPORT FACILITIES INSTALLATION

- A. Comply with the following:
1. Provide construction for temporary field offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible in accordance with ASTM E136. 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. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
 2. Protect existing site improvements to remain, including curbs, pavement, and utilities.
 3. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary offsite parking areas for construction personnel, coordinated parking with Owner's requirements.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar construction is completed.
 3. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Coordinate signs with Owner's requirements and requirements of authorities having jurisdiction. Unauthorized signs are not permitted.
1. 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.
 2. Maintain and touch up signs, so they are legible at all times.
- G. Waste Disposal Facilities: Comply with requirements specified in Section 01 7419 "Construction Waste Management and Disposal."
- H. Comply with progress cleaning requirements in Section 01 7300 "Execution."

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.
- C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

- D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- F. 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 materials approved by authorities having jurisdiction.
- G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.
 - 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
- H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- I. Temporary Egress: Provide temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- J. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- L. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.
 - 1. Construct dustproof partitions with gypsum wallboard, with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.
 - 2. Construct dustproof partitions with two layers of 6-mil 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 foot mats in vestibule, for dust control.
 3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 5. Protect air-handling equipment.
 6. Provide walk-off mats at each entrance through temporary partition.
- M. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

3.6 MOISTURE AND MOLD CONTROL

- A. Moisture and Mold Protection: Protect stored materials and installed Work in accordance with Moisture and Mold Protection Plan.
- B. Exposed Construction Period: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Period: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard and replace stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows wet materials adequate time to dry before enclosing the material in gypsum board or other interior finishes.
- D. Controlled Construction Period: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary or permanent HVAC system to control humidity.

3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits. Refer to technical specification sections for additional and more stringent criteria.

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.
 2. Maintain markers for underground lines. Protect from damage during excavation operations.
- 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.
 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 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 1000 "Summary" for Contractor requirements related to Owner-furnished products.
 - 2. Section 01 2500 "Substitution Procedures" for requests for substitutions.
 - 3. Section 01 7700 "Closeout Procedures" for submitting warranties.

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. Salvaged items or items reused from other projects are not considered new products. Items that are manufactured or fabricated to include recycled content materials are considered new products, unless indicated otherwise.
 - 3. Comparable Product: Product by named manufacturer that is demonstrated and approved through the comparable product submittal process described in Part 2 "Comparable Products" Article, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "Product Standard" or "basis-of-design product,"

including make or model number or other designation. Published attributes and characteristics of basis-of-design product establish salient characteristics of products.

1. Evaluation of Comparable or Equivalent Products: In addition to the basis-of-design product description, product attributes and characteristics are listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification. Manufacturer's published attributes and characteristics of basis-of-design product also establish salient characteristics of products for purposes of evaluating comparable products.
- C. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.
1. Hazardous Substance Compliance: Contractor shall take whatever measures deemed necessary to ensure that all employees, suppliers, vendors, fabricators, subcontractors, or their assigns, comply with hazardous substance requirements.
- D. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at the time Contractor's services are rendered, any amendments for Contractor's services rendered after the effective date of any such amendments.
- E. Contractor shall submit an affidavit on construction company letterhead signed by an officer of the company, notarized by a notary public, which certifies compliance with the environmental laws controlling hazardous substances for the construction of this Project.
- F. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications; submit a comparable product request or substitution request, if applicable.
- G. Comparable Product Request Submittal: An action submittal requesting consideration of a comparable product, including the following information:
1. Identification of basis-of-design product or fabrication or installation method to be replaced, including Specification Section number and title and Drawing numbers and titles.
 2. Data indicating compliance with the requirements specified in Part 2 "Comparable Products" Article.
- H. Basis-of-Design Product Specification Submittal: An action submittal complying with requirements in Section 01 3300 "Submittal Procedures."

- I. Substitution: Refer to Section 01 2500 "Substitution Procedures" for definition and limitations on substitutions.

1.4 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.
- B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.
 1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
 2. Equipment Nameplates: Provide a permanent nameplate on each item of service- or power-operated equipment. Locate on a visually accessible but inconspicuous surface. Include information essential for operation, including the following:
 - a. Name of product and manufacturer.
 - b. Model and serial number.
 - c. Capacity.
 - d. Speed.
 - e. Ratings.
 3. See individual identification Sections in Divisions 21, 22, 23, and 26 for additional equipment identification requirements.

1.5 COORDINATION

- A. Modify or adjust affected work as necessary to integrate work of approved comparable products and approved substitutions.

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 that products are undamaged and properly protected.

C. Storage:

1. Provide a secure location and enclosure at Project site for storage of materials and equipment.
2. Store products to allow for inspection and measurement of quantity or counting of units.
3. Store materials in a manner that will not endanger Project structure.
4. Store products that are subject to damage by the elements under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation and with adequate protection from wind.
5. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

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 standard warranty form furnished by individual manufacturer for a particular product and issued in the name of the Owner or endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner and issued in the name of the Owner or endorsed by manufacturer to Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included in the Project Manual, prepare a written document, using indicated form properly executed.

3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 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 Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Products and materials brought onto the Project Site, and products and materials incorporated into the Work, shall comply with relevant environmental laws.
7. Or Equal: For products specified by name and accompanied by the term "or equal," "or approved equal," or "or approved," or "or equivalent," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
 - a. Submit additional documentation required by Architect in order to establish equivalency of proposed products. Unless otherwise indicated, evaluation of "or equal" product status is by the Architect, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - a. Sole product may be indicated by the phrase "Subject to compliance with requirements, provide the following."
2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

- a. Sole manufacturer/source may be indicated by the phrase "Subject to compliance with requirements, provide products by the following."
3. Limited List of Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of products may be indicated by the phrase "Subject to compliance with requirements, provide one of the following."
4. Non-Limited List of Products: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed or an unnamed product that complies with requirements.
 - a. Non-limited list of products is indicated by the phrase "Subject to compliance with requirements, available products that may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of an unnamed product is not considered a substitution, if the product complies with requirements.
5. Limited List of Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - a. Limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, provide products by one of the following."
6. Non-Limited List of Manufacturers: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed or a product by an unnamed manufacturer that complies with requirements.
 - a. Non-limited list of manufacturers is indicated by the phrase "Subject to compliance with requirements, available manufacturers whose products may be incorporated in the Work include, but are not limited to, the following."
 - b. Provision of products of an unnamed manufacturer is not considered a substitution, if the product complies with requirements.
7. Basis-of-Design Product (Product Standard): Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications may additionally indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - a. For approval of products by unnamed manufacturers, comply with requirements in Section 01 2500 "Substitution Procedures" for substitutions for convenience.

- C. Descriptive Specification Requirements: Where Specifications describe a product, or assembly, listing exact characteristics required, without use of a brand or trade name, provide a product, material or assembly that provides the characteristics and otherwise complies with Contract requirements.
- D. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product or material is specified for a specific application.
 - 1. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
- E. Compliance with Standards, Codes and Regulations: Where Specifications only require compliance with imposed code, standard or regulation, select product that complies with standards, codes or regulations specified.
- F. Visual Matching Specification: Where Specifications require the phrase "match Architect's sample," provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 2500 "Substitution Procedures" for proposal of product.
- G. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or a similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.
 - 1. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
 - 2. Custom Range: Where Specifications include the phrase "custom range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.
 - 3. Special Custom Range: Where Specifications include the phrase "special custom range of colors patterns, textures" or similar phrase, Architect will select a new color, pattern, or texture different from those normally produced by the manufacturer.

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 the following requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those of the named basis-of-design (or standard) product. Significant product qualities include attributes, such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects, with project names and addresses and names and addresses of architects and owners, if requested.
 5. Samples, if requested.
- B. Architect's Action on Comparable Products Submittal: If necessary, Architect will request additional information or documentation for evaluation, as specified in Section 01 3300 "Submittal Procedures."
1. Form of Approval of Submittal: As specified in Section 01 3300 "Submittal Procedures."
 2. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- C. Submittal Requirements, Two-Step Process: Approval by the Architect of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.
- D. Submittal Requirements, Single-Step Process: When acceptable to Architect, incorporate specified submittal requirements of individual Specification Section in combined submittal for comparable products. Approval by the Architect of Contractor's request for use of comparable product and of individual submittal requirements will also satisfy other submittal requirements.

2.3 RESTRICTION OF HAZARDOUS SUBSTANCES

- A. Contractor agrees that it shall not knowingly after reasonable diligence and effort, incorporate into the Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of, the environment, including soil, the atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages in any of the activities prohibited in this paragraph, to the fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.
- B. In the event Contractor observes on the Project Site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on the Project Site, in a manner violative of any applicable environmental laws, Contractor shall immediately notify Owner and report the condition to Owner in writing. The Work in the

affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at the Project Site, to the fullest extent permitted by the law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

- C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about the Project Site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of the Project Site conducted as it deems appropriate, and Contractor shall be responsible for the cost of such studies to the extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 6000

SECTION 01 7300 - EXECUTION

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 general administrative and procedural requirements governing execution of the Work, including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of Owner-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 1000 "Summary" for coordination of Owner-furnished products, and limits on use of Project site.
 - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.
 - 3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
 - 4. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

1.3 DEFINITIONS

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

1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
 - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
 - a. Contractor's superintendent.
 - b. Trade supervisor responsible for cutting operations.
 - c. Trade supervisor(s) responsible for patching of each type of substrate.
 - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affected by cutting and patching operations.
 - 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- B. Layout Conference: Conduct conference at Project site.
 - 1. Prior to establishing layout of new perimeter and structural column grid, review building location requirements. Review benchmark, control point, and layout and dimension requirements. Inform Architect of scheduled meeting. Require representatives of each entity directly concerned with Project layout to attend, including the following:
 - a. Contractor's superintendent.
 - b. Professional engineer responsible for performing Project surveying and layout.
 - c. Professional engineer responsible for performing site survey serving as basis for Project design.
 - 2. Review meanings and intent of dimensions, notes, terms, graphic symbols, and other layout information indicated on the Drawings.
 - 3. Review requirements for including layouts on Shop Drawings and other submittals.
 - 4. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certified Surveys: Submit two copies signed by surveyor or professional engineer.
- C. Certificates: Submit certificate signed by surveyor or professional engineer, certifying that location and elevation of improvements comply with requirements.
- D. 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. Dates: Indicate when cutting and patching will be performed.
 5. 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.
 6. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.
- E. Retention System Certification: Submit a statement certified by the Contractor's registered structural engineer that the design of components of the excavation support system is in compliance with provisions of the Contract Documents and the local building code, and is in keeping with generally accepted engineering practice.
1. Submit, if requested, design calculations, specifications and erection drawings, bearing the Contractor's registered structural engineer's stamp, to the local building code official.
 2. Submit complete excavation support system shop drawings for information coordination purposes only.
 3. Architect/Engineer will neither review nor approve excavation support system shop drawings.
- F. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.6 QUALITY ASSURANCE

- A. Professional Engineer Qualifications: Refer to Section 01 4000 "Quality Requirements."
- B. Retention System Engineering: Each component of the excavation support system shall be designed by a registered structural engineer, in accordance with the local building code, and registered structural engineer shall be engaged by the Contractor.
- C. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
1. Structural Elements: When cutting and patching structural elements, or when encountering the need for cutting and patching of elements whose structural function is not known, notify Architect of locations and details of cutting and await directions from

- Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
 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.
- D. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of specified products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials. Use materials that are not considered hazardous.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 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 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, gas service piping, and water-service piping; underground electrical services; and other utilities.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
 - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - 1. Description of the Work, including Specification Section number and paragraph, and Drawing sheet number and detail, where applicable.
 - 2. List of detrimental conditions, including substrates.
 - 3. List of unacceptable installation tolerances.
 - 4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 INSTALLATION, GENERAL

- A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
 - 1. Respective manufacturer/fabricator's written installation instructions.
 - 2. Accepted submittals.
 - 3. Contract Documents.

- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by isolating metals and other materials from direct contact with incompatible materials.

3.3 PREPARATION

- A. Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.
- B. 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.
- C. 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.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect in accordance with requirements in Section 01 3100 "Project Management and Coordination."

3.4 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks and existing conditions. If discrepancies are discovered, notify Architect promptly.
- B. Engage a land surveyor or professional engineer experienced in laying out the Work, using the following accepted surveying practices:
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. 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.
- E. 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.

3.5 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: Within 30 days after completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.6 INSTALLATION

- A. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces, unless otherwise indicated on Drawings.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated, unless indicated otherwise in the Contract Documents.
- C. Install products at the time and under conditions that will ensure satisfactory results as judged by Architect. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations, so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy of type expected for Project.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on-site and placement in permanent locations.
- F. Tools and Equipment: Select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for Work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions with manufacturer.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 2. Allow for building movement, including thermal expansion and contraction.
 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed Work are not indicated, arrange joints for the best visual effect, as judged by Architect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

- K. Repair or remove and replace damaged, defective, or nonconforming Work.
 - 1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.7 CUTTING AND PATCHING

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of Work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements in Section 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, as judged by Architect. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

- a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
- b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

- a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch, corner to corner of wall and edge to edge of ceiling. Provide additional coats until patch blends with adjacent surfaces.
- b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.

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.

3.8 COORDINATION OF OWNER'S PORTION OF THE WORK

A. Site Access: Provide access to Project site for Owner's construction personnel.

1. Provide temporary facilities required for Owner-furnished, Contractor-installed products.
2. Refer to Section 01 1000 "Summary" for other requirements for Owner-furnished, Contractor-installed products.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.9 PROGRESS CLEANING

- A. Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers specifically intended for holding types of waste materials identified where applicable, e.g., blue colored containers with labeling and symbols for bio-waste.
 - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where Work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 01 Section "Temporary Facilities and Controls." and Division 01 Section "Construction Waste Management and Disposal", whichever is the more restrictive.
- H. Remove construction markings not required and graffiti immediately, repairing or replacing damaged material.
- 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 ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.10 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."

3.11 PROTECTION AND REPAIR OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Repair Work previously completed and subsequently damaged during construction period. Repair to like-new condition.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

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Construction Documents

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 and/or recycling nonhazardous demolition and construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Salvage / Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within 30 days of date established for commencement of the Work.

1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.

3. Total quantity of waste in tons.
 4. Total quantity of waste recovered (salvaged plus recycled) in tons.
 5. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. 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.
- D. 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.
- E. Waste Management Letter: Letter signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements have been met.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling 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.
 2. Review requirements for documenting quantities of each type of waste and its disposition.
 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements of this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. 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 site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
 - 2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
 - 3. 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.
- D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there were no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
 - 1. Total quantity of waste.
 - 2. Estimated cost of disposal (cost per unit). Include transportation and tipping fees and cost of collection containers and handling for each type of waste.
 - 3. Total cost of disposal (with no waste management).
 - 4. Revenue from salvaged/recycled materials.
 - 5. Savings in transportation and tipping fees that are avoided.
 - 6. Handling and transportation costs. Include cost of collection containers for each type of waste.
 - 7. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total nonhazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials.

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. 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, recycled, reused, donated, and sold.
 2. Comply with Section 01 5000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.
- 3.2 RECYCLING CONSTRUCTION WASTE, GENERAL
- A. 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.
- 3.3 DISPOSAL OF WASTE
- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 - B. Burning: Do not burn waste materials.
 - C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 7419

SECTION 01 7700 - CLOSEOUT 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 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.
 - 6. Attic stock provisions.
- B. Related Requirements:
 - 1. Section 01 2900 "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and Final Completion.
 - 2. Section 01 7823 "Operation and Maintenance Data" for additional 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 to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

1.3 ACTION SUBMITTALS

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

1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's "punch list"), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction, permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit 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.
 - 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 Owner's signature for receipt of submittals.
 - 5. Submit testing, adjusting, and balancing records.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
 6. Advise Owner of changeover in utility services.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements.
 10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
- E. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining Final Completion, complete the following:
1. Submit a final Application for Payment in accordance with Section 01 2900 "Payment Procedures."
 - a. If applicable, the final change order must be executed and included in the final application for payment before final completion can be achieved.
 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.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (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, listed by room or space number.
 2. Organize items applying to each space by major element, including categories for ceilings, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.
 4. Submit list of incomplete items in format agreed upon by the Owner and Architect.

1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties 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. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
 2. Submit on digital media acceptable to Architect.
- D. 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, as applicable, 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 not planted, mulched, or 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. Clean flooring, removing debris, dirt, and staining; clean according to manufacturer's recommendations.
 - i. Sweep concrete floors broom clean in unoccupied spaces. Mop where necessary.
 - j. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - k. 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.
 - l. Remove labels that are not permanent.
 - m. Remove all graffiti and construction writing.
 - n. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - r. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
 - s. Clean strainers.
 - t. 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 5000 "Temporary Facilities and Controls." and Section 01 7419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations required by Section 01 7300 "Execution" 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 all lamps and starters to comply with requirements for new fixtures.

C. All Warranties remain in effect.

3.3 ATTIC STOCK PROVISIONS

A. Where applicable, the following quantities of attic stock shall be provided:

1. Carpet: 50 LF per 600 SF.
2. Carpet Base: 200 LF.
3. Floor and Wall Tile (Restroom): 2 boxes.
4. Resilient Flooring: 2 boxes.
5. Sheet Vinyl: 250 SF.
6. Rubber Base 1 box/110 LF.
7. Paint: 5 interior colors and 1 exterior color, -6-8 gallons each.
8. Ceiling Panels, 2 Types: 4-5 cartons each.

END OF SECTION 01 7700

SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

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 preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory manuals.
 - 2. Emergency manuals.
 - 3. Systems and equipment operation manuals.
 - 4. Systems and equipment maintenance manuals.
 - 5. Product maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

1.3 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.

1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Owner.
 - 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.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect 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.
- E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

1.5 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:
 - 1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
 - 2. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
 - 3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

1.6 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.

2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

1.7 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
 1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Owner.
 4. Date of submittal.
 5. Name and contact information for Contractor.
 6. Name and contact information for 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. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

1.8 EMERGENCY MANUALS

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.
 - 2. Flood.
 - 3. Gas leak.
 - 4. Water leak.
 - 5. Power failure.
 - 6. Water outage.
 - 7. System, subsystem, or equipment failure.
 - 8. Chemical release or spill.
- D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- E. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

- B. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 2. Performance and design criteria if Contractor has delegated design responsibility.
 3. Operating standards.
 4. Operating procedures.
 5. Operating logs.
 6. Wiring diagrams.
 7. Control diagrams.
 8. Piped system diagrams.
 9. Precautions against improper use.
 10. License requirements including inspection and renewal dates.
- C. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
 2. Manufacturer's name.
 3. Equipment identification with serial number of each component.
 4. Equipment function.
 5. Operating characteristics.
 6. Limiting conditions.
 7. Performance curves.
 8. Engineering data and tests.
 9. Complete nomenclature and number of replacement parts.
- D. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
 2. Equipment or system break-in procedures.
 3. Routine and normal operating instructions.
 4. Regulation and control procedures.
 5. Instructions on stopping.
 6. Normal shutdown instructions.
 7. Seasonal and weekend operating instructions.
 8. Required sequences for electric or electronic systems.
 9. Special operating instructions and procedures.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.

1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
 - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
 - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranties and bonds as described below.
- C. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins; include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - a. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- E. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.
 - F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
 - G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
 - H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
 - I. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 1. Include procedures to follow and required notifications for warranty claims.
 - J. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
 1. Do not use original project record documents as part of maintenance manuals.
- 1.11 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
 - B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
 - C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
 - D. Product Information: Include the following, as applicable:
 1. Product name and model number.

2. Manufacturer's name.
 3. Color, pattern, and texture.
 4. Material and chemical composition.
 5. Reordering information for specially manufactured products.
- E. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
 2. Types of cleaning agents to be used and methods of cleaning.
 3. List of cleaning agents and methods of cleaning detrimental to product.
 4. Schedule for routine cleaning and maintenance.
 5. Repair instructions.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

SECTION 01 7839 - PROJECT RECORD DOCUMENTS

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 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 7300 "Execution" for final property survey.
 - 2. Section 01 7700 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 7823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal:
 - 1) Submit PDF electronic files of scanned record.
 - a) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record.
- 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.
- 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.

1.4 ELECTRONIC PROJECT MANAGEMENT SOFTWARE

- A. Electronic File of Project Record Documents: Provide Architect with an independent electronic archive of accepted project record documents using electronic project management software as defined in Section 01 3100 "Project Management and Coordination", in addition to the printed documents described elsewhere in this Section.

1.5 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation, where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations.
 - 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 prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

1.6 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation, where installation varies from that indicated in Specifications, addenda, and Contract modifications.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
 5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
- B. Format: Submit record specifications as scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.7 RECORD PRODUCT DATA

- A. 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.
- B. Format: Submit Record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
 1. Include Record Product Data directory organized by Specification Section number and title, electronically linked to each item of Record Product Data.

1.8 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 scanned PDF electronic file(s) of marked-up miscellaneous record submittals.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.9 MAINTENANCE OF RECORD DOCUMENTS

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7839

SECTION 01 7900 - DEMONSTRATION AND TRAINING

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 instructing Owner's personnel, including the following:
 - 1. Instruction in operation and maintenance of systems, subsystems, and equipment.
 - 2. Demonstration and training video recordings.

1.3 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.
- B. Qualification Data: For 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.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

- B. 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 instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals.

1.6 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.

- b. Systems and equipment operation manuals.
 - c. Systems and equipment maintenance manuals.
 - d. Product maintenance manuals.
 - e. Project Record Documents.
 - f. Identification systems.
 - g. Warranties and bonds.
 - h. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.

- c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning.
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Schedule training with Owner, with at least seven days' advance notice.
- C. 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.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.
- E. 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.

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MRI Replacement
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Intermountain Healthcare

Construction Documents

PART 2 - PRODUCTS

PART 3 - EXECUTION

END OF SECTION 01 7900

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-retardant-treated lumber at "knock-out panel" shielding wall.
 - a. Provide new wood studs only to extent that existing wood studs cannot be reused.

B. Related Requirements:

1. Section 06 1600 "Sheathing" for sheathing.

1.2 DEFINITIONS

- A. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- B. Lumber grading agencies, and abbreviations used to reference them, include the following:
1. NeLMA: Northeastern Lumber Manufacturers' Association.
 2. NLGA: National Lumber Grades Authority.
 3. WCLIB: West Coast Lumber Inspection Bureau.
 4. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
1. Include data for 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 in accordance with 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.

1.4 INFORMATIONAL SUBMITTALS

A. Material Certificates:

1. For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

1.5 DELIVERY, STORAGE, AND HANDLING

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

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

- ##### A.
- Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content:

1. Dimension Lumber: 19 percent unless otherwise indicated.

2.2 FIRE-RETARDANT-TREATED LUMBER

- ##### A.
- General: Where fire-retardant-treated materials are indicated, materials are to 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 in accordance with 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 is not to promote corrosion of metal fasteners.

2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 3. Design Value Adjustment Factors: Treated lumber is to be tested according to ASTM D5664 and design value adjustment factors are to be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency and other information required by authorities having jurisdiction.
- E. Application: Treat items indicated on Drawings, and the following:
1. Concealed blocking and framing.

2.3 DIMENSION LUMBER FRAMING

- A. Non-Load-Bearing Interior Partitions by Grade: Construction or No. 2 grade.
1. Application: Interior MRI shielding walls.
 2. Species:
 - a. Hem-fir; WCLIB, or WWP.

2.4 FASTENERS

- A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate wood studs to comply with requirements for attaching other construction.
- C. Provide framing as indicated and as required to support shielding assembly materials.

- D. 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.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code (IBC).
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.

3.2 INSTALLATION OF SHIELDING WALL FRAMING

- A. General: Provide wood studs in configuration indicated, matching existing. Fasten plates to supporting construction unless otherwise indicated.
 - 1. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced to match existing spacing.

END OF SECTION 06 1000

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. Rooftop equipment bases and support curbs.
 - 2. Wood blocking and nailers.
 - 3. Plywood backing panels.

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 for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness 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. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 3. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- 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, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 4. Plywood backing panels.

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. Rooftop equipment bases and support curbs.
- B. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Mixed southern pine or southern pine, No. 2 grade; SPIB.
 2. Eastern softwoods, No. 2 Common grade; NELMA.
 3. Northern species, No. 2 Common grade; NLGA.
 4. 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 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.5 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, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C1002, 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 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. 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.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- D. Do not splice structural members between supports unless otherwise indicated.

- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, toilet accessories, railings, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- G. 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.
- H. 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.

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 AND MRI SHIELDING KNOCKOUT WALLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. MRI shielding knock out wall sheathing.
 - a. Provide new sheathing only to extent that existing sheathing cannot be reused.
2. MRI shielding ceiling sheathing assemblies adjacent to knock out wall.
 - a. Provide new sheathing only to extent that existing sheathing cannot be reused.
3. MRI shielding floor sheathing assemblies adjacent to knock out wall.
 - a. Provide new sheathing only to extent that existing sheathing cannot be reused.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

A. Product Data:

1. Sheathing components of knock out wall, floor, and ceiling shielding assemblies.

B. Product Data Submittals: 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 plywood complies with requirements. Include physical properties of treated materials.
2. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency in accordance with ASTM D5516.
3. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

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

1. Fire-retardant-treated plywood.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. 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.

1.6 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 in accordance with 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 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested in accordance with 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. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Interior Type A: Treated materials are to have a moisture content of 28 percent or less when tested in accordance with ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 3. Design Value Adjustment Factors: Treated lumber plywood is to be tested in accordance with ASTM D5516 and design value adjustment factors are to be calculated in accordance with ASTM D6305. Span ratings after treatment are to be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

2.4 KNOCK-OUT WALL SHEATHING COMPONENTS OF MRI SHIELDING ASSEMBLIES

- A. Knockout Wall Plywood Sheathing, Walls and Ceilings: DOC PS 1, Exposure 1 sheathing.
 - 1. Nominal Thickness: Not less than 5/8 inch.
- B. Substrate with Copper Sheet Surface at Shielding Wall and Ceiling:
 - 1. Adhere 10 oz. copper sheet to outermost substrate surface. Use same substrate material as existing.
 - 2. Provide new substrate with copper sheet shielding surface only to extent that existing knockout wall is removed and existing materials cannot be reused.
- C. Hardboard with Copper Sheet Underlayment at Shielding Floor: ANSI A135.4, Class 4 (Service), Surface S1S; with back side sanded. Masonite hardboard or equal.
 - 1. Adhere 10 oz. copper sheet to hardboard surface.
 - 2. Provide underlayment nominal 1/4-inch thicknesses over smooth subfloors.
 - 3. Provide new hardboard with copper sheet underlayment only to extent that existing floor underlayment is removed and existing materials cannot be reused.
- D. Cement Board Flooring Substrate at Shielding Floor: ANSI A118.9 and ASTM C1325, with manufacturer's standard edges.
 - 1. USG; DUROCK Cement Board or equal.

2. Thickness: 1/2 inch.
3. Apply in 2 layers.
4. Provide new cement board flooring substrate only to extent that existing cement board substrate is removed and existing materials cannot be reused.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For knockout wall and adjacent floor and ceilings, use fasteners indicated, or if not indicated, as recommended by shielding contractor.
- B. Screws for Fastening Sheathing to Wood Framing: ASTM C1002.
- C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- 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 less than 0.0329 inch thick, use screws that comply with ASTM C1002.

2.6 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.
 1. Verify adhesive has a VOC content of 50 g/L or less.
- B. Brass T-Clips: As indicated in Drawings for shielding assembly. Provide new where existing cannot be reused.

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 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

- D. Coordinate exterior wall 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 INSTALLATION OF WOOD STRUCTURAL PANEL

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.

3.3 INSTALLATION OF GYPSUM SHEATHING

- 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.
- 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.
 2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Seal sheathing joints in accordance with 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.

3.4 INSTALLATION OF CEMENT BOARD FLOORING

- A. Install panels and treat joints in accordance with ANSI A108.11 and manufacturer's written instructions for type of application indicated.

3.5 INSTALLATION OF SHIELDING PANEL COMPONENTS

- A. Comply with MRI Shielding designer's recommendations and material manufacturer's written instructions for preparing and applying each type of material and assembly.

END OF SECTION 06 1600

SECTION 06 4116 - PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

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. Plastic-laminate-clad architectural cabinets.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-clad architectural cabinets that are not concealed within other construction.

- B. Related Requirements:

- 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.
 - 2. Section 12 3662 "Solid Surface Countertops" for countertops

1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.4 PREINSTALLATION MEETINGS

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

1.5 ACTION SUBMITTALS

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

- B. Shop Drawings:

- 1. Include plans, elevations, sections, and attachment details.
 - 2. Show large-scale details.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

C. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
 - a. Provide one sample applied to core material with specified edge material applied to one edge.
2. Thermoset Decorative Panels: 8 by 10 inches, for each color, pattern, and surface finish.
 - a. Provide edge banding on one edge.
3. Corner Pieces:
 - a. Cabinet-front frame joints between stiles and rails and at exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
4. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Certificates: For the following:
 1. Composite wood products.
 2. Thermoset decorative panels.
 3. High-pressure decorative laminate.
 4. Adhesives.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.

- B. Installer Qualifications: Manufacturer of products.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Build mockups of typical architectural cabinets as shown on Drawings.
 - 2. 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. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET MANUFACTURERS

- A. Fabricators: Subject to compliance with requirements, provide products by one of the following mills, certified by AWI:
 - 1. Firms certified by (AWI) Architectural Woodworking Institute:

- a. Advanced Cabinets
- b. Boswell Wasatch Mill.
- c. Contempo Cabinet & Mill.
- d. Fetzer Architectural Woodwork
- e. Granite Mill & Fixture Co.
- f. Huetter Mill & Cabinet Inc.
- g. Johnson Brothers Planing Mill Inc.
- h. Mapleleaf Cabinets, Inc.
- i. Masterpiece Commercial Millwork.
- j. Pacific Cabinets, Inc.
- k. Riverwoods Mill, Inc.

2.2 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Finish Schedule Item PL-1 (Wilsonart) product indicated in the Drawings, or a comparable product by one of the following:
 - a. Provide basis of design product, or, subject to compliance with requirements a comparable product approved by Architect by one of the following:
 - 1) Formica Corporation.
 - 2) Nevamar; a Panolam Industries International, Inc. brand.
 - 3) Pionite; a Panolam Industries International, Inc. brand.
 - 4) Wilsonart LLC.
- F. Chemical-Resistant, High-Pressure Decorative Laminate: NEMA LD 3, Grade HGP, and as follows:
 1. For cabinets installed in labs, laminate has the following ratings when tested with indicated reagents according to NEMA LD 3, Test Procedure 3.9.5:

- a. Nitric Acid (30 Percent): Moderate effect.
- b. Sulfuric Acid (77 Percent): Moderate effect.
- c. Hydrochloric Acid (37 Percent): Moderate effect.
- d. Phosphoric Acid (75 Percent): No effect.
- e. Acetic Acid (98 Percent): No effect.
- f. Formaldehyde: No effect.
- g. Ethyl Acetate: No effect.
- h. Ethyl Ether: No effect.
- i. Phenol (85 Percent): Moderate effect.
- j. Benzene: No effect.
- k. Xylene: No effect.
- l. Butyl Alcohol: No effect.
- m. Furfural: No effect.
- n. Methyl Ethyl Ketone: No effect.
- o. Sodium Hydroxide (25 Percent): No effect.
- p. Sodium Sulfide (15 Percent): No effect.
- q. Ammonium Hydroxide (28 Percent): No effect.
- r. Zinc Chloride: No effect.
- s. Gentian Violet: No effect.
- t. Methyl Red: No effect.

G. Laminate Cladding for Exposed Surfaces:

- 1. Horizontal Surfaces: Grade HGP.
- 2. Postformed Surfaces: Grade HGP.
- 3. Vertical Surfaces: Grade HGS.
- 4. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
- 5. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels, unless directed otherwise.

H. Materials for Semiexposed Surfaces:

- 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade CLS.
- 2. Drawer Sides and Backs: Thermoset decorative panels with PVC or polyester edge banding.
- 3. Drawer Bottoms: Thermoset decorative panels.

I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.

J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.

1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 1. As indicated on Finish Legend.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.
 1. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
 2. Softwood Plywood: DOC PS 1, medium-density overlay.
 3. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 08 7100 "Door Hardware."
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Sugatsune.
 - b. Accuride Corp.
 - c. CompX International, Inc.
 - d. Doug Mockett & Company, Inc.
 - e. Engineered Products Company.
 - f. Glynn-Johnson.
 - g. H.B. Ives Company.
 - h. Häfele America Company.
 - i. Julius Blum, Inc.
 - j. Knappe & Vogt.
 - k. Stanley Hardware.

- A. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- B. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- C. Wire Pulls: Back mounted, solid metal, 4 inches long, 1-1/2 inches deep, and 5/16 inch in diameter.
- D. Catches: Push-in magnetic catches, ANSI/BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal two-pin plastic with shelf hold-down clip.
- G. Drawer Slides: ANSI/BHMA A156.9.
 - 1. Grade 1: Side mounted.
 - a. Type: Full extension.
 - b. Material: Zinc-plated steel with polymer rollers.
 - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-overtravel-extension type; zinc-plated-steel ball-bearing slides.
 - 3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
 - 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
 - 6. For computer keyboard shelves, provide Grade 1HD-100.
 - 7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- H. Door Locks: ANSI/BHMA A156.11, E07121.
- I. Drawer Locks: ANSI/BHMA A156.11, E07041.
- J. Digital Cabinet Locks:
 - 1. Basis of Design: Digilock, Versa, Basic.
 - a. Lock Management: Managed with Manufacturer's Basic system.
 - b. Orientation: Standard Vertical with ADA knob at bottom.
 - c. Functionality: Both shared and assigned.
 - d. Mounting: Surface mounted.
 - e. Locking option: Flat cam type.
 - f. Power Source: Standard surface mount with (2) 2450 coin cell.
 - g. Finish: Brushed nickel.

- K. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- L. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Color: Black.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Aluminum, Clear Anodized: ANSI/BHMA 628.
 - 2. Satin Stainless Steel: ANSI/BHMA 630.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.6 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 4116

SECTION 07 8413 - PENETRATION FIRESTOPPING

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. Penetration firestopping systems for the following applications:

- a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in smoke barriers.

- B. Related Requirements:

- 1. Section 07 8443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

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

- B. Sustainable Design Submittals:

- 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.

- C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment

or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approval according to FM Approval 4991, "Approval Standard for Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.
- C. Properly install fire stop systems to prevent or retard the spread of fire, smoke, water, and gases through the building.
 - 1. In addition to other locations indicated or required by code, this requirement applies to openings designed for telecommunications use that may or may not be penetrated by cables, wires, or raceways.
 - 2. Provide proper fire stopping for all sleeves and slots per national and local codes.
 - 3. Install firestop material designed specifically for the building construction conditions.

1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.

- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics:

1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. Hilti, Inc.
 - c. Specified Technologies, Inc. (EZ-Path)
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

- D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
1. Sealant shall have a VOC content of 250 g/L or less.
 2. Sealant shall 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."
- E. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 4. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 5. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 6. Special Coating: Corrosion resistant on interior of fittings.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
 2. Substrate primers.
 3. Collars.
 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, 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: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 PROCEDURE REQUIREMENTS

- A. Install and seal penetrations (conduit, sleeves, slots, chases) into or through fire-rated barriers created by or made for or on the behalf of the Contractor to prevent the passage of smoke, fire, toxic gas, or water through the penetrations.
 - 1. Use a sleeve for all through-penetrations in a fire rated surface, regardless of penetration diameter or penetrating cable count.
 - 2. Install fire rated membrane penetrations in compliance with UL requirement, IBC Membrane Penetration requirement and Intermountain Healthcare master specification 26 05 33 Raceways, Cable Trays, and Boxes.
 - a. Use "Ring and string" method, directed by the Owner, only in non-fire-rated partitions.
- B. Provide intumescent mechanical systems in floor chases in an approved fashion in all openings.
- C. Provide firestopping in an approved manner in all openings where there are penetrations through walls.
- D. Submit training manuals to Owner with instructions on methods of adding or removing cabling to or from fire stopped sleeves and chases.
- E. Provide manufacturer recommended material for rated protection for any barrier.
- F. Laminate and permanently affix adjacent to chases the following information:
 - 1. Manufacturer of fire stop system.
 - 2. Date of installation/repair.
 - 3. Part and model numbers of system and all components.
 - 4. Name and phone numbers of local distributor and manufacturer's corporate headquarters.

- G. Obtain solutions and Shop Drawings/Submittals for fire stop materials and systems for written approval of materials/systems prior to purchase and installation.
- H. Install materials per Manufacturer instructions, that are UL-listed for intended use and meet NEC and locals codes for fire stopping measures.
- I. Distinctively color each chosen material so it is clearly distinguishable from other materials, adheres to itself, and maintains the characteristics for which it is designed to allow for the removal and/or addition of communication cables without the necessity of drilling holes in the material.
- J. Use fire stopping materials that maintain and establish the fire-rated integrity of the wall that has been penetrated.

3.4 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.5 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.
 - 1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of

penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.6 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.7 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

3.8 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Penetration Firestopping Systems with No Penetrating Items:
 1. UL-Classified Systems:

- a. C-AJ-0001-0999.
 - b. W-J-0001-0999.
 - c. W-L-0001-0999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- C. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing:
1. UL-Classified Systems:
 - a. C-AJ-1001-1999.
 - b. W-J-1001-1999.
 - c. W-L-1001-1999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- D. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing:
1. UL-Classified Systems:
 - a. C-AJ-3001-3999.
 - b. W-J-3001-3999.
 - c. W-L-3001-3999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- E. Penetration Firestopping Systems for Electrical Cables:
1. UL-Classified Systems:
 - a. W-J-3001-3999.
 - b. W-L-3001-3999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- F. Penetration Firestopping Systems for Cable Trays with Electric Cables:
1. UL-Classified Systems:

- a. C-AJ-4001-4999.
 - b. W-J-4001-4999.
 - c. W-L-4001-4999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- G. Penetration Firestopping Systems for Insulated Pipes:
1. UL-Classified Systems:
 - a. C-AJ-5001-5999.
 - b. W-J-5001-5999.
 - c. W-L-5001-5999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- H. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants:
1. UL-Classified Systems:
 - a. C-AJ-6001-6999.
 - b. W-L-6001-6999.
 - c. W-J-6001-6999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- I. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants:
1. UL-Classified Systems:
 - a. C-AJ-7001-7999.
 - b. W-J-7001-7999.
 - c. W-L-7001-7999.
 2. F-Rating: Hours matching rating of penetrated wall.
 3. T-Rating: Hours matching rating of penetrated wall.
 4. W-Rating: No leakage of water at completion of water leakage testing.
 5. Type of Fill Materials: As required to achieve rating.
- J. Penetration Firestopping Systems for Groupings of Penetrants:

1. UL-Classified Systems:
 - a. C-AJ-8001-8999.
 - b. W-J-8001-8999.
 - c. W-L-8001-8999.
2. F-Rating: Hours matching rating of penetrated wall.
3. T-Rating: Hours matching rating of penetrated wall.
4. W-Rating: No leakage of water at completion of water leakage testing.
5. Type of Fill Materials: As required to achieve rating.

END OF SECTION 07 8413

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. Silicone joint sealants.
 - 2. Nonstaining silicone joint sealants.
 - 3. Urethane joint sealants.
 - 4. Mildew-resistant joint sealants.
 - 5. Butyl joint sealants.
 - 6. Latex joint sealants.

- B. Related Requirements:

- 1. Section 07 9100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
 - 2. Section 07 9219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

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. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 1. Joint-sealant location and designation.
 2. Manufacturer and product name.
 3. Type of substrate material.
 4. Proposed test.
 5. Number of samples required.
- D. Field-Adhesion-Test Reports: For each sealant application tested.
- E. 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.

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.
 4. Sealant shall 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."

- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: 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.; SCS2000 SilPruf.
 - b. Pecora Corporation; 896-TBS.
 - c. Sika Corporation; Joint Sealants; Sikasil WS-295.
 - d. The Dow Chemical Company; Dow Corning® 791 Silicone Weatherproofing Sealant.

2.3 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether 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.; SCS7000.
 - b. Pecora Corporation; DynaTrol I-XL Tru-White.
 - c. Sika Corporation; Joint Sealants; SikaHyflex-150 LM.

2.4 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.

2.5 URETHANE JOINT SEALANTS

- A. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type S, Grade P, Class 25, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Corporation; MasterSeal SL 1 (Pre-2014: Sonolastic SL1).
 - b. Pecora Corporation; NR-201.
- B. 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.
- C. Urethane, M, NS, 25, T, NT: Multicomponent, nonsag, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C920, Type M, Grade NS, Class 25, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Bostik, Inc; Chem-Calk 505.
 - b. Master Builders Solutions; MasterSeal NP 2 (Pre-2014: Sonolastic NP2).
 - c. Sika Corporation; Joint Sealants; Sikaflex 2c NS EZ Mix.

2.6 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - b. Pecora Corporation; Pecora 860.
 - c. The Dow Chemical Company; DOW CORNING® 786 SILICONE SEALANT -.

2.7 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.

2.8 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Adfast; Adseal DWM 1090.
 - b. Everkem Diversified Products, Inc.; SilTex 40 Siliconized Acrylic Latex Caulk.
 - c. Pecora Corporation; AC-20.

2.9 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.

2.10 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.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.
 - b. Glass.
 - c. Porcelain enamel.
 - d. Glazed surfaces of ceramic tile.

- 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 flush joint profile according to Figure 8B in ASTM C1193, unless indicated otherwise.

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 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified third party testing agency to perform tests on the building envelope assembly and to submit reports.

3.7 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.

3.8 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - 2. Joint Sealant: Urethane, M, NS, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Perimeter joints between frames of doors windows and adjacent wall materials.
 - c. Control and expansion joints in ceilings and other 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.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - 2. Joint Sealant: Urethane, S, P, 25, T, NT.
 - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. 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.
 - b. Tile control and expansion joints.
 2. Joint Sealant: Urethane, S, NS, 25, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces subject to movement and required to be paintable.
1. Joint Locations:
 - a. Gypsum board to metal or wood trim.
 - b. Gypsum board to door and window frames, penetrating conduits and piping, light-fixtures, electrical cover plates, building specialty items, ductwork, grilles, supply diffusers, faucets, piping, escutcheon plates and similar items.
 - c. Woodwork to abutting surfaces
 2. Joint Sealant: STPE, S, NS, 50, NT.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces subject to movement and not required to be paintable.
1. Joint Locations:
 - a. Metal to metal.
 - b. Woodwork to abutting surfaces
 2. Joint Sealant: Silicone, S, NS, 50, NT
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
 - a. Control joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
 2. Joint Sealant: Acrylic latex.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Joints where USDA approval is required.
 - c. Tile control and expansion joints where indicated.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 50, NT.
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. Interior 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, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.

C. Samples for Verification:

1. Fabrication: Prepare Samples approximately 12 by 12 inches to demonstrate compliance with requirements for quality of materials and construction:
 - a. Doors: Show vertical-edge, top, and bottom construction; core construction; and hinge and other applied hardware reinforcement. Include separate section showing glazing if applicable.
 - b. Frames: Show profile, corner joint, floor and wall anchors, and silencers. Include separate section showing fixed hollow-metal panels and glazing if applicable.

- D. 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 fire-rated hollow-metal door and frame assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.
- B. Field quality control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.9 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. Republic Doors and Frames.
 - 4. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated on Drawings, based on testing at positive pressure according to NFPA 252 or UL 10C.

2.3 INTERIOR 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. Heavy-Duty Doors and Frames (Item HM on Door and Frame Schedule in the Drawings): ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B.
 - 1. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch (nominal 16 gage).

- b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
- 2. Exposed Finish: Prime for field finishing.

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. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. 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. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

C. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

D. 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.
 - 2. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
 - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
 - 3. Terminated Stops (Hospital Stops): Terminate stops 6 inches above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- B. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; 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.
 - b. Install frames with removable stops located on secure side of opening.
 - 2. Fire-Rated Openings: Install frames according to NFPA 80.
 - 3. 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.
 - 4. Solidly pack mineral-fiber insulation inside frames.
 - 5. 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. Testing Agency: Owner will engage a qualified third party testing agency to perform tests on the building envelope assembly and to submit reports.

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.

END OF SECTION 08 1113

SECTION 08 1416 - FLUSH WOOD 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. Five-ply flush wood veneer-faced doors for transparent finish.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.

- B. Related Requirements:

- 1. Section 06 4216 "Flush Wood Paneling" for requirements for veneers from the same flitches for both flush wood doors and flush wood paneling.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including the following:

- 1. Door core materials and construction.
 - 2. Door edge construction
 - 3. Door face type and characteristics.
 - 4. Door louvers.
 - 5. Door trim for openings.
 - 6. Factory-machining criteria.
 - 7. Factory-finishing specifications.

- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

- 1. Door schedule indicating door location, type, size, fire protection rating, and swing.

2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
3. Louver blade and frame sections, 6 inches long, for each material and finish specified.
4. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Special warranties.

B. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

C. Manufacturer's Certification: Licensed participant in AWI Quality Certification Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Delamination of veneer.
 - b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Wood Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

2.3 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI/AWMAC/WT's "Architectural Woodwork Standards."
 - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.
- B. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Composite Wood Products: Products shall be made using ultra-low-emitting formaldehyde resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Doors:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Eggers Industries.
 - b. Oshkosh Door Company.
 - c. VT Industries Inc.
 - 2. Performance Grade: ANSI/WDMA I.S. 1A Heavy Duty.
 - 3. Performance Grade:
 - 4. Architectural Woodwork Standards Grade: Premium.
 - 5. Faces: Single-ply wood veneer not less than 1/50 inch thick.
 - a. Species and Cut: Match species, cut and color of existing maple doors in area (Existing Door Basis of Design: Oshkosh Sliced White Maple, with Oshkosh 600-102 finish).
 - b. Match between Veneer Leaves: Match existing doors in area.
 - c. Assembly of Veneer Leaves on Door Faces: Match existing doors in area.
 - d. Pair and Set Match: Provide for doors hung in same opening.
 - e. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet or more.
 - 6. Exposed Vertical and Top Edges: Same species as faces or a compatible species - Architectural Woodwork Standards edge Type A.

- a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
 - b. Fire-Rated Pairs of Doors: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
7. Core for Non-Fire-Rated Doors:
- a. ANSI A208.1, Grade LD-1 particleboard.
 - 1) Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a) 5-inch top-rail blocking, in doors indicated to have closers.
 - b) 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - c) 5-inch midrail blocking, in doors indicated to have exit devices.
 - 2) Provide doors with glued-wood-stave cores instead of particleboard cores for doors scheduled to receive exit devices in Section 08 7100 "Door Hardware."
8. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.
- a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.
9. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: Flush rectangular beads.
 - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch-thick, cold-rolled steel sheet; with baked-enamel- or powder-coated finish; and approved for use in doors of fire-protection rating indicated on Drawings.
- C. Metal Louvers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Activar Construction Products Group, Inc.
 - b. Allegion plc.
 - c. Anemostat Products; a Mestek company.
 - d. ASSA ABLOY.
 - e. L & L Louvers, Inc.
 - f. McGill Architectural Products.
2. Blade Type: Vision-proof, inverted V.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, with baked-enamel- or powder-coated finish.

2.6 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated.
 1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 2. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied.
 1. Locate hardware to comply with DHI-WDHS-3.
 2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.
 3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
 4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
 5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Factory cut and trim openings through doors.
 1. Light Openings: Trim openings with moldings of material and profile indicated.
 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."
 3. Louvers: Factory install louvers in prepared openings.

2.7 FACTORY FINISHING

- A. Comply with referenced quality standard for factory finishing.
 1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

2. Finish faces, all four edges, edges of cutouts, and mortises.
 3. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
1. Architectural Woodwork Standards Grade: Premium.
 2. Finish: Basis of Design, matching existing: Oshkosh 600-102 Finish
 3. Staining: Match existing doors in area.
 4. Effect: Open-grain finish.
 5. Sheen: Match existing doors in area.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Examine wall openings to receive sliding doors for plumb, level, and square. Note: Finish door operation will be affected by out of tolerance framing.
 3. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 7100 "Door Hardware."
- B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. Install frames level, plumb, true, and straight.
1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
 2. Anchor frames to anchors or blocking built in or directly attached to substrates.
 - a. Secure with countersunk, concealed fasteners and blind nailing.
 - b. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork.
 - 1) For factory-finished items, use filler matching finish of items being installed.

3. Install fire-rated doors in accordance with NFPA 80.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Automatic operators.
 - 4. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Stile and Rail Wood Doors".
 - 4. Division 08 Section "Sound Control Hollow Metal Door Assemblies".
 - 5. Division 08 Section "Sound Control Wood Door Assemblies".
 - 6. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 7. Division 08 Section "Automatic Door Operators".
 - 8. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.

8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
 - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.
- E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- F. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

- C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Integrated Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.
- F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
 - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
 - 1. Function of building, purpose of each area and degree of security required.
 - 2. Plans for existing and future key system expansion.
 - 3. Requirements for key control storage and software.
 - 4. Installation of permanent keys, cylinder cores and software.
 - 5. Address and requirements for delivery of keys.
- I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representative(s) of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures
- J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 - 1. Structural failures including excessive deflection, cracking, or breakage.
 - 2. Faulty operation of the hardware.
 - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
 - 1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 - 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
 - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
 - 3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
 - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
 - a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
 - a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.2 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
 1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
 2. Manufacturers:
 - a. Pemko (PE).
- B. Continuous Double-Acting Hinges (Behavioral Health). ANSI/BHMA A156.26 Grade 1-300 Certified continuous hinges.
 1. Provide hinges with functions and features as follows:
 - a. ADA compliance meeting ICC/ANSI A117.1 (2009) for barrier free compliance.
 - b. CMS Compliance eliminating additional ligature points ensuring compliance for reimbursement through Centers for Medicare and Medicaid Services.
 - c. Opens 100° in either direction.
 - d. Built-in stop to prevent finger pinching.
 - e. Spans the entire opening height eliminating hinge side sight lines.
 - f. Provide an emergency release stop to create a complete anti-barricade system with a flush bolt that is used to release the door in emergency situations that allows it to swing in the opposite direction. Stop shall be supplied standard with Torx security screws and hospital tips.
 2. Manufacturers:
 - a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR) - DSH1000.
 - b. Pemko (PE) - DSH1000 Series.

2.3 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. McKinney (MK) - QC (# wires) Option.

- B. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Pemko (PE) - EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.

- C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.

2. Furnish dust proof strikes for bottom bolts.
 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Rockwood (RO).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
 6. Manufacturers:
 - a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match Facility Standard.
- C. Large Format Interchangeable Cores: Provide removable cores (LFIC) as specified, core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware.

- D. Keying System: Each type of lock and cylinders to be factory keyed.
 - 1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 - 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 - 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
 - 1. Change Keys per Cylinder: Two (2)
 - 2. Master Keys (per Master Key Level/Group): Five (5).
 - 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide temporary keyed construction cores.
- G. Key Registration List (Bitting List):
 - 1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 - 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ML2000 Series.
 - b. dormakaba BEST (BE) - 45H Series.

2.7 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.
 - 1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - CLX3300 Series.
 - b. dormakaba BEST (BE) - 9K Series.

2.8 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
 - 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
 - 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
 - 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
 - 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.
- B. Standards: Comply with the following:
 - 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
 - 2. Strikes for Bored Locks and Latches: BHMA A156.2.
 - 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
 - 4. Dustproof Strikes: BHMA A156.16.

2.9 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.
 - 1. Manufacturers:
 - a. HES (HS) - 1500/1600 Series.
- B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:
 - 1. Exit devices shall have a five-year warranty.
 - 2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
 - b. Von Duprin (VD) - 35A/98 XP Series.

2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Large body cast iron surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
 - a. Corbin Russwin Hardware (RU) - DC8000 Series.
 - b. LCN Closers (LC) - 4040XP Series.

2.12 ELECTROMECHANICAL DOOR OPERATORS

A. Electromechanical Door Operators (High Traffic): Provide ANSI/BHMA A156.19 Certified Products Directory (CPD) listed low energy operators that are UL325/991 and UL10C certified and comply with requirements for the Americans with Disabilities Act (ADA). Operators shall accommodate openings up to 250 pounds and 48" wide.

1. Provide operators with features as follows:
 - a. Non-handed with push and pull side mounting.
 - b. Activation by push button, hands-free or radio frequency devices.
 - c. Adjustable opening force and closing power.
 - d. Two-year limited warranty.
 - e. Wi-Fi interface where the operator is a secure, password protected WiFi hot spot with no connection to building's IT required.
 - 1) Simple setup with no app required.
 - 2) View status and make adjustments without removing the cover.
 - 3) Built-in logic to support single use restroom applications with no external relay boards, logic modules, position switches required.
 - f. Mounting backplate to simplify and speed up installation.
 - g. Integration with access control systems.
2. Operators shall have the following functionality:
 - a. Adjustable Hold Open: Amount of time a door will stay in the full open position after an activation.

- b. Blow Open for Smoke Ventilation: Door opens when signal is received from alarm system allowing air or smoke to flow through opening. Door will stay open until signal from alarm system is stopped.
- c. Emergency Interface Relay: Door closes and ignores any activation input until signal is discontinued.
- d. Infinite Hold Open: Door will hold open at set position until power is turned off.
- e. Latch Assist: At closed position, after an activation, the door is pulled in. After the door has closed, the door is pulled in to assist with latch release/engagement.
- f. Obstruction Detection: Door closes if it hits an obstruction while opening; door will reverse to open position if it hits an obstruction while closing. Door will stop once it hits an obstruction and will rest against the obstruction until removed.
- g. Open Delay: Delays operator opening for locking hardware.
- h. Outside Wall Switch Disable: When contact is closed, outside wall switch is disabled.
- i. Power Assist: Senses the door is being opened manually and applies small amount of power to assist the user in opening the door with force less than 5 lbs. The door opens only as far as it is moved manually, then closes once released.
- j. Power Close: Additional force to assist door closing between 7° and 2°.
- k. Presence Detector Input: Input for external sensor to detect presence at door open or close position only.
- l. Push & Go: As the door is manually opened, the operator "senses" movement and opens door to the full-open position.
- m. Selector Mode Switch: Off disables the signal inputs unless Blow Open is activated, on activates the signal inputs, hold open activates the unit (unless Blow Closed is activated) to the hold open position.
- n. Vestibule Delay: When the wall switch is pressed, first door in vestibule will open. Second door will open once vestibule door delay has expired. Delay is adjustable.
- o. Executive Mode Feature: When the door receives an activation signal it opens and remains open until either a second signal is received, or the door is manually moved in closing direction.

3. Manufacturers:

- a. ASSA ABLOY Entrance Systems (BE) - SW200 Series.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

- 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
- 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Rockwood (RO).

2.14 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood (RO).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).

2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Shop Installation: Install hardware on the doors prior to shipment to the jobsite. Field installed hardware will only be permitted as itemized below. Comply with all other Part 3 installation requirements.
 - 1. Extent of shop installed hardware shall include, but is not limited to:
 - a. Hanging devices.
 - b. Latching devices.
 - c. Operating trim.
 - d. Through-door wiring cables.
 - e. Door closers and overhead stops.
 - f. Flush bolts, surface bolts, and coordinating accessories.
 - g. Protective trim - protection plates, edge guards, trim protectors.
 - h. Coat hooks, viewers, and all other door mounted accessories.
 - 2. Hardware items which are permitted to be installed in the field include:
 - a. Door stops (wall, floor, other mounting).
 - b. Frame mounted closer brackets.
 - c. Lock and latch strike plates.
 - d. Frame wiring cables.
 - 3. Bench test shop installed work. This includes both mechanical and electrical components. Replace defective items.
 - 4. Ship field installed hardware items clearly labeled with the door number and attached to the door using shrink wrap. Include all templates and instructions which are required to complete the installation.

- B. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
- F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- G. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.
 - 2. Submit documentation of incomplete items in the following formats:

- a. PDF electronic file.
- b. Electronic formatted file integrated with the Openings Studio™ door opening management software platform.

- B. Fire Door Assembly Inspection: Reference Division 01 Sections "Closeout Procedures". Conduct an initial fire door assembly inspection, including documentation reporting, upon completion of door hardware installation according to NFPA 80 Standard for Fire Doors and Other Opening Protectives, paragraph 5.2.4, requirements.

3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. SU - Securitron
4. RO - Rockwood
5. RU - Corbin Russwin
6. VO - Von Duprin
7. SC - Schlage
8. HS - HES
9. RF - Rixson
10. LC - LCN Closers
11. BM - Besam
12. NO - Norton
13. AK - Alarm Controls
14. OT - Other
15. SA - Sargent Manufacturing

Hardware Sets

Set: 13.0

Doors: M101

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Passage Set	8215 LNMW	US26D	SA
1 Conc Overhead Stop	6ADJ-X36	630	RF

END OF SECTION 087100

SECTION 09 2216 - NON-STRUCTURAL 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. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
- B. Related Requirements:
 - 1. Section 05 4000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Evaluation Reports: For firestop tracks and post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- C. Studs and Tracks: ASTM C645.
 - 1. Steel Studs and Tracks:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) MarinoWARE.
 - 4) The Steel Network, Inc.
 - b. Minimum Base-Steel Thickness: 0.0329 inch.
 - c. Depth: As indicated on Drawings.
- D. Slip-Type Head Joints: Where indicated, provide the following:
 - 1. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich.
 - 3) MarinoWARE.
 - 4) The Steel Network, Inc.
- E. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CEMCO; California Expanded Metal Products Co.; FAS Track.
 - b. ClarkDietrich; BlazeFrame or MaxTrak.
 - c. Fire Trak Corp: Fire Trak System, attached to studs with Fire Trak Posi Klip.
 - d. The Steel Network, Inc.; VertiTrack VT.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ClarkDietrich; Backer Bar or Backing Plate.
 - b. Steel Construction Systems; Flat Strap and Blocking.
 2. Minimum Base-Steel Thickness: 0.0329 inch.
- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ClarkDietrich; Spazzer 9200.
 - b. Steel Construction Systems; Steel-Con CRC Cold Rolled Channel.
 2. Depth: 1-1/2 inches.
 3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ClarkDietrich.
 - b. MarinoWARE.
 - c. MBA Building Supplies.
 - d. MRI Steel Framing, LLC.
 - e. SCAFCO Steel Stud Company.

f. Steel Construction Systems.

2. Minimum Base-Steel Thickness: 0.0329 inch.
3. Depth: 7/8 inch.

2.3 SUSPENSION SYSTEMS

A. Hanger Attachments to Concrete:

B. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.

1. Depth: 2 inches.

C. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: 0.0329 inch.
 - b. Depth: As indicated on Drawings.
3. Hat-Shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: 0.0329 inch.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.

3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 5. Acoustic-Rated Partitions: Install framing to comply with acoustic-rated assembly indicated.
- E. Direct Furring:
 1. Attach to masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Hangers: 48 inches o.c.
 - 2. Carrying Channels (Main Runners): 48 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 2216

SECTION 09 2900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Interior gypsum board.

- B. Related Requirements:

- 1. Section 07 9219 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
 - 2. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Gypsum board, Type X.
 - 2. Gypsum ceiling board.
 - 3. Interior trim.
 - 4. Joint treatment materials.
 - 5. Sound-attenuation blankets.

- B. Samples for Verification: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

- 1. Build mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; 5/8" FireBloc® Type X Gypsum Wallboard.
 - b. CertainTeed Gypsum; CertainTeed Type X Gypsum Board.
 - c. National Gypsum Company; Gold Bond® Fire-Shield® Gypsum Board.
 - d. USG Corporation; USG Imperial® Gypsum Base, Firecode® X.
2. Thickness: 5/8 inch.
3. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; 1/2" LightRoc® Lightweight Gypsum Wallboard.
 - b. CertainTeed Gypsum; CertainTeed Interior Ceiling Gypsum Board.
 - c. National Gypsum Company; Gold Bond® Ceiling Board.
 - d. USG Corporation; USG Imperial® Sag-Resistant Interior Ceiling Gypsum Base.
2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet or plastic.
2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. L-Bead: L-shaped; exposed long flange receives joint compound.
 - d. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide the following products by the following manufacturer, or equivalent products approved by Architect, by another manufacturer:
 - a. Fry Reglet Corporation.
 - 1) "T" Molding (TDM-625-75).

- a) Size: 5/8 inch by 1/2 inch.
- 2) Drywall Reveal Molding (DRM-625-50).
 - a) Size: 5/8 inch by 1/2 inch.
- 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
- 3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use setting-type, sandable topping compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.6 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
 1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 07 9219 "Acoustical Joint Sealants."
 1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered

edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Type X: Vertical surfaces unless otherwise indicated.
 - 2. Ceiling Type: Ceiling surfaces.
 - 3. Acoustically Enhanced Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

- a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
3. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. Fastening Methods: Fasten base layers with screws; fasten face layers with adhesive and supplementary fasteners.
- D. Assure that assemblies are continuous and tightly caulked between spaces.

3.4 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings, or if not indicated, according to ASTM C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. L-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.

- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 5: All occupied areas.
 - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 2900

SECTION 09 5113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for interior ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
 - 1. Acoustical Panels: Set of 6-inch-square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Ceiling suspension-system members.
 - 2. Structural members to which suspension systems will be attached.
 - 3. Method of attaching hangers to building structure.
 - a. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.

4. Carrying channels or other supplemental support for hanger-wire attachment where conditions do not permit installation of hanger wires at required spacing.
5. Size and location of initial access modules for acoustical panels.
6. Items penetrating finished ceiling and ceiling-mounted items including the following:
 - a. Lighting fixtures.
 - b. Diffusers.
 - c. Grilles.
 - d. Speakers.
 - e. Sprinklers.
 - f. Access panels.
 - g. Perimeter moldings.
7. Show operation of hinged and sliding components covered by or adjacent to acoustical panels.
8. Minimum Drawing Scale: 1/4 inch = 1 foot.

B. Qualification Data: For testing agency.

C. Product Test Reports: For each acoustical panel ceiling, for tests performed by a qualified testing agency.

D. Evaluation Reports: For each acoustical panel ceiling suspension system and anchor and fastener type, from ICC-ES.

E. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
3. Impact Clips: Equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockup of typical ceiling area in location as directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Suspended ceilings shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index: Class A according to ASTM E1264.
 2. Smoke-Developed Index: 50 or less.

2.3 GENERAL ACOUSTICAL PANELS

- A. Basis-of-Design Product: Item ACP-1 (Armstrong Ceiling & Wall Solutions; Ultima® Square Lay-In) as indicated on Finish Legend in Drawings.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.
- C. Classification: Provide panels as follows:
 - 1. Type and Form: Type IV, mineral base with membrane-faced overlay; Form 2, water felted; with acoustically transparent latex finish.
 - 2. Pattern: E (lightly textured)
- D. Color: White.
- E. Light Reflectance (LR): Not less than 0.88.
- F. Ceiling Attenuation Class (CAC): Not less than 35.
- G. Noise Reduction Coefficient (NRC): Not less than 0.75.
- H. Edge/Joint Detail: Square.
- I. Thickness: 3/4 inch.
- J. Modular Size: 24 by 24 inches.
- K. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D3273, ASTM D3274, or ASTM G21 and evaluated according to ASTM D3274 or ASTM G21.

2.4 TYPICAL METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Armstrong Ceiling & Wall Solutions.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) type.
3. Face Design: Flat, flush.
4. Cap Material: Cold-rolled steel.
5. Cap Finish: Painted white.

2.5 MRI METAL SUSPENSION SYSTEM

- A. Basis of Design: Subject to compliance with requirements, provide the following or an equivalent product approved by Architect, from another Manufacturer:
 1. Armstrong Ceiling & Wall Solutions; ARMSTRONG® Clean Room™ Ceiling Systems.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, aluminum suspension system and non-magnetic accessories according to ASTM C635/C635M and designated by type, structural classification, and finish indicated.
- C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- D. MRI; Wide-Face, Double-Web, Metal Suspension System: Main and cross runners formed from extruded aluminum to produce structural members with prefinished 15/16-inch-wide flanges.
 1. Structural Classification: Heavy-duty system.
 2. Face Design: Flat, flush.
 3. Face Finish: Painted white.
 4. Location: MRI rooms.

2.6 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 1. At MRI Rooms, provide non-magnetic attachment devices
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
 2. Stainless-Steel Wire: ASTM A580/A580M, Type 304, nonmagnetic.
 3. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- C. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

- E. Angle Hangers: Angles with legs not less than 7/8-inch-wide; formed with 0.04-inch-thick, galvanized-steel sheet complying with ASTM A653/A653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
- F. Impact Clips: Manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.
- G. Seismic Clips: Manufacturer's standard seismic clips designed to secure acoustical panels in place during a seismic event.
- H. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- I. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.

2.7 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Armstrong World Industries, Inc.
- B. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Edge moldings shall fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
 - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
 - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C. MRI, Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils. Comply with ASTM C635/C635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C636/C636M, seismic design requirements, and manufacturer's written instructions.
 - 1. Use only non-magnetic suspended ceiling assembly components in MRI room.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and

- appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to long axis of space.
 - c. Install panels in a basket-weave pattern.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

4. Install impact and seismic clips in areas indicated; space according to panel manufacturer's written instructions unless otherwise indicated.
5. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
 1. Periodic inspection during the installation of suspended ceiling grids according to ASCE/SEI 7.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages and when installation of ceiling suspension systems on each floor has reached 20 percent completion, but no panels have been installed. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations of acoustical panel ceiling hangers show compliance with requirements.
 1. Within each test area, testing agency will select one of every 10 power-actuated fasteners and postinstalled anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two postinstalled anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
 2. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers, anchors, and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

SECTION 09 6516 - RESILIENT SHEET FLOORING

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 vinyl sheet flooring.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient sheet flooring.
 - 1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
 - 2. Provide seaming plan for architect's approval.
 - 3. Show details of special patterns.
- C. Samples for Verification: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of resilient sheet flooring required.
 - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.
 - 1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - a. Size: Minimum 100 sq. ft. for each type, color and pattern in locations directed by Architect.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- B. Flooring products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 UNBACKED HOMOGENOUS SHEET FLOORING

- A. Basis of Design Manufacturer: Provide Items SG-2 and SG-3 (Tarkett; iQ Optima) as indicated on Finish Legend in the Drawings.
- B. Thickness: 0.080 inch.
- C. Wearing Surface: Smooth.
- D. Sheet Width: 6 foot 6 inches wide.
- E. Seamless-Installation Method: Heat welded.

- F. Colors and Patterns: As indicated on Finish Legend in Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.
- C. Seamless-Installation Accessories:
 - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.
 - a. Color: As selected by Architect from manufacturer's full range to contrast with flooring.
- D. Integral-Flash-Cove-Base Accessories: Items IC and IC6 in finish schedule.
 - 1. Heights:
 - a. IC: 4 inches.
 - b. IC6: 6 inches.
 - 2. Cove Strip: 1-inch radius provided or approved by resilient sheet flooring manufacturer.
 - 3. Cap Strip: Aluminum cap provided or approved by resilient sheet flooring manufacturer.
 - 4. Corners: Aluminum inside and outside corners and end stops provided or approved by resilient sheet flooring manufacturer.
- E. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

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

3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.
- B. Seaming Plan Approval: Obtain Architect's approval of seaming plan prior to installation of sheet flooring.
 - 1. Do not place seams at middles of corridors.
- C. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.
 - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient sheet flooring as follows:
 - 1. Maintain uniformity of flooring direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
 - 3. Match edges of flooring for color shading at seams.
 - 4. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
 - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 4 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
 - 1. Install metal corners at inside and outside corners.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

- B. Perform the following operations immediately after completing resilient sheet flooring installation:
 - 1. Remove adhesive and other blemishes from surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.
 - 1. Apply three coats.
- E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 6516

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.
- B. Sherwin Williams Contractor Job Tracking Form. See end of this Section. Comply with Intermountain Healthcare paint requirements.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel and iron.
 - 2. Galvanized metal.
 - 3. Plastic.
 - 4. Gypsum board.
 - 5. Cotton or canvas insulation covering.
 - 6. ASJ insulation covering.
- B. Related Requirements:
 - 1. Section 05 1200 "Structural Steel Framing" for shop priming structural steel.
 - 2. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

- A. MPI Gloss Level 3 (eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.
- B. MPI Gloss Level 4 (satin-like): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.
- C. MPI Gloss Level 5 (semigloss): 35 to 70 units at 60 degrees, according to ASTM D523.
- D. 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. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
 - 2. Indicate VOC content.
- B. Submitted products must meet or exceed performance levels of basis of design products listed in each category.
- C. Samples for Initial Selection: For each type of topcoat product.
- D. 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. 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 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 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected 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 paint system.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other 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 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 1. Sherwin-Williams Company (The).

2.2 PAINT, 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. Use product that are Greenguard Certified for Low Chemical Emissions.
- B. 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. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 100 g/L.
3. Dry-Fog Coatings: 150 g/L.
4. Primers, Sealers, and Undercoaters: 100 g/L.
5. Rust-Preventive Coatings: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.

- C. Colors: As indicated on Finish Legend in the Drawings, or if not indicated, as selected by Architect from manufacturer's full range.

1. Refer to items P-1, P-2, P-3, and P-5 for walls and ceiling colors.
2. Refer to item P-4 for metal doors, frames, and trim color.
3. Refer to item EP-1 for wet wall locations.

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 paints 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. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- 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.
- 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 paints.
- G. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

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.
 6. Do not paint finish copper, bronze, chromium plate, nickel, stainless steel, anodized aluminum, or monel metal except as explicitly indicated or specified.
- 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.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

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:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, rust-inhibitive, water based.
 - 1) Sherwin-Williams: Pro Industrial: Pro-Cryl Universal Primer - B66W01310.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light industrial coating, interior, water based, semi-gloss (MPI Gloss Level 5).
 - 1) Sherwin-Williams: Pro Industrial; Acrylic Semi-Gloss Coating – B66-650 Series.
- B. Galvanized-Metal Substrates:

1. Water-Based Dry-Fall System:
 - a. Prime Coat: Primer, rust-inhibitive, water based.
 - 1) Sherwin-Williams: Pro Industrial: Pro-Cryl Universal Primer - B66W01310.
 - b. Topcoat: Dry fall, water based, for galvanized steel, egg-shell (MPI Gloss Level 3).
 - 1) Sherwin-Williams: Pro Industrial; Waterborne Acrylic DryFall Eg-Shel - B42-82.
- C. Plastic Substrates:
 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer, complying with VOC code requirements, as recommended by topcoat manufacturer for copper substrates.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 5).
 - 1) Sherwin-Williams: ProMar 200 HP Zero VOC; Interior Acrylic Semi-Gloss - B31-1900 Series.
- D. Gypsum Board Substrates: Offices and back of house walls and ceilings.
 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - 1) Sherwin-Williams: Quick Dry Stainblocking; Interior/Exterior Latex Primer - B51W08670.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural (MPI Gloss Level 3).
 - 1) Sherwin-Williams: ProMar 200 HP Zero VOC; Interior Acrylic Semi-Gloss - B31-1900 Series.
- E. Gypsum Board Substrates: Procedural Rooms, Mechanical Rooms, Data Closets, Electrical Rooms, and other walls often requiring cleaning.
 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
 - 1) Sherwin-Williams: Quick Dry Stainblocking; Interior/Exterior Latex Primer - B51W08670.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.

- c. Topcoat: Latex, interior, institutional low odor/VOC, semi-gloss (MPI Gloss Level 5).
 - 1) Sherwin-Williams: ProMar 200 HP Zero VOC; Interior Acrylic Semi-Gloss – B31-1900 Series.
- F. Gypsum Board Substrates: Toilet Room walls and ceilings.
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - 1) Sherwin-Williams: Quick Dry Stainblocking; Interior/Exterior Latex Primer - B51W08670.
 - b. Intermediate Coat: Interior, water based epoxy, matching topcoat.
 - c. Topcoat: Interior, water based epoxy, semi-gloss (MPI Gloss Level 5).
 - 1) Sherwin-Williams: Pro Industrial; Pro Industrial Pre-Catalyzed Waterbased Epoxy Semi-Gloss - K46 Series.
 - d. Color: EP-1 as indicated on Finish Legend in Drawings.
- G. Cotton or Canvas and ASJ Insulation-Covering Substrates: Including pipe and duct coverings.
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, latex, interior.
 - 1) Sherwin-Williams: Quick Dry Stainblocking; Interior/Exterior Latex Primer - B51W08670.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC (MPI Gloss Level 3).
 - 1) Sherwin-Williams: ProMar 200 HP Zero VOC; Interior Acrylic Eg-Shel - B20-1900 Series.

END OF SECTION 09 9123

SECTION 12 3662 - SOLID SURFACING COUNTERTOPS

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. Solid surface material countertops.
 - 2. Solid surface material backsplashes.
 - 3. Solid surface material end splashes.

- B. Related Requirements:

- 1. Section 05 5000 "Metal Fabrications" for countertop support brackets with vertical leg concealed in wall.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.

- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.

- 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.

- C. Samples for Initial Selection: For each type of material exposed to view.

- D. Samples for Verification: For the following products:

- 1. Countertop material, 6 inches square.
 - 2. One full-size solid surface material countertop, with front edge and backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.
- C. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and execution.
 - 1. Build mockup of typical countertop.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.8 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis of Design: Item SS-1 (E. I. du Pont de Nemours and Company; Corian.) as indicated on Finish Legend in the Drawings.
 - a. Provide basis of design product or equivalent product complying with requirements and approved by Architect prior to bid, by one of the following:
 - 1) Formica Corporation.
 - 2) Samsung Chemical USA, Inc.

- 3) Swan Corporation (The).
- 4) Wilsonart LLC.

2. Type: Provide Standard type unless Special Purpose type is indicated.

B. Colors and Patterns: As indicated.

2.2 COUNTERTOP FABRICATION

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WT's "Architectural Woodwork Standards."

1. Grade: Custom

B. Use backing materials that comply with requirements of the BOH (Board of Health)

C. Configuration:

1. Front: 1/8" eased edge or as indicated in drawings.
2. Backsplash: Radius edge with 3/8-inch radius.
3. End Splash: Matching backsplash.

D. Countertops: 3/4-inch- thick, solid surface material with front edge built up with same material.

E. Backsplashes: 3/4-inch- thick, solid surface material.

F. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.

1. Fabricate with loose backsplashes for field assembly.
2. Install integral sink bowls in countertops in the shop.

G. Joints: Fabricate countertops without joints.

H. Joints: If countertop cannot be made without joints, fabricate countertops in sections for joining in field, with joints at locations indicated.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints where indicated. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

I. Cutouts and Holes:

1. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
2. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
 1. Verify adhesives have a VOC content of 70 g/L or less.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.
- D. Secure countertops to subtops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.

- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- H. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3662

SECTION 21 1000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following fire-suppression piping inside the building:
1. Wet-pipe sprinkler systems.
 2. Preaction sprinkler systems single interlock.
 3. Description: Portions of the existing building being remodeled will have existing sprinkler heads removed and replaced and arranged to match new floor plan.
- B. Related Sections include the following:
1. Division 10 Section "Fire Extinguisher Cabinets" and "Fire Extinguishers" for cabinets and fire extinguishers.
 2. Division 22 Section "Facility Water Distribution Piping" for piping outside the building.
 3. Division 28 Section "Fire Detection and Alarm" for alarm devices not specified in this Section.
- C. Size fire sprinkler system to allow for expansion.
- D. All black steel sprinkler pipe shall have a wall thickness less than or equal to schedule 40 and greater than schedule 10.
1. Exception: Pipe with a nominal pipe size of 6 inches and greater may be schedule 10.

E. Summary Table:

Item	Summary
Underground service entrance piping	Ductile Iron, restrained as required, with thrust blocks, transitioned with bolted flange.
Interior pipe type	Mains: Schedule 40 Branchlines: Threadable thinwall or schedule 40
Sprinkler Finish	Flat Plate Concealed, except uprights and storage
Extended Coverage	Not Allowed
Center of Tile	Required, Center thirds are acceptable for rectangular tiles
Flexible Sprinkler Drops	Designers' preference

FM Global	Yes Area reduction for quick response sprinklers is not allowed
Calculations	Required, use reduced flow data
Alarm Device	Horn/Strobe
FDC	Flush Polished Brass 2-inlet Coordinate installation with local Fire Department
Coordination	All sprinkler piping exposed to view shall be coordinated with the architect prior to final design acceptance.

1.3 DEFINITIONS

- A. CPVC: Chlorinated polyvinyl chloride plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. High-Pressure Piping System: Fire-suppression piping system designed to operate at working pressure higher than standard 175 psig.
- D. PE: Polyethylene plastic.
- E. Underground Service-Entrance Piping: Underground service piping below the building.

1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

- A. Standard Piping System Component Working Pressure: Listed for at least 175 psig.
- B. High-Pressure Piping System Component Working Pressure: Listed for 250 psig minimum 300 psig.
- C. Fire-suppression standpipe system design shall be approved by authorities having jurisdiction.
 - 1. Minimum residual pressure at each hose-connection outlet is the following:
 - a. NPS 1-1/2 Hose Connections: 65 psig.
 - b. NPS 2-1/2 Hose Connections: 100 psig.

2. Unless otherwise indicated, the following is maximum residual pressure at required flow at each hose-connection outlet:
 - a. NPS 1-1/2 Hose Connections: 100 psig.
 - b. NPS 2-1/2 Hose Connections: 175 psig.
- D. Design sprinkler piping according to the following and obtain approval from engineer, prior to submitting to other authorities having jurisdiction:
 1. Design sprinkler system with the following 10% reduced flow data:

Flow data available at 1000 W 1000 N in Tremonton.

Static – 87 psi

Residual – 68 psi @ 1,443 gpm flowing

Date of Test –12/10/2024 Flow test by Tremonton City Public Works
 2. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 3. Sprinkler Occupancy Hazard Classifications:
 - a. Automobile Parking Areas: Ordinary Hazard, Group 1.
 - b. Building Service Areas: Ordinary Hazard, Group 1.
 - c. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - d. General Storage Areas: Ordinary Hazard, Group 1.
 - e. Laundries: Ordinary Hazard, Group 1.
 - f. Libraries, Except Stack Areas: Light Hazard.
 - g. Library Stack Areas: Ordinary Hazard, Group 2.
 - h. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - i. Office and Public Areas: Light Hazard.
 - j. Residential Living Areas: Light Hazard.
 - k. Restaurant Service Areas: Ordinary Hazard, Group 1.
 4. Sprinkler Occupancy Hazard Classifications per FM Global:
 - a. Automobile Parking Areas: Hazard Class 2.
 - b. Building Service Areas: Hazard Class 1.
 - c. Electrical Equipment Rooms: Hazard Class 2.
 - d. General Storage Areas: Hazard Class 1.
 - e. Laundries: Hazard Class 1.
 - f. Libraries: Hazard Class 1.
 - g. Mechanical Equipment Rooms: Hazard Class 2.
 - h. Office and Public Areas: Hazard Class 1.
 - i. Residential Living Areas: Hazard Class 1.
 - j. Restaurant Service Areas: Hazard Class 1.

- k. Exterior hangovers and Attic Spaces: per FM DS 1-12
 - 5. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
 - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
 - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
 - d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
 - e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
 - f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
 - 6. Sprinkler Design Demands for Hazard Categories with ceilings up to 30 ft.:
 - a. Hazard Class 1-Wet: 0.10 gpm over 1500-sq. ft. area.
 - b. Hazard Class 1-Dry: 0.10 gpm over 1500-sq. ft. area.
 - c. Hazard Class 2-Wet: 0.20 gpm over 2500-sq. ft. area.
 - d. Hazard Class 2-Dry: 0.20 gpm over 3500-sq. ft. area.
 - e. Hazard Class 3-Wet: 0.30 gpm over 2500-sq. ft. area.
 - f. Hazard Class 3-Dry: 0.30 gpm over 3500-sq. ft. area.
 - 7. Minimum Sprinkler K-Factors for Hazard Categories with ceilings up to 30 ft.:
 - a. Hazard Class 1: K5.6, 155 deg. F
 - b. Hazard Class 2: K8.0, 155 deg. F
 - c. Hazard Class 3: K11.2, 286 deg. F
 - 8. Maximum Protection Area per Sprinkler: Per UL listing. Per FM Approval
 - 9. Total Combined Hose-Stream Demand Requirement: According to NFPA 13, unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
 - c. Extra-Hazard Occupancies: 500 gpm for 90 to 120 minutes.
 - 10. Total Combined Hose-Stream Demand Requirement for ceilings under 60 ft. Per FM Global:
 - a. Hazard Class 1: 250 gpm for 60 minutes.
 - b. Hazard Class 2: 250 gpm for 60 to 90 minutes.
 - c. Hazard Class 3: 500 gpm for 90 to 120 minutes.
 - 11. Sprinklers are to be installed throughout the premises, as required by NFPA 13.
- E. Seismic Performance: Fire-suppression piping shall be capable of withstanding the effects of earthquake motions determined according to NFPA 13 and FM Global Data Sheet 2-8.

1.6 SUBMITTALS

A. Product Data: For the following:

1. Piping materials, including dielectric fittings, flexible connections, and sprinkler specialty fittings.
2. Pipe hangers and supports, including seismic restraints.
3. Valves, including listed fire-protection valves, unlisted general-duty valves, and specialty valves and trim.
4. Air compressors, including electrical data.
5. Sprinklers, escutcheons, and guards. Include sprinkler flow characteristics, mounting, finish, and other pertinent data.
6. Fire department connections, including type; number, size, and arrangement of inlets; caps and chains; size and direction of outlet; escutcheon and marking; and finish.
7. Alarm devices, including electrical data.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Fire-hydrant flow test report.

D. Seismic Calculations.

E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations, if applicable. Drawings are to be approved by Engineer prior to submission to State Fire Marshal. Drawings are to be submitted to FM Global prior to submission to Engineer.

1. Installation and Fabrication drawings indicating the location of rigid and flexible couplings, seismic separation assemblies, planned clearance cut-outs between piping and solid structural members for seismic movement, and any additional anchoring points required for ceiling systems where sprinklers are fixed or supported in accordance with NFPA and FM Global Data Sheet 2-8.

F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13 and NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping."

G. Welding certificates.

H. Field quality-control test reports.

I. Operation and Maintenance Data: For standpipe and sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. An experienced installer who has designed and installed fire-suppression piping similar to that indicated for this Project and obtained design approval and inspection approval from authorities having jurisdiction. The Engineer requires evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor, who cannot show such experience, may be found not suitable to perform the work. The following are the approved contractors for this project:
 - a. PRE-APPROVED CONTRACTORS LIST
 - 1) A&D Fire
 - 2) Alta Fire
 - 3) Blazemaster Fire Protection
 - 4) Broken Arrow Fire Protection
 - 5) Certified Fire
 - 6) Delta Fire
 - 7) FireTrol
 - 8) FireFly Fire Protection
 - 9) Interwest Fire Protection
 - 10) Kimco Fire
 - 11) Quality Fire Protection
 - 12) Pye Barker Co.
 - 13) State Fire DC Specialties
 - 14) Summit Fire & Security
 - 15) The Safety Team (TST)
 - 16) Western Automatic Sprinkler Co.
 - 17) Or prior approved equal
 - b. A contractor not listed in the "PRE-APPROVED CONTRACTORS LIST" must receive prior approval from the engineer to bid this project.
- B. Installer's responsibilities include designing, fabricating, and installing fire-suppression systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 1. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer or NICET Level III technician.
- C. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
- D. NFPA Standards: Fire-suppression-system equipment, specialties, accessories, installation, and testing shall comply with the following:
 1. NFPA 13, "Installation of Sprinkler Systems."
 2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."
- E. International Conference of Building Code Officials codes and standards complying with the following:

1. IBC-2021, "International Building Code."
2. IFC-2021, "International Fire Code."

F. Utah Amendments

1. Title 15A

G. FM Global Property Loss Prevention Data Sheets:

1. 1-12
2. 2-0
3. 2-8
4. 3-0
5. 3-10
6. 3-26
7. 8-9

1.8 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Sprinkler Cabinets: Finished, wall-mounting, steel cabinet with hinged cover, with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler on Project.

1.10 General Engineering Quality

- A. Unless noted otherwise the following applies:
1. The maximum water velocity shall not exceed 32-fps.
 2. Submit the calculations using the reduced flow data.
 3. When calculating flexible drops, the contractor shall use the maximum number of bends for the associated length. The value is to be taken from the UL tests (unless the material is only FM approved).
 4. In the event of multiple (3) submittal rejections (including revise and resubmit) a meeting shall be held at the engineer's office at the engineer time of choosing and the designer, fire sprinkler contractor, and general contractor shall be physically in attendance to discuss the required modifications to the design.

1.11 Contract Completion

A. Incomplete and Unacceptable work:

1. If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor, then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. All products to be FM Global approved.

2.2 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell end and plain end.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, Class 53, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron gland, rubber gasket, and steel bolts and nuts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell end and plain end.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
2. Gaskets: AWWA C111, rubber.

2.3 C-900 TUBE AND FITTINGS

A. PVC, AWWA Pipe: AWWA C900, Class 150, with bell end with gasket and spigot end.

1. Comply with UL 1285 for fire-service mains if indicated.
2. PVC Fabricated Fittings: AWWA C900, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Gaskets: AWWA C111, rubber.
5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 STAINLESS STEEL IN BUILDING RISER

- A. Continuous from the factory, no field formed fittings in the stainless-steel riser. Field modifications are not allowed. Restrain with thrust block, per NFPA 24, rods as required by manufacture.
 1. Inlet: AWWA C900/DIP
 2. Outlet: AWWA 606

2.5 STEEL PIPE AND FITTINGS

- A. Threaded-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed threaded ends.
 1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe hot-dip galvanized where indicated. Include ends matching joining method.
 5. Steel Threaded Couplings: ASTM A 865 hot-dip galvanized-steel pipe where indicated.
- B. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe not allowed.
 1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.
- C. Plain-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795 hot-dip galvanized-steel pipe not allowed.
 1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 2. Steel Flanges and Flanged Fittings: ASME B16.5.

- D. Grooved-End, Standard-Weight Steel Pipe: ASTM A 53/A 53M, ASTM A 135, or ASTM A 795, hot-dip galvanized where indicated and with factory- or field-formed, roll-grooved ends.
1. Grooved-Joint Piping Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.
 - 2) Bull Moose Tube Co.
 - 3) Grinnell (Tyco)
 - 4) Victaulic Co. of America.
 - 5) Wheatland Tube
 - b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.
 - c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.
- E. Threaded-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed threaded ends.
1. Cast-Iron Threaded Flanges: ASME B16.1.
 2. Malleable-Iron Threaded Fittings: ASME B16.3.
 3. Gray-Iron Threaded Fittings: ASME B16.4.
 4. Steel Threaded Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, seamless steel pipe.
 5. Steel Threaded Couplings: ASTM A 865.
- F. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10 not allowed.
1. Locking-Lug Fittings: UL 213, ductile-iron body with retainer lugs that require one-quarter turn to secure pipe in fitting not allowed.
- G. Plain-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10 not allowed.
1. Steel Welding Fittings: ASTM A 234/A 234M, and ASME B16.9 or ASME B16.11.
 2. Steel Flanges and Flanged Fittings: ASME B16.5.
- H. Grooved-End, Threadable, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 40 and greater than Schedule 10, and with factory- or field-formed, roll-grooved ends.

1. Grooved-Joint Piping Systems:

a. Manufacturers:

- 1) Anvil International, Inc.
- 2) Bull Moose Tube Co.
- 3) Grinnell (Tyco)
- 4) Victaulic Co. of America.
- 5) Wheatland Tube

b. Grooved-End Fittings: UL-listed, ASTM A 536, ductile-iron casting with OD matching steel-pipe OD.

c. Grooved-End-Pipe Couplings: UL 213 and AWWA C606, rigid pattern, unless otherwise indicated; gasketed fitting matching steel-pipe OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts.

I. Plain-End, Schedule 10 Steel Pipe: ASTM A 135 or ASTM A 795, Schedule 10 is not allowed.

J. Plain-End, Nonstandard OD, Thinwall Steel Pipe: ASTM A 135 or ASTM A 795, with wall thickness less than Schedule 10 is not allowed.

K. Plain-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5 is not allowed.

L. Grooved-End, Hybrid Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with wall thickness less than Schedule 10 and greater than Schedule 5; with factory- or field-formed, roll-grooved ends are not allowed.

M. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795, lightwall, with plain ends is not allowed.

2.6 CPVC TUBE AND FITTINGS

A. CPVC fire sprinkler pipe and fittings are extruded/molded from CPVC compounds manufactured by Lubrizol Advanced Materials. The pipe and fitting compounds shall meet cell class 23547 and 24447, respectively, as defined by ASTM D1784, and shall be certified by NSF International for use with potable water. Both pipe and fitting compounds shall be pressure rated by the Plastics Pipe Institute (PPI).

1. Pipe and Fittings:

- a. Pipe shall meet or exceed the requirements of ASTM F442 material designation CPVC 4120-06 in standard dimension ratio (SDR) 13.5. Additionally, the pipe must be marked with the following pressure ratings: "320 PSI @ 73° F", "175 PSI @ 150° F", and "100 PSI @ 180° F".
- b. Fittings shall meet or exceed the requirements of:

- 1) ASTM F437 (schedule 80 threaded)
 - 2) ASTM F438 (schedule 40 socket)
 - 3) ASTM F439 (schedule 80 socket)
 - c. Both pipe and fittings shall be Listed by Underwriters Laboratories for use in wet automatic fire sprinkler systems and shall bear the logo of the Listing Agency. See UL Fire Protection Equipment Directory, categories VIWT and HFYH.
 - d. Ancillary products coming into contact with pipe and fittings must be chemically compatible as determined by CPVC pipe and fittings manufacturer or compound manufacturer, and thus Listed on pipe, fittings, or compound manufacturer's chemical compatibility program (i.e., FGG/BM/CZ™ System Compatible Program).
 2. Solvent Cement:
 - a. All socket type joints shall be made up employing solvent cements that meet or exceed the requirements of ASTM F493. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be certified by NSF International for use with potable water and approved by the manufacturers. The solvent cements shall be compatible with their CPVC pipe and fittings.
 - b. Follow manufacturer's instructions for set and cure times for solvent cement joints. Avoid significant stresses during set and cure times. Do not apply any stress that will disturb an un-dried joint. Sprinkler fittings shall be allowed to cure in accordance with the manufacturer's guidelines and the contractor shall assure the outlets are clear of any excess cement prior to installing sprinklers.
 3. Manufacturers (BlazeMaster):
 - a. Georg Fischer Harvel
 - b. NIBCO INC.
 - c. Tyco Fire Suppression & Building Products
 - d. The Viking Corporation
 4. Manufacturers (Spears):
 - a. FlameGuard CPVC Fire Sprinkler Product Line
- B. Contractor shall have received installation training from either the pipe/fitting manufacturer or his designated representative (such as the local Lubrizol Piping System Consultant) and shall furnish a copy of the "training documentation" within the project submittal for each installing individual showing current installation training within two (2) years of start of this project for all CPVC piping systems.

2.7 CPVC TUBING INSTALLATION PROCEDURES, LIMITATIONS, AND TESTING

- A. Installation practices such as pipe support spacing, bracing, allowance for thermal expansion/contraction, solvent cementing and handling and storage shall be in accordance with the manufacturer's instructions and the UL Listing which included installation limitations.

- B. BlazeMaster CPVC pipe and fittings are intended for use at a maximum working pressure of 175 PSI at 150°F in accordance with the manufacturer's instructions and appropriate listing agencies. Installations resulting in higher pressures than intended working pressures shall not be permitted.
- C. All CPVC piping systems have an inherent compatibility and incompatibility with other chemicals, building materials, fire-stopping, and elements. The CPVC piping and fittings shall not at any time come into contact with incompatible materials. Use published references from the piping manufacturer to determine compatibilities and incompatibilities before ordering or installing product.
- D. After the system is installed and any solvent cement is cured per the manufacturer's installation instructions, the system shall be hydrostatically tested per the requirements of the applicable NFPA Standard (NFPA 13, 13R, 13D, and/or 25). Do not perform preliminary pneumatic testing on CPVC systems.

2.8 COPPER TUBE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper; with plain ends.
 - 1. Copper fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Brazing Filler Metals: AWS A5.8, BCuP-3, or BCuP-4.
- B. Plain-End, Hard Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, drawn temper.
 - 1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
 - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match tubing system.
 - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body with ball-and-socket metal-to-metal seating surfaces, and solder-joint or threaded ends.
 - 4. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube not allowed.
 - 5. Brazing Filler Metals: AWS A5.8, BCuP-3, or BCuP-4.
- C. Grooved-End, Hard Copper Tube: ASTM B 88, Type K or ASTM B 88, Type L, water tube, drawn temper; with factory- or field-formed, roll-grooved ends.
 - 1. Copper, Mechanically Formed Tee Option: For forming T-branch on copper water tube not allowed.
 - 2. Grooved-Joint Systems:
 - a. Manufacturers:
 - 1) Anvil International, Inc.

2) Victaulic Co. of America.

- b. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting. Fittings may have ends factory or field expanded to steel-pipe OD if required for copper tube systems using grooved-end-pipe couplings.
- c. Grooved-End-Tube Couplings: UL 213, rigid pattern, unless otherwise indicated; gasketed fitting equivalent to AWWA C606, but made to match copper-tube OD. Include ductile-iron housing with keys matching steel-pipe and fitting grooves, prelubricated rubber gasket listed for use with housing, and steel bolts and nuts. Use grooved-end-pipe couplings for tube and fitting that have expanded ends.

2.9 DIELECTRIC FITTINGS

- A. Assembly shall be copper alloy, ferrous, and insulating materials with ends matching piping system.
- B. Dielectric Unions: Factory-fabricated assembly, designed for 250-psig minimum working pressure at 180 deg F. Include insulating material that isolates dissimilar materials and ends with inside threads according to ASME B1.20.1.

1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.
- d. Hart Industries International, Inc.
- e. Watts Industries, Inc.; Water Products Div.
- f. Zurn Industries, Inc.; Wilkins Div.

- C. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 175-psig minimum working-pressure rating as required for piping system.

1. Manufacturers:

- a. Capitol Manufacturing Co.
- b. Central Plastics Company.
- c. Epco Sales, Inc.
- d. Watts Industries, Inc.; Water Products Div.

- D. Dielectric Flange Insulation Kits: Components for field assembly shall include CR or phenolic gasket, PE or phenolic bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:

- a. Advance Products and Systems, Inc.
- b. Calpico, Inc.
- c. Central Plastics Company.

- d. Pipeline Seal and Insulator, Inc.
 - e. Insert manufacturer's name.
- E. Dielectric Couplings: Galvanized steel with inert and noncorrosive thermoplastic lining and threaded ends and 300-psig working-pressure rating at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel with inert and noncorrosive thermoplastic lining, with combination of plain, threaded, or grooved ends and 300-psig working-pressure rating at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corporation.
 - b. Precision Plumbing Products, Inc.
 - c. Victaulic Co. of America.

2.10 FLEXIBLE SPRINKLER DROPS

- A. Flexible connectors shall be FM approved with exterior wire braid and have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
 - 1. NPS 1: Threaded.
- B. Manufacturers:
 - 1. Flex-Head
 - 2. Victaulic
- C. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- D. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.11 FLEXIBLE PIPE CONNECTORS (SEISMIC)

- A. Flexible connectors shall be FM approved with exterior wire braid and have materials suitable for system fluid. Include 175-psig minimum working-pressure rating and ends according to the following:
 - 1. NPS 2 and Smaller: Threaded.
 - 2. NPS 2-1/2 and Larger: Flanged.
 - 3. Option for NPS 2-1/2 and Larger: Grooved for use with grooved-end-pipe couplings.
- B. Manufacturers:
 - 1. Flexicraft Industries.
 - 2. Flex-Pression, Ltd.
 - 3. Metraflex, Inc.
- C. Bronze-Hose, Flexible Connectors: Corrugated, bronze, inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze welded to hose.
- D. Stainless-Steel-Hose/Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include steel nipples or flanges, welded to hose.
- E. Stainless-Steel-Hose/Stainless-Steel Pipe, Flexible Connectors: Corrugated, stainless-steel, inner tubing covered with stainless-steel wire braid. Include stainless-steel nipples or flanges, welded to hose.

2.12 CORROSION-PROTECTIVE ENCASEMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.13 SPRINKLER SPECIALTY FITTINGS

- A. Sprinkler specialty fittings shall be FMG approved with 175-psig minimum working-pressure rating, and made of materials compatible with piping. Sprinkler specialty fittings shall have 250-psig minimum working-pressure rating if fittings are components of high-pressure piping systems.
- B. Sprinkler Drain and Alarm Test Fittings: Cast- or ductile-iron body, with threaded or locking-lug inlet and outlet, test valve, and orifice and sight glass.
 - 1. Manufactures:
 - a. Central Sprinkler Corp.
 - b. Fire-End and Croker Corp.

- c. Viking Corp.
 - d. Victaulic Co. of America.
- C. Sprinkler Branch-Line Test Fittings: Brass body with threaded inlet, capped drain outlet, and threaded outlet for sprinkler.
- D. Sprinkler Inspector's Test Fitting: Cast- or ductile-iron housing with threaded inlet and drain outlet and sight glass.
- E. Drop-Nipple Fittings: UL 1474, adjustable with threaded inlet and outlet, and seals.
- F. Dry-Pipe-System Fittings: UL listed for dry-pipe service.

2.14 LISTED FIRE-PROTECTION VALVES

- A. Valves shall be FMG approved, with 175-psig minimum pressure rating. Valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
- B. Gate Valves with Wall Indicator Posts:
- 1. Gate Valves: UL 262, cast-iron body, bronze mounted, with solid disc, nonrising stem, operating nut, and flanged ends.
 - 2. Indicator Posts: UL 789, horizontal-wall type, cast-iron body, with hand wheel, extension rod, locking device, and cast-iron barrel.
 - 3. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. McWane, Inc.; Kennedy Valve Div.
 - c. NIBCO.
 - d. Stockham.
- C. Ball Valves: Comply with UL 1091, except with ball instead of disc.
- 1. NPS 1-1/2 and Smaller: Bronze body with threaded ends.
 - 2. NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
 - 3. NPS 3: Ductile-iron body with grooved ends.
 - 4. Manufacturers:
 - a. NIBCO.
 - b. Victaulic Co. of America.
- D. Butterfly Valves: UL 1091.
- 1. NPS 2 and Smaller: Bronze body with threaded ends.

- a. Manufacturers:
 - 1) Global Safety Products, Inc.
 - 2) Milwaukee Valve Company.
- 2. NPS 2-1/2 and Larger: Bronze, cast-iron, or ductile-iron body; wafer type or with flanged or grooved ends.
 - a. Manufacturers:
 - 1) Central Sprinkler Corp.
 - 2) McWane, Inc.; Kennedy Valve Div.
 - 3) Mueller Company.
 - 4) NIBCO.
 - 5) Victaulic Co. of America.
- E. Check Valves NPS 2 and Larger: UL 312, swing type, cast-iron body with flanged or grooved ends.
 - 1. Manufacturers:
 - a. American Cast Iron Pipe Co.; Waterous Co.
 - b. Central Sprinkler Corp.
 - c. Clow Valve Co.
 - d. Crane Co.; Crane Valve Group; Crane Valves.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Fivalco Inc. dba Aleum USA
 - g. Globe Fire Sprinkler Corporation.
 - h. Grinnell Fire Protection.
 - i. Hammond Valve.
 - j. McWane, Inc.; Kennedy Valve Div.
 - k. Mueller Company.
 - l. NIBCO.
 - m. Potter-Roemer; Fire Protection Div.
 - n. Reliable Automatic Sprinkler Co., Inc.
 - o. Star Sprinkler Inc.
 - p. Stockham.
 - q. United Brass Works, Inc.
 - r. Victaulic Co. of America.
 - s. Watts Industries, Inc.; Water Products Div.
- F. Gate Valves: UL 262, OS&Y type.
 - 1. NPS 2 and Smaller: Bronze body with threaded ends.
 - a. Manufacturers:
 - 1) Crane Co.; Crane Valve Group; Crane Valves.

- 2) Fivalco Inc. dba Aleum USA.
- 3) Hammond Valve.
- 4) NIBCO.
- 5) United Brass Works, Inc.

2. NPS 2-1/2 and Larger: Cast-iron body with flanged ends.

a. Manufacturers:

- 1) Clow Valve Co.
- 2) Crane Co.; Crane Valve Group; Crane Valves.
- 3) Crane Co.; Crane Valve Group; Jenkins Valves.
- 4) Fivalco Inc. dba Aleum USA
- 5) Hammond Valve.
- 6) Milwaukee Valve Company.
- 7) Mueller Company.
- 8) NIBCO.
- 9) United Brass Works, Inc.

G. Indicating Valves: UL 1091, with integral indicating device and ends matching connecting piping.

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and Visual.
2. NPS 2 and Smaller: Ball or butterfly valve with bronze body and threaded ends.

a. Manufacturers:

- 1) Fivalco Inc. dba Aleum USA
- 2) Milwaukee Valve Company.
- 3) NIBCO.
- 4) Victaulic Co. of America.

3. NPS 2-1/2 and Larger: Butterfly valve with cast- or ductile-iron body; wafer type or with flanged or grooved ends.

a. Manufacturers:

- 1) Central Sprinkler Corp.
- 2) Fivalco Inc. dba Aleum USA
- 3) Grinnell Fire Protection.
- 4) McWane, Inc.; Kennedy Valve Div.
- 5) Milwaukee Valve Company.
- 6) NIBCO.
- 7) Victaulic Co. of America.

H. Supervised Normally Closed Valve

1. Indicator: Electrical, 115-V ac, prewired, single-circuit, supervisory switch and visual to send signal on partial close.
 - a. Manufactures:
 - 1) Fivalco Inc. dba Aleum USA
 - 2) NIBCO.
 - 3) Victaulic Co. of America.

2.15 UNLISTED GENERAL-DUTY VALVES

- A. Ball Valves NPS 2 and Smaller: MSS SP-110, 2-piece copper-alloy body with chrome-plated brass ball, 600-psig minimum CWP rating, blowout-proof stem, and threaded ends.
- B. Check Valves NPS 2 and Smaller: MSS SP-80, Type 4, Class 125 minimum, swing type with bronze body, nonmetallic disc, and threaded ends.
- C. Gate Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, solid wedge, and threaded ends.
- D. Globe Valves NPS 2 and Smaller: MSS SP-80, Type 2, Class 125 minimum, with bronze body, nonmetallic disc, and threaded ends.

2.16 SPECIALTY VALVES

- A. Sprinkler System Control Valves: FMG approved, cast- or ductile-iron body with flanged or grooved ends, and 175-psig minimum pressure rating. Control valves shall have 250-psig minimum pressure rating if valves are components of high-pressure piping system.
 1. Manufacturers:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Victaulic Co. of America.
 - d. Viking Corp.
 2. Dry-Pipe Valves: UL 260, differential type; with bronze seat with O-ring seals, single-hinge pin, and latch design. Include UL 1486, quick-opening devices, trim sets for air supply, drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.
 - a. Air-Pressure Maintenance Device: UL 260, automatic device to maintain correct air pressure in piping. Include shutoff valves to permit servicing without shutting down sprinkler piping, bypass valve for quick filling, pressure regulator or switch to maintain pressure, strainer, pressure ratings with 14- to 60-psig adjustable range, and 175-psig maximum inlet pressure.

1) Manufacturers:

- a) AFAC Inc.
- b) Central Sprinkler Corp.
- c) General Air Products, Inc.
- d) Globe Fire Sprinkler Corporation.
- e) Reliable Automatic Sprinkler Co., Inc.
- f) Viking Corp.

b. Air Compressor: UL 753, fractional horsepower, 120-V ac, 60 Hz, single phase.

1) Manufacturers:

- a) AFAC Inc.
- b) Gast Manufacturing, Inc.
- c) General Air Products, Inc.
- d) Grinnell Fire Protection.
- e) Reliable Automatic Sprinkler Co., Inc.
- f) Viking Corp.

B. Automatic Drain Valves: UL 1726, NPS 3/4, ball-check device with threaded ends.

1. Manufacturers:

- a. Grinnell Fire Protection.

2.17 SPRINKLERS

A. Sprinklers shall be UL listed or FMG approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum 300-psig pressure rating if sprinklers are components of high-pressure piping system.

B. Sprinklers shall be FM approved, with 175-psig minimum pressure rating. Sprinklers shall have 250-psig minimum 300-psig pressure rating if sprinklers are components of high-pressure piping system.

C. Manufacturers:

- 1. Globe Fire Sprinkler Corporation.
- 2. Reliable Automatic Sprinkler Co., Inc.
- 3. Victaulic Co. of America.
- 4. Viking Corp.
- 5. Tyco Fire

D. Automatic Sprinklers: With heat-responsive element complying with the following:

- 1. UL 199, for nonresidential applications.

2. UL 1626, for residential applications.
- E. Sprinkler Types and Categories: Nominal 1/2-inch orifice for "Ordinary" temperature classification rating, unless otherwise indicated or required by application.
 1. Open Sprinklers: UL 199, without heat-responsive element.
 - a. Orifice: 1/2 inch, with discharge coefficient K between 5.3 and 5.8.
 - b. Orifice: 17/32 inch, with discharge coefficient K between 7.4 and 8.2.
- F. Sprinkler types, features, and options as follows:
 1. Concealed ceiling sprinklers, including cover plate.
 2. Extended-coverage sprinklers, not allowed unless approved in writing prior to bidding.
 3. Flow-control sprinklers, with automatic open and shutoff feature.
 4. Flush ceiling sprinklers, including escutcheon, not allowed.
 5. Institution sprinklers, made with a small, breakaway projection.
 6. Pendent sprinklers.
 7. Pendent, dry-type sprinklers.
 8. Quick-response sprinklers.
 9. Sidewall sprinklers.
 10. Sidewall, dry-type sprinklers.
 11. Upright sprinklers.
- G. Sprinkler Finishes: Chrome plated, bronze, and painted. Finishes as approved by FM Global.
- H. Special Coatings: Wax, lead, and corrosion-resistant paint.
- I. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 1. Ceiling Mounting: Flat plate concealed, white.
 2. Sidewall Mounting: Flat plate concealed, white.
- J. Sprinkler Guards: Wire-cage type, including fastening device for attaching to sprinkler.

2.18 FIRE DEPARTMENT CONNECTIONS

- A. Manufacturers:
 1. Central Sprinkler Corp.
 2. Elkhart Brass Mfg. Co., Inc.
 3. Fire-End and Croker Corp.
 4. Fire Protection Products, Inc.
 5. Guardian Fire Equipment Incorporated.
 6. Potter-Roemer; Fire-Protection Div.

7. Reliable Automatic Sprinkler Co., Inc.
 8. United Brass Works, Inc.
- B. Wall-Type, Fire Department Connection: UL 405, 175-psig minimum pressure rating; with corrosion-resistant-metal body with brass inlets, brass wall escutcheon plate, brass lugged caps with gaskets and brass chains, and brass lugged swivel connections. Include inlets with threads according to NFPA 1963 and matching local fire department sizes and threads, outlet with pipe threads, extension pipe nipples, check devices or clappers for inlets, and escutcheon plate with marking similar to "AUTO SPKR & STANDPIPE."
1. Type: Flush, with three inlets and square or rectangular escutcheon plate.
 2. Finish: Polished brass.

2.19 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Design the Fire Alarm Systems per FM Global Data Sheet 5-40. The fire alarm system and related equipment shall be FM approved. This includes but is not limited to the fire alarm control panel, all detectors, water flow alarms, and tamper switches.
- C. Electrically Operated Alarm: UL 464, with 8-inch- minimum- diameter, vibrating-type, metal alarm bell with red-enamel factory finish and suitable for outdoor use.
1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. Safe Signal, formerly System Sensor.
- D. Electrically Operated Alarm: Horn/Strobe, NEMA 3R minimum suitable for outdoor use.
1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. Safe Signal, formerly System Sensor.
- E. Water-Flow Indicator: UL 346, electrical-supervision, paddle-operated-type, water-flow detector with 250-psig pressure rating and designed for horizontal or vertical installation. Include two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
1. Manufacturers:
 - a. ADT Security Services, Inc.
 - b. Grinnell Fire Protection.
 - c. ITT McDonnell & Miller.

- d. Potter Electric Signal Company.
 - e. Safe Signal, formerly System Sensor.
 - f. Viking Corp.
 - g. Watts Industries, Inc.; Water Products Div.
- F. Pressure Switch: UL 753, electrical-supervision-type, water-flow switch with retard feature. Include single-pole, double-throw, normally closed contacts, and design that operates on rising pressure and signals water flow.
 - 1. Manufacturers:
 - a. Grinnell Fire Protection.
 - b. Potter Electric Signal Company.
 - c. Safe Signal, formerly System Sensor.
 - d. Viking Corp.
- G. Valve Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled valve is in other than fully open position.
 - 1. Manufacturers:
 - a. McWane, Inc.; Kennedy Valve Div.
 - b. Potter Electric Signal Company.
 - c. Safe Signal, formerly System Sensor.
- H. Indicator-Post Supervisory Switch: UL 753, electrical, single-pole, double-throw switch with normally closed contacts. Include design that signals controlled indicator-post valve is in other than fully open position.
 - 1. Manufacturers:
 - a. Potter Electric Signal Company.
 - b. Safe Signal, formerly System Sensor.

2.20 PRESSURE GAGES

- A. Manufacturers:
 - 1. Brecco Corporation.
 - 2. Dresser Equipment Group; Instrument Div.
 - 3. Marsh Bellofram.
 - 4. WIKA Instrument Corporation.
- B. Description: UL 393, 3-1/2- to 4-1/2-inch- diameter, dial pressure gage with range of 0 to 250 psig minimum.

1. Water System Piping: Include caption "WATER" or "AIR/WATER" on dial face.
2. Air System Piping: Include retard feature and caption "AIR" or "AIR/WATER" on dial face.

2.21 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers

1. Ames
2. Backflow Direct
3. Febco
4. Wilkins
5. Watts

- B. Description: Resilient seated, spring loaded with testable outlets provided, as required by Authorities Having Jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Obtain Engineer's Water Analysis or fire-hydrant flow test. Use results for system design calculations required in "Quality Assurance" Article in Part 1 of this Section.
- B. Engineer's Water Analysis. See Flow Analysis provided by Van Boerum & Frank Associates.

3.2 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.3 EXAMINATION

- A. Examine roughing-in for hose connections and stations to verify actual locations of piping connections before installation.
- B. Examine walls and partitions for suitable thicknesses, fire- and smoke-rated construction, framing for hose-station cabinets, and other conditions where hose connections and stations are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.4 PIPING APPLICATIONS

- A. Shop weld pipe joints where welded piping is indicated.
- B. Do not use welded joints for galvanized-steel pipe.
- C. Flanges, flanged fittings, unions, nipples, and transition and special fittings with finish and pressure ratings same as or higher than system's pressure rating may be used in aboveground applications, unless otherwise indicated.
- D. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- E. Underground Service-Entrance Piping: Ductile-iron, push-on or mechanical-joint pipe and fittings and restrained joints. Include corrosion-protective encasement.
- F. Sprinkler piping over 2-1/2" inches nominally: Use the following:
 - 1. Schedule 10 steel pipe with roll-grooved ends. No plain ends allowed.
 - 2. Outlets shall be welded.
 - a. Victaulic Brand Mechanical tee fittings may be used in lieu of welded outlets.
- G. Sprinkler piping 2-1/2" and smaller in nominal diameter: Use the following:
 - 1. Schedule 40 steel pipe with threaded ends or roll-grooved ends; ductile-iron threaded fittings or mechanical fittings.
 - a. Victaulic Brand Mechanical tee fittings may be used

3.5 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Fire-Protection-Service Valves: UL listed and FM approved for applications where required by NFPA 13 and NFPA 14.
 - 2. General-Duty Valves: For applications where UL-listed and FM-approved valves are not required by NFPA 13 and NFPA 14.
 - a. Shutoff Duty: Use gate, ball, or butterfly valves.
 - b. Throttling Duty: Use globe, ball, or butterfly valves.

3.6 JOINT CONSTRUCTION

- A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping joint construction.
- B. Ductile-Iron-Piping, Grooved Joints: Use ductile-iron pipe with radius-cut-grooved ends; ductile-iron, grooved-end fittings; and ductile-iron, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions.
- C. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut or roll-grooved ends and Schedule 30 or thinner steel pipe with roll-grooved ends; steel, grooved-end fittings; and steel, keyed couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to coupling manufacturer's written instructions. Use gaskets listed for dry-pipe service for dry piping.

3.7 WATER-SUPPLY CONNECTION

- A. Install shutoff Backflow preventions assemblies, valve, pressure gages, drain, and other accessories at connection to water service.

3.8 PIPING INSTALLATION

- A. Refer to Division 23 Section "Common Work Result for HVAC" for basic piping installation.
- B. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- C. Install all new underground service-entrance piping with restrained joints, hydrants, and post indicator valves per FM Global Data Sheet 3-10.
- D. Make connections between underground and above-ground piping using bolted flange.
- E. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 23 Section "Common Work Result for HVAC."
- F. Use approved fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- G. Install unions adjacent to each valve in pipes NPS 2 and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

- H. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2 and larger connections.
- I. Install "Inspector's Test Connections" in sprinkler piping, complete with shutoff valve, sized and located according to NFPA 13.
- J. Install sprinkler piping with drains for complete system drainage.
- K. Install ball drip valves to drain piping between fire department connections and check valves. Drain to floor drain or outside building.
- L. Install alarm devices in piping systems.
- M. Hangers and Supports: Comply with NFPA 13 for hanger materials. Install according to NFPA 13 for sprinkler piping and to NFPA 14 for standpipes.
 - 1. No powder driven studs allowed.
 - 2. Wrap-around braces are to be provided at end of branch lines.
- N. Earthquake Protection: Install piping according to NFPA 13-9.3 and FM Global Datasheet 2-8 requirements, to protect from earthquake damage. Seismic Bracing shall be designed to withstand vertical forces and movement.
- O. Install piping with grooved joints according to manufacturer's written instructions. Construct rigid piping joints, unless otherwise indicated, or required by NFPA 13 for flexibility in seismic zones.
- P. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- Q. When a fire pipe crosses a seismic expansion joint it shall have a Metraflex fire loop installed at the joint in accordance with NFPA 13 chapter 9.

3.9 SPECIALTY SPRINKLER FITTING INSTALLATION

- A. Install specialty sprinkler fittings according to manufacturer's written instructions.

3.10 VALVE INSTALLATION

- A. Refer to Division 23 Section "Valves" for installing general-duty valves. Install fire-protection specialty valves, trim, fittings, controls, and specialties according to NFPA 13 and NFPA 14, manufacturer's written instructions, and authorities having jurisdiction.

- B. Valves: Install fire-protection-service valves supervised-open, located to control sources of water supply except from fire department connections. Provide permanent identification signs indicating portion of system controlled by each valve.
- C. Double Check Valve Assemblies: Install valves in vertical up or horizontal position, per listings and for proper direction of flow.

3.11 SPRINKLER APPLICATIONS

- A. General: All sprinklers are to be quick response type. Sprinkler heads shall be of the latest design closed spray type for 155°F unless specified otherwise or required by code. Extended coverage heads shall not be used. Orifices larger than 1/2" may be used as required by density and spacing demands. Use sprinklers according to the following applications:
 - 1. Rooms without Ceilings: Upright and/or pendent sprinklers. Provide mechanical guards on all heads at or below 7'-0" height above the floor or where damage from room occupant use may occur.
 - 2. Rooms with Ceilings: Concealed sprinklers unless indicated otherwise.
 - 3. Wall Mounting: Concealed sidewall sprinklers unless indicated otherwise.
 - 4. Institutional sprinklers shall be installed in areas of detention, correctional or mental health care facilities.
 - 5. Spaces Subject to Freezing: Upright; pendent, dry-type; and sidewall, dry-type sprinklers.
 - 6. Provide freeze proof type automatic sprinkler heads serving unconditioned spaces, areas subject to freezing and in other areas requiring their use.
 - 7. Heads located within the air streams of unit heaters or other heat-emitting equipment shall be selected for proper temperature rating.
 - 8. Sprinkler Finishes: Use sprinklers with the following finishes:
 - a. Upright, Pendent, and Sidewall Sprinklers: Chrome in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.
 - b. Concealed Sprinklers: Rough brass, with White cover plate to match ceiling color.
- B. Sprinklers: Use the following:
 - 1. All sprinklers shall be listed, quick response type.
 - 2. Sprinkler in future finish spaces (shelled) 10' x 10' spacing shall be pendants/uprights installed with 1 x 1/2" bushing, to accommodate future finishes.
 - 3. Finish ceiling spaces shall have flat-plate concealed sprinklers.

3.12 SPRINKLER INSTALLATION

- A. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid if included, as well as lights, diffusers, and grilles. Offsets shall be made in piping to accommodate ductwork in the ceiling. Heads shall be symmetrical in all

- ceilings and all piping run parallel or perpendicular to building lines. Heads shall be linearly aligned in corridors.
1. In no case shall sprinkler heads be installed closer than approved distances from ceiling obstructions and HVAC ductwork.
 2. Sprinkler heads shall not conflict with tile grids.
 3. Sprinkler heads shall be located near center of corridors.
- B. Where layout of sprinkler heads is shown on reflected ceiling plans the locations shall be followed unless approval is obtained from the Architect, or such locations shown do not meet the requirements of NFPA-13. In either case, approval of the Architect shall be obtained in writing before sprinkler head locations are changed. If the installation of additional heads is needed to conform to NFPA 13 requirements in areas where heads are shown on reflected ceiling plans, they shall be included in the contract price.
- C. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing. Use dry-type sprinklers with water supply from heated space.
- D. Future finish shelled and tenant finish; Shell spaces shall be piped to accommodate future. Install sprinklers with 1" x ½" bushings, and space heads at a maximum spacing of 100 sq. ft. per head. Occupancy shall be Ordinary-Hazard Group 1 Design.
- E. Concealed type sprinkler shall be installed in the following areas:
1. All areas.

3.13 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. When installing the Fire Department Connection, the contractor is to ensure that there are no permanent obstruction(s) as to the fire department access. If an obstruction is present immediately notify the designer and the design team before proceeding with the installation.
- B. Coordinate the exact location with the Architect and the Authority Having Jurisdiction.
- C. Install ball drip valves at each check valve for fire department connection. Drain to floor drain or outside building.

3.14 CONNECTIONS

- A. Connect water-supply piping and standpipes and sprinklers where indicated.
- B. Connect piping to specialty valves, hose valves, specialties, fire department connections, and accessories.
- C. Electrical Connections: Power wiring is specified in Division 28.

- D. Connect alarm devices to fire alarm.

3.15 LABELING AND IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13 and in Division 23 Section "Common Work Result for HVAC."

3.16 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. When making a mechanical tee connection the coupon shall be attached at the mechanical tee.
- D. Report test results promptly and in writing to Architect and authorities having jurisdiction.
- E. Whether the underground serving the sprinkler system is done by this contractor or another, this contractor will be responsible to assure and have in his possession a certificate that the underground has been flushed and tested by the contractor who installed it in accordance with NFPA-24 prior to connection of the underground piping to the overhead sprinkler system.

3.17 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers having paint other than factory finish.

3.18 PROTECTION

- A. Protect sprinklers from damage until Substantial Completion.

3.19 COMMISSIONING

- A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.
- B. Verify that specified tests of piping are complete, and that "Material Test Certificates" are complete.

- C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.
- D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.
- E. Verify that hose connections and fire department connections have threads compatible with local fire department equipment.
- F. Fill wet-pipe sprinkler piping with water.
- G. Coordinate with fire alarm tests. Operate as required.

3.20 DEMONSTRATION & TESTS

- A. Demonstrate equipment, specialties, and accessories. Review operating and maintenance information.
- B. All tests will be conducted as required by the local authority having jurisdiction, and in no case less than those required by NFPA standards. As a minimum, piping in the sprinkler system shall be tested at a water pressure at 200 psi for a period of not less two hours, or at 50 psi more than the normal pressure when the normal pressure is above 150 psi. Bracing shall be in place, and air shall be removed from the system through the hydrants and drain valves before the test pressure is applied. No apparent leaks will be permitted on interior or underground piping.
- C. The local jurisdiction having authority and the Utah State Fire Marshal's office (where required) shall be notified at least three working days in advance of all tests and flushing. This includes any flushing of underground, hydrostatic testing, or flow testing that may be required.
- D. This contractor shall make all the required tests to the sprinkler system as required by code. He shall be responsible to assure that the Contractor Test Certificates for the overhead, backflow and underground work are completed and delivered to the owner's insurance underwriter to assure proper insurance credit.
- E. All tests requiring the witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness, then they will be run later and all damage caused by the system, or caused in uncovering the system for such test, will be borne by this contractor.

3.21 WARRANTY

- A. This contractor shall warranty the sprinkler system and all its components for one year from the date of acceptance by the owner. Any costs incurred to extend any warranties of materials to assure this time frame shall be borne by this contractor.

- B. Provide Operation and Maintenance Manuals with correct as-builts test certificates and warranties included. A minimum 6 sets to be provided in red 3-ring binders. Include a current adopted version of NFPA 25 softbound copy left with owner.
- C. Electronic copy of AutoCAD as-built drawings shall also be provided on CD, with each O&M Manual.

3.22 FIELD QUALITY CONTROL

- A. Flush, test and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter.
- B. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.
- C. Report test results promptly and in writing to Architect and authorities having jurisdiction.

END OF SECTION 21 1000

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SECTION 22 0500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Transition fittings.
 - 3. Dielectric fittings.
 - 4. Mechanical sleeve seals.
 - 5. Sleeves.
 - 6. Escutcheons.
 - 7. Grout.
 - 8. Equipment installation requirements common to equipment sections.
 - 9. Painting and finishing.
 - 10. Concrete bases.
 - 11. Supports and anchorages.
 - 12. Link Seal
 - 13. Lead Free requirements.

1.3 LEAD FREE REQUIREMENTS

- A. For all projects within the United States, and when water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with PUBLIC LAW 111-380 "Reduction of Lead in Drinking Water Act" 124 STAT. 4131, 42-USC 1201, January 4th, 2011.

1.4 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, and crawlspaces.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases and accessible tunnels.

- 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 rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.
- G. Lead Free:
 - 1. Not containing more than 0.2 percent lead when used with respect to solder and flux.
 - 2. Not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings and fixtures.
 - 3. Calculation: The weighted average lead content of a pipe, pipe fitting, plumbing fitting or fixture shall be calculated by using the formula prescribed in the law named in LEAD FREE REQUIREMENTS above.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. 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 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 plumbing 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. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

2.4 TRANSITION FITTINGS

- A. Flexible Transition Couplings for Underground Nonpressure 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. Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Fernco, Inc.
 - c. Mission Rubber Company.
 - d. Plastic Oddities, Inc.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
1. Manufacturers:

- a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. 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. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - 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.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.

- c. Sioux Chief Manufacturing Co., Inc.
- d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 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: Stainless steel. 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.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, 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.
- E. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- D. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 LINK SEAL

- A. Link-Seal® Modular Seal Pressure Plates
 - 1. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
 - a. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
 - Flexural Strength @ Yield = 30,750 psi per ASTM D-790
 - Flexural Modulus = 1,124,000 psi per ASTM D-790
 - Elongation Break = 11.07% per ASTM D-638
 - Specific Gravity = 1.38 per ASTM D-792
 - 2. Models LS200-275-300-315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-525-575-600 shall incorporate an integral recess known as a "Hex Nut Interlock" designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer's name molded into it.
 - 3. For fire and Hi-Temp service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.
 - 4. Link-Seal® Modular Seal Hardware: All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be: 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

2.11 LEAD FREE PRODUCTS:

- A. For all products to be purchased whenever water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall comply with the LEAD FREE REQUIREMENTS in PART 1 above.

PART 3 - EXECUTION

3.1 PLUMBING DEMOLITION

- A. Refer to Division 01 Section "Cutting and Patching" and Division 02 Section "Selective Structure Demolition" for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing 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 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 SEISMIC REQUIREMENTS

- A. Comply with SEI/ASCE 7 and with requirements for seismic seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

3.3 LEAD FREE REQUIREMENTS

- A. Installations where water is anticipated for human consumption, all pipes, pipe fittings, plumbing fittings and fixtures shall be Lead Free as given in PART 1 above.

3.4 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying 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: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use the following:

- a. Chrome-Plated Piping: Split-casting, cast-brass type with chrome-plated finish.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and spring clips.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting, cast-brass type with chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge and set screw.
 - f. Bare Piping in Equipment Rooms: Split-casting, cast-brass type.
 - g. Bare Piping in Equipment Rooms: Split-plate, stamped-steel type with set screw or spring clips.
 - h. Bare Piping at Floor Penetrations in Equipment Rooms: Split-casting, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. 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.
 - a. 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:
 - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
 - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.

- Q. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- R. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- T. Verify final equipment locations for roughing-in.
- U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.5 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- J. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.6 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.7 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.8 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.9 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. 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.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.11 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.

- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

3.12 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

END OF SECTION 22 0500

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Link-Seal
 - 4. Metraflex Company (The).
 - 5. Pipeline Seal and Insulator, Inc.
 - 6. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Division 07 Section "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Division 07 Section "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.

- 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
3. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves .
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
4. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 0517

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.

9. Tel-Tru Manufacturing Company.
 10. Trerice, H. O. Co.
 11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 12. Weiss Instruments, Inc.
 13. WIKA Instrument Corporation - USA.
 14. Winters Instruments - U.S.
 15. Weksler
- B. Standard: ASME B40.200.
- C. Case: Liquid-filled and sealed type(s); stainless steel with 5 inch nominal diameter.
- D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.
- E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.
- F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.
- G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
- H. Window: Plain glass or plastic.
- I. Ring: Stainless steel.
- J. Element: Bimetal coil.
- K. Pointer: Dark-colored metal.
- L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Flo Fab Inc.
 - b. Miljoco Corporation.
 - c. Palmer Wahl Instrumentation Group.
 - d. Tel-Tru Manufacturing Company.
 - e. Trerice, H. O. Co.
 - f. Weiss Instruments, Inc.
 - g. Winters Instruments - U.S.
 - h. Weksler

2. Standard: ASME B40.200.
3. Case: Cast aluminum 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass or plastic.
8. Stem: Aluminum and of length to suit installation.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

C. Description: Pressure-tight, socket-type metal fitting made for insertion into piping and of type, diameter, and length required to hold thermometer.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.

- c. Ernst Flow Industries.
 - d. Flo Fab Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - m. Weiss Instruments, Inc.
 - n. WIKA Instrument Corporation - USA.
 - o. Winters Instruments - U.S.
 - p. Weksler
-
- 2. Standard: ASME B40.100.
 - 3. Case: Liquid-filled Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
 - 4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
 - 5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
 - 6. Movement: Mechanical, with link to pressure element and connection to pointer.
 - 7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
 - 8. Pointer: Dark-colored metal.
 - 9. Window: Glass or plastic.
 - 10. Ring: Metal or Brass.
 - 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACH TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flow Design, Inc.
 - 2. MG Piping Products Co.
 - 3. National Meter, Inc.
 - 4. Peterson Equipment Co., Inc.
 - 5. Sisco Manufacturing Co.
 - 6. Trerice, H. O. Co.
 - 7. Weksler.
 - 8. Watts Industries, Inc.; Water Products Div.
- B. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

- C. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- D. Core Inserts: One or two self-sealing rubber valves.
 - 1. Insert material for water service at 20 to 200 deg F shall be CR.
 - 2. Insert material for water service at minus 30 to plus 275 deg F shall be EPDM.
- E. Test Kit: Furnish one test kit(s) containing one pressure gage and adaptor, one thermometer, and carrying case. Pressure gage, adapter probes, and thermometer sensing elements shall be of diameter to fit test plugs and of length to project into piping.
 - 1. Pressure Gage: Small bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be 0 to 200 psig.
 - 2. Low-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 25 to 125 deg F.
 - 3. High-Range Thermometer: Small bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial ranges shall be 0 to 220 deg F.
 - 4. Carrying case shall have formed instrument padding.

2.6 ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston porous-metal-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending a minimum of 2 inches into fluid one-third of pipe diameter to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install thermometers in the following locations:
 - 1. Inlet and outlet of each water heater.
 - 2. Inlets and outlets of each domestic water heat exchanger.
 - 3. Inlet and outlet of each domestic hot-water storage tank.
 - 4. Inlet and outlet of each remote domestic water chiller.
- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building.
 - 2. Inlet and outlet of each pressure-reducing valve.
 - 3. Suction and discharge of each domestic water pump.
- J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- K. Adjust faces of meters and gages to proper angle for best visibility.
- L. Install remote-mounting dial thermometers on panel, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.
- M. Install test plugs in tees in piping.
- N. Install permanent indicator on walls or brackets in accessible and readable positions.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlets and outlets of each domestic water heat exchanger shall be one of the following:
 - 1. Liquid-filled Sealed, bimetallic-actuated type.
 - 2. Industrial-style, liquid-in-glass type.
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 20 to 240 deg F and 0 to 150 deg C.

3.4 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be one of the following:
 - 1. Liquid-filled Sealed Open-front, pressure-relief, direct-mounted, metal case.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
 - 1. Liquid-filled Sealed Open-front, pressure-relief, direct mounted, metal case.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
 - 1. Liquid-filled Sealed Open-front, pressure-relief , direct-mounted, metal case.

3.5 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping 0 to 160 psi and 0 to 1100 kPa.
- B. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

END OF SECTION 22 0519

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SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze angle valves.
2. Bronze ball valves.
3. Iron, single-flange butterfly valves.
4. Bronze lift check valves.
5. Bronze swing check valves.
6. Iron swing check valves.
7. Bronze globe valves.
8. Iron globe valves.

B. Related Sections:

1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
2. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.

- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 5 plug valves, for each size square plug-valve head.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Bronze Disc:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hammond Valve.
 - b. Milwaukee Valve Company.
 - 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Crane Co.; Crane Valve Group; Crane Valves.
 - d. Hammond Valve.
 - e. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

B. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Crane Valves.
 - c. Hammond Valve.
 - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.

- d. Body Design: Two piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

C. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. DynaQuip Controls.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Red-White Valve Corporation.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

D. Three-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.

- d. Body Design: Three piece.
- e. Body Material: Bronze.
- f. Ends: Threaded.
- g. Seats: PTFE or TFE.
- h. Stem: Stainless steel.
- i. Ball: Stainless steel, vented.
- j. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - d. Crane Co.; Crane Valve Group; Jenkins Valves.
 - e. Crane Co.; Crane Valve Group; Stockham Division.
 - f. DeZurik Water Controls.
 - g. Flo Fab Inc.
 - h. Hammond Valve.
 - i. Kitz Corporation.
 - j. Milwaukee Valve Company.
 - k. NIBCO INC.
 - l. Norriseal; a Dover Corporation company.
 - m. Red-White Valve Corporation.
 - n. Spence Strainers International; a division of CIRCOR International, Inc.
 - o. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Ductile-Iron Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
- b. American Valve, Inc.
- c. Conbraco Industries, Inc.; Apollo Valves.
- d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
- e. Crane Co.; Crane Valve Group; Center Line.
- f. Crane Co.; Crane Valve Group; Stockham Division.
- g. DeZurik Water Controls.
- h. Flo Fab Inc.
- i. Hammond Valve.
- j. Kitz Corporation.
- k. Milwaukee Valve Company.
- l. Mueller Steam Specialty; a division of SPX Corporation.
- m. NIBCO INC.
- n. Norriseal; a Dover Corporation company.
- o. Spence Strainers International; a division of CIRCOR International, Inc.
- p. Sure Flow Equipment Inc.
- q. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nickel-plated or -coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the:
 - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
 - b. American Valve, Inc.
 - c. Conbraco Industries, Inc.; Apollo Valves.
 - d. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
 - e. Crane Co.; Crane Valve Group; Jenkins Valves.
 - f. Crane Co.; Crane Valve Group; Stockham Division.
 - g. DeZurik Water Controls.
 - h. Flo Fab Inc.
 - i. Hammond Valve.
 - j. Kitz Corporation.
 - k. Milwaukee Valve Company.
 - l. Mueller Steam Specialty; a division of SPX Corporation.
 - m. NIBCO INC.

- n. Norriseal; a Dover Corporation company.
- o. Red-White Valve Corporation.
- p. Spence Strainers International; a division of CIRCOR International, Inc.
- q. Sure Flow Equipment Inc.
- r. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

2.5 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
- 2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Vertical flow.
 - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
 - e. Ends: Threaded.
 - f. Disc: Bronze.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Crane Co.; Crane Valve Group; Crane Valves.

- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Hammond Valve.
- f. Kitz Corporation.
- g. Milwaukee Valve Company.
- h. NIBCO INC.
- i. Powell Valves.
- j. Red-White Valve Corporation.
- k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- l. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

B. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. American Valve, Inc.
- b. Crane Co.; Crane Valve Group; Crane Valves.
- c. Crane Co.; Crane Valve Group; Jenkins Valves.
- d. Crane Co.; Crane Valve Group; Stockham Division.
- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Red-White Valve Corporation.
- i. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Powell Valves.
 - i. Red-White Valve Corporation.
 - j. Sure Flow Equipment Inc.
 - k. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - l. Zy-Tech Global Industries, Inc.
 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.
 - g. Gasket: Asbestos free.
- B. Class 250, Iron Swing Check Valves with Metal Seats:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. CWP Rating: 500 psig.
 - c. Body Design: Clear or full waterway.
 - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - e. Ends: Flanged.
 - f. Trim: Bronze.

- g. Gasket: Asbestos free.

2.8 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Powell Valves.
 - h. Red-White Valve Corporation.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - j. Zy-Tech Global Industries, Inc.
2. Description:
 - a. Standard: MSS SP-80, Type 1.
 - b. CWP Rating: 200 psig.
 - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
 - d. Ends: Threaded or solder joint.
 - e. Stem and Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.

2.9 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Kitz Corporation.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Powell Valves.
 - i. Red-White Valve Corporation.

- j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- k. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

B. Class 250, Iron Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Division.
- d. Hammond Valve.
- e. Milwaukee Valve Company.
- f. NIBCO INC.
- g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.

- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service Globe, angle, ball or butterfly valves.
 - 4. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Ball Valves: One, Two, or Three piece, full, regular or reduced port, with brass, bronze or stainless-steel trim.
3. Bronze Lift Check Valves: Class 125, bronze disc.
4. Bronze Swing Check Valves: Class 125, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, NBR seat, aluminum-bronze, ductile-iron or stainless-steel disc.
3. Iron Swing Check Valves: Class 125, metal seats.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Angle Valves: Class 125 or Class 150, bronze disc.
3. Ball Valves: One, Two or Three piece, full or, regular port, bronze with bronze or stainless-steel trim.
4. Bronze Swing Check Valves: Class 125 or Class 150, bronze disc.
5. Bronze Globe Valves: Class 125 or Class 150, bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.

2. Ball Valves: One, Two or Three piece, full or, regular port, bronze with bronze or stainless-steel trim.
3. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze, ductile-iron or stainless-steel disc.
4. Iron Swing Check Valves: Class 125 or Class 250, metal seats.
5. Iron Globe Valves: Class 125 or Class 250.

END OF SECTION 22 0523

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SECTION 22 0529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Thermal-hanger shield inserts.
 - 5. Fastener systems.
 - 6. Pipe stands.
 - 7. Pipe positioning systems.
 - 8. Equipment supports.
- B. Related Sections include the following:
 - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
 - 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 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."

1.4 SEISMIC REQUIREMENTS

- A. Component Importance Factor. All plumbing components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
 - 1. The component is required to function for life-safety purposes after an earthquake.
 - 2. The component contains hazardous materials.
 - 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.

1.5 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
 - 1. For components with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 - 2. For components with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.6 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Thermal-hanger shield inserts.
 - 3. Powder-actuated fastener systems.
 - 4. Pipe positioning systems.
 - 5. Mechanical Anchors: ICC-ES Evaluation Reports validating 'Cracked Concrete' testing per A.C. 193 must be provided for anchors resisting seismic loads and/or supporting life-safety systems including fire sprinkler systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
 2. Metal framing systems. Include Product Data for components.
 3. Pipe stands. Include Product Data for components.
 4. Equipment supports.
- C. Welding certificates.
- D. Delegated-Design Submittal:
1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
 4. Seismic calculations and detailed analysis: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices. Project specific design documentation and calculations shall be prepared and stamped by a registered professional engineer who is responsible for the seismic restraint design and who is licensed in the state where the project is being constructed (ASCE 7, 13.2.1.1).

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel." and ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
 4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
 1. Anvil International.
 2. AAA Technology & Specialties Co., Inc.
 3. Bergen-Power Pipe Supports.
 4. B-Line Systems, Inc.; a division of Cooper Industries.
 5. Carpenter & Paterson, Inc.
 6. Empire Industries, Inc.
 7. ERICO/Michigan Hanger Co.
 8. FNW/Ferguson Enterprises
 9. Globe Pipe Hanger Products, Inc.
 10. Grinnell Corp.
 11. GS Metals Corp.
 12. National Pipe Hanger Corporation.
 13. PHD Manufacturing, Inc.
 14. PHS Industries, Inc.
 15. Piping Technology & Products, Inc.
 16. Tolco Inc.
 17. Simpson Strong-Tie Co.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. Anvil International.
2. B-Line Systems, Inc.; a division of Cooper Industries.
3. ERICO/Michigan Hanger Co.; ERISTRUT Div.
4. FNW/Ferguson Enterprises
5. GS Metals Corp.
6. Hilti, Inc.
7. Power-Strut Div.; Tyco International, Ltd.
8. Thomas & Betts Corporation.
9. Tolco Inc.
10. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 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 with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate.

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.

2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

- a. Hilti, Inc.
- b. MKT Fastening, LLC.
- c. Powers Fasteners.
- d. Simpson Strong-Tie Co.

- B. Mechanical-Expansion Anchors and Concrete Screws: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used. For anchors resisting seismic loads and/or supporting life- safety systems including fire sprinkler systems, Anchors shall have been tested for 'Cracked Concrete' per A.C. 193 per a valid ICC-ES Evaluation Report. Manufacturers with these anchors have been designated below with: '**'

1. Manufacturers:

- a. B-Line Systems, Inc.; a division of Cooper Industries.
- b. Empire Industries, Inc.
- c. Hilti, Inc.
- d. ITW Ramset/Red Head.
- e. MKT Fastening, LLC.
- f. Powers Fasteners.
- g. Simpson Strong-Tie Co. *

2.7 PIPE STAND FABRICATION

- A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

- a. Anvil International.
- b. ERICO/Michigan Hanger Co.
- c. MIRO Industries.
- d. Unipure

- C. Low-Type, Single-Pipe Stand: One-piece stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

1. Manufacturers:
 - a. MIRO Industries.
- D. High-Type, Single-Pipe Stand: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. Anvil International.
 - b. ERICO/Michigan Hanger Co.
 - c. MIRO Industries.
 - d. Portable Pipe Hangers.
 2. Base: Stainless steel.
 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 1. Manufacturers:
 - a. Anvil International.
 - b. Portable Pipe Hangers.
 2. Bases: One or more plastic.
 3. Vertical Members: Two or more protective-coated-steel channels.
 4. Horizontal Member: Protective-coated-steel channel.
 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
 1. C & S Mfg. Corp.
 2. HOLDRITE Corp.; Hubbard Enterprises.
 3. Samco Stamping, Inc.

2.9 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 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, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 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-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18 or Simpson Blue Banger Concrete insert with UL & FM approvals): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- C. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- E. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- F. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual. Powder actuated fasteners shall not be used for seismic bracing attachments.
 - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions. For anchors resisting seismic loads and/or supporting life-safety systems including fire sprinkler systems, anchors shall have been tested for 'Cracked Concrete' per A.C. 193 and shall have a valid ICC-ES Evaluation Report
- G. Pipe Stand Installation:
 - 1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 - 2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- H. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

- I. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- J. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- K. 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.
- L. Install lateral bracing with pipe hangers and supports to prevent swaying.
- M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- N. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- P. Insulated Piping: Comply with the following:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:

- a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
 6. Insert Material: Length at least as long as protective shield.
 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

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. For applications where seismic bracing is required, 'Cracked Concrete' expansion anchors or concrete screws tested per A.C. 193 must be provided for seismic bracing anchorage where post-installed anchors are required.

3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.6 PAINTING

- A. Touch 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. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 22 0529

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SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following restraints and vibration isolation as defined in Section 230548 "Vibration Isolation and Seismic Controls for HVAC" for the following:
 - 1. Plumbing Piping.
 - 2. Plumbing Equipment.

PART 2 - PRODUCTS

2.1 (NOT USED)

PART 3 - EXECUTION

3.1 (NOT USED)

END OF SECTION 22 0548

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

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SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Equipment labels.
- 2. Warning signs and labels.
- 3. Pipe labels.
- 4. Stencils.
- 5. Valve tags.
- 6. Warning tags.
- 7. Ceiling grid

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Blue.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-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.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: Black.

C. Background Color: Yellow.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-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.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. 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.
 - 1. 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.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 4. Color: Yellow background with black lettering.

2.7 CEILING GRID

- A. Provide valve identification for all plumbing and med gas valves located above the ceiling on the ceiling grid below the valve.

PART 3 - EXECUTION

3.1 PREPARATION

- A. 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.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule:
 - 1. Low-Pressure, Compressed-Air Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 - 2. Medium-Pressure, Compressed-Air Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 - 3. Domestic Water Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.
 - 4. Sanitary Waste and Storm Drainage Piping:
 - a. Background Color: Comply with ASME A13.1.
 - b. Letter Color: Comply with ASME A13.1.

3.4 VALVE-TAG INSTALLATION

- A. 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 similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
 - 1. Valve-Tag Size and Shape:
 - a. Cold Water: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.
 - c. Low-Pressure Compressed Air: 1-1/2 inches, round.
 - d. High-Pressure Compressed Air: 1-1/2 inches, round.
 - 2. Valve-Tag Color:
 - a. Cold Water: Comply with ASME A13.1.
 - b. Hot Water: Comply with ASME A13.1.
 - c. Low-Pressure Compressed Air: Comply with ASME A13.1.
 - d. High-Pressure Compressed Air: Comply with ASME A13.1.
 - 3. Letter Color:
 - a. Cold Water: Comply with ASME A13.1.
 - b. Hot Water: Comply with ASME A13.1.
 - c. Low-Pressure Compressed Air: Comply with ASME A13.1.
 - d. High-Pressure Compressed Air: Comply with ASME A13.1.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 22 0553

SECTION 22 0700 - PLUMBING 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. Insulation Materials:
 - a. Flexible elastomeric.
 - b. Mineral fiber.
- 2. Adhesives.
- 3. Lagging adhesives.
- 4. Sealants.
- 5. Factory-applied jackets.
- 6. Field-applied fabric-reinforcing mesh.
- 7. Field-applied jackets.
- 8. Tapes.
- 9. Securements.
- 10. Corner angles.

- B. Related Sections include the following:

- 1. Division 23 Section "HVAC Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail attachment and covering of heat tracing inside insulation.
 - 3. Detail insulation application at pipe expansion joints for each type of insulation.

4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.

- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop

Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

- C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.
 - e. Manson Insulation Inc.; AK Board.
 - f. Owens Corning; Fiberglass 700 Series.
- I. Mineral-Fiber, Preformed Pipe Insulation:
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000(Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; CrimpWrap.
 - b. Johns Manville; MicroFlex.
 - c. Knauf Insulation; Pipe and Tank Insulation.

- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA Inc.; Aeroseal.
 - b. Armacell LCC; 520 Adhesive.
 - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
 - d. RBX Corporation; Rubatex Contact Adhesive.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-82.
 - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
 - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
 - d. Marathon Industries, Inc.; 225.
 - e. Mon-Eco Industries, Inc.; 22-25.
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Chemical Company (The); 739, Dow Silicone.
 - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Red Devil, Inc.; Celulon Ultra Clear.
 - e. Speedline Corporation; Speedline Vinyl Adhesive.

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-35.
 - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
 - c. ITW TACC, Division of Illinois Tool Works; CB-50.
 - d. Marathon Industries, Inc.; 590.
 - e. Mon-Eco Industries, Inc.; 55-40.
 - f. Vimasco Corporation; 749.
 - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
 - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 5. Color: White.
- C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Encacel.
 - b. Foster Products Corporation, H. B. Fuller Company; 60-95/60-96.
 - c. Marathon Industries, Inc.; 570.
 - d. Mon-Eco Industries, Inc.; 55-70.
 - 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 - 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 - 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 - 5. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-52.
 - b. Foster Products Corporation, H. B. Fuller Company; 81-42.
 - c. Marathon Industries, Inc.; 130.

- d. Mon-Eco Industries, Inc.; 11-30.
 - e. Vimasco Corporation; 136.
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over equipment and pipe insulation.
3. Service Temperature Range: Minus 50 to plus 180 deg F.
4. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76-8.
 - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
 - c. Marathon Industries, Inc.; 405.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Vimasco Corporation; 750.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. PVDC Jacket for Indoor Applications: 4-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
5. PVDC Jacket for Outdoor Applications: 6-mil- thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
6. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
 - a. Products: Subject to compliance with requirements, provide the following:
 - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto PVC Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.

4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
5. Factory-fabricated tank heads and tank side panels.

C. Metal Jacket:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products, Division of ITW; Metal Jacketing Systems.
 - b. PABCO Metals Corporation; Surefit.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.
 - 4) Flange and union covers.
 - 5) End caps.
 - 6) Beveled collars.
 - 7) Valve covers.
 - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
 - b. Compac Corp.; 104 and 105.

- c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 11.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - b. Compac Corp.; 110 and 111.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 491 AWF FSK.
 - d. Venture Tape; 1525 CW, 1528 CW, and 1528 CW/SQ.
 - 2. Width: 3 inches.
 - 3. Thickness: 6.5 mils.
 - 4. Adhesion: 90 ounces force/inch in width.
 - 5. Elongation: 2 percent.
 - 6. Tensile Strength: 40 lbf/inch in width.
 - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
 - b. Compac Corp.; 130.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
 - d. Venture Tape; 1506 CW NS.
 - 2. Width: 2 inches.
 - 3. Thickness: 6 mils.
 - 4. Adhesion: 64 ounces force/inch in width.
 - 5. Elongation: 500 percent.
 - 6. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.

- b. Compac Corp.; 120.
 - c. Ideal Tape Co., Inc., an American Biltrite Company; 488 AWF.
 - d. Venture Tape; 3520 CW.
 - 2. Width: 2 inches.
 - 3. Thickness: 3.7 mils.
 - 4. Adhesion: 100 ounces force/inch in width.
 - 5. Elongation: 5 percent.
 - 6. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape: White vapor-retarder PVDC tape with acrylic adhesive.
- 1. Products: Subject to compliance with requirements, provide the following:
 - a. Dow Chemical Company (The); Saran 540 Vapor Retarder Tape.
 - 2. Width: 3 inches.
 - 3. Film Thickness: 4 mils.
 - 4. Adhesive Thickness: 1.5 mils.
 - 5. Elongation at Break: 145 percent.
 - 6. Tensile Strength: 55 lbf/inch in width.

2.9 SECUREMENTS

A. Bands:

- 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Products; Bands.
 - b. PABCO Metals Corporation; Bands.
 - c. RPR Products, Inc.; Bands.
- 2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing or closed seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
- 4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

- 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series T.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.
 - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum or Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Insul-Hangers, Series TSA.
 - 2) GEMCO; Press and Peel.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Aluminum or Stainless steel], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

- d. Adhesive-backed base with a peel-off protective cover.
- 5. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, aluminum or stainless-steel] sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; RC-150.
 - 2) GEMCO; R-150.
 - 3) Midwest Fasteners, Inc.; WA-150.
 - 4) Nelson Stud Welding; Speed Clips.
 - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy or 0.062-inch soft-annealed, stainless steel.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. C & F Wire.
 - b. Childers Products.
 - c. PABCO Metals Corporation.
 - d. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.
 - 2. Testing agency labels and stamps.
 - 3. Nameplates and data plates.
 - 4. Manholes.
 - 5. Handholes.
 - 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
 - B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
 - C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
 - D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
 - E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.
 - F. Insulation Installation at Floor Penetrations:
 1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."
- 3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION
- A. Mineral Fiber, Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.
 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
 2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
 3. Protect exposed corners with secured corner angles.
 4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:

- a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
 6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
 7. Stagger joints between insulation layers at least 3 inches.
 8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
 9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
 10. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

B. Insulation Installation on Pumps:

1. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch- diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
2. Fabricate boxes from aluminum or stainless steel, at least 0.040 inch thick.
3. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

3.6 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.7 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.

2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

D. Where PVDC jackets are indicated, install as follows:

1. Apply three separate wraps of filament tape per insulation section to secure pipe insulation to pipe prior to installation of PVDC jacket.
2. Wrap factory-presized jackets around individual pipe insulation sections with one end overlapping the previously installed sheet. Install presized jacket with an approximate overlap at butt joint of 2 inches over the previous section. Adhere lap seal using adhesive or SSL, and then apply 1-1/4 circumferences of appropriate PVDC tape around overlapped butt joint.
3. Continuous jacket can be spiral wrapped around a length of pipe insulation. Apply adhesive or PVDC tape at overlapped spiral edge. When electing to use adhesives, refer to manufacturer's written instructions for application of adhesives along this spiral edge to maintain a permanent bond.

4. Jacket can be wrapped in cigarette fashion along length of roll for insulation systems with an outer circumference of 33-1/2 inches or less. The 33-1/2-inch- circumference limit allows for 2-inch- overlap seal. Using the length of roll allows for longer sections of jacket to be installed at one time. Use adhesive on the lap seal. Visually inspect lap seal for "fishmouthing," and use PVDC tape along lap seal to secure joint.
5. Repair holes or tears in PVDC jacket by placing PVDC tape over the hole or tear and wrapping a minimum of 1-1/4 circumferences to avoid damage to tape edges.

3.10 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.11 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.12 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment in paragraphs below that is not factory insulated.
- C. Steam-to-hot-water converter insulation shall be one of the following:
 1. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.
 2. Mineral-Fiber Pipe and Tank: 2 inches thick.
- D. Unfired Hot Water Storage Tanks
 1. Mineral-Fiber Board: 3.5 inches thick and 2-lb/cu. ft. nominal density.
 2. Mineral-Fiber Pipe and Tank: 3.5 inches thick.

- E. Domestic water pump insulation shall be the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
- F. Domestic hot-water pump insulation shall be the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
- G. Domestic water, domestic chilled-water (potable), and domestic hot-water hydropneumatic tank insulation shall be one of the following:
 - 1. Mineral-Fiber Board: 1 inch thick and 2-lb/cu. ft. nominal density.
 - 2. Mineral-Fiber Pipe and Tank: 1 inch thick.

3.13 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Underground piping.
 - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.14 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch
 - 2. NPS 2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
 - 2. NPS 2 and Larger: Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.
 - C. Domestic Chilled Water (Potable):
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
 - D. Stormwater and Overflow:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
 - E. Roof Drain and Overflow Drain Bodies:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
 - F. Condensate and Equipment Drain Water below 60 Deg F:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch.
- 3.15 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
 - B. If more than one material is listed, selection from materials listed is Contractor's option.
 - C. Equipment, Concealed:
 - 1. None.
 - D. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches.
 - 1. Aluminum, Stucco Embossed: 0.016 inch thick.
 - E. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:
 - 1. Aluminum, Stucco Embossed with 1-1/4-Inch- Deep Corrugations: 0.032 inch thick.
 - F. Piping, Concealed:

1. None.

G. Piping, Exposed:

1. PVC: 20 mils thick.
 - a. Jacket Color: (Mechanical Rooms and where exposed)
 - 1) Domestic Water (Hot & Cold & Hot Return): Green
 - 2) Industrial Water (Hot & Cold & Hot Return): Brown
 - 3) All Other Piping: White

3.16 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 1. None.
- D. Piping, Exposed:
 1. PVC: 20 mils thick.

END OF SECTION 22 0700

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

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SECTION 22 1116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For transition fittings and dielectric fittings.
- B. Delegated-Design Submittal:
 - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
 - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 - 1. Notify Construction Manager or owner no fewer than two days in advance of proposed interruption of water service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."
- C. All piping shall be American made and tested; no import pipe will be permitted.
- D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.
- E. All piping installed in or passing through a plenum must be plenum rated, fire wrapped, or installed in a metal conduit.

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.

4. Solder-joint or threaded ends.

2.3 DUCTILE-IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe:

1. AWWA C151/A21.51, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Standard-Pattern, Mechanical-Joint Fittings:

1. AWWA C110/A21.10, ductile or gray iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Compact-Pattern, Mechanical-Joint Fittings:

1. AWWA C153/A21.53, ductile iron.
2. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

D. Plain-End, Ductile-Iron Pipe: AWWA C151/A21.51.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. PP Pipe and Fittings: Manufacturer's recommended fusion-weld system.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Coupling: AWWA C219.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cascade Waterworks Manufacturing.
 - b. Dresser, Inc.; Piping Specialties Products.
 - c. Ford Meter Box Company, Inc. (The).
 - d. JCM Industries.
 - e. Romac Industries, Inc.
 - f. Smith-Blair, Inc.; a Sensus company.
 - g. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
2. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Colonial Engineering, Inc.
 - b. NIBCO Inc.
 - c. Spears Manufacturing Company.
2. Description:

- a. CPVC four-part union.
- b. Brass threaded end.
- c. Solvent-cement-joint plastic end.
- d. Rubber O-ring.
- e. Union nut.

2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Nipples and Waterways:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products; Tyco Fire Products LP.
 - c. Matco-Norca.
 - d. Clearflow/Perfection Corp.
 - e. Precision Plumbing Products, Inc.
 - f. Victaulic Company.
 - 2. Standard: IAPMO PS 66 or ASTM F-1545-97.
 - 3. Electroplated steel nipple or waterway complying with ASTM F 1545 or ANSI/NSF-61 Compliant.
 - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
 - 5. End Connections: Male threaded or grooved.
 - 6. Lining: Inert and noncorrosive, propylene or LTHS.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Division 22 Section "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Division 22 Section "Domestic Water Piping Specialties."
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
 - 1. Piping will be drained seasonally for freeze protection.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- K. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- L. 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.
- M. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.

- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Division 22 Section "Meters and Gages for Plumbing Piping."
- T. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Division 22 Section "Domestic Water Pumps."
- U. Install thermometers on inlet piping from each water heater. Comply with requirements for thermometers in Division 22 Section "Meters and Gages for Plumbing Piping."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- F. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- G. Joint Construction for Grooved-End Steel Piping: Make joints according to AWWA C606. Roll groove ends of pipe as specified. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.
- H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings.

3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples/waterways.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric nipples/waterways.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric nipples/waterways.

3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

- B. Comply with requirements for pipe hanger, support products, and installation in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
 - 8. NPS 8 to NPS 12: 12 feet with 7/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install supports for vertical PP piping every 60 inches for NPS 1 and smaller, and every 72 inches for NPS 1-1/4 and larger.

- J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
 - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
 - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 - 3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code. Comply with requirements for connection sizes in Division 22 plumbing fixture Sections.
 - 4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Division 22 Section "Identification for Plumbing Piping and Equipment."
- B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

- 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
 - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
 - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.10 ADJUSTING

- A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
 2. Open shutoff valves to fully open position.
 3. Open throttling valves to proper setting.
 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
- a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
 - d. Repeat procedures if biological examination shows contamination.
 - e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

- A. Some piping types and sizes mentioned in this section may not be used on this project.
- B. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- C. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- D. All exposed water supply piping in toilet rooms, custodial rooms and kitchens shall be chromium plated.
- E. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- G. Under-building-slab, combined domestic water, building-service, and fire-service-main piping, NPS 6 to NPS 12, shall be the following:
 - 1. Mechanical-joint, ductile-iron pipe; standard-, mechanical-joint fittings; and mechanical joints.
- H. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be the following:
 - 1. Hard copper tube; ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- I. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-copper, solder-joint fittings; and soldered joints.
- J. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type L; cast-copper, solder-joint fittings; and soldered joints.

K. Aboveground domestic water piping, NPS 5 and larger, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast-copper, solder-joint fittings; and soldered joints.

3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball for piping NPS 3 and smaller. Use butterfly, with flanged ends for piping NPS 4 and larger.
2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

END OF SECTION 22 1116

SECTION 22 1119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following domestic water piping specialties:
 - 1. Vacuum breakers.
 - 2. Backflow preventers.
 - 3. Water pressure-reducing valves.
 - 4. Balancing valves.
 - 5. Temperature-actuated water mixing valves.
 - 6. Strainers.
 - 7. Outlet boxes.
 - 8. Hose bibbs.
 - 9. Wall hydrants.
 - 10. Drain valves.
 - 11. Water hammer arresters.
- B. Related Sections include the following:
 - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
 - 2. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
 - 3. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.

- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
 - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. FEBCO; SPX Valves & Controls.
 - e. Rain Bird Corporation.
 - f. Toro Company (The); Irrigation Div.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
 - 2. Standard: ASSE 1001.
 - 3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
 - 4. Body: Bronze.
 - 5. Inlet and Outlet Connections: Threaded.
 - 6. Finish: Chrome plated.
- B. Hose-Connection Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. MIFAB, Inc.
 - e. Prier Products, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
 - i. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Toro Company (The); Irrigation Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.

4. Accessories:
 - a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
 - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ames Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Industries, Inc.; Water Products Div.
 - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.

5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Accessories:
 - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

C. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Ford Meter Box Company, Inc. (The).
 - f. Honeywell Water Controls.
 - g. McDonald, A. Y. Mfg. Co.
 - h. Mueller Co.; Water Products Div.
 - i. Watts Industries, Inc.; Water Products Div.
 - j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1024.
3. Operation: Continuous-pressure applications.
4. Body: Bronze with union inlet.

E. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Lancer Corporation.
 - c. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators: (Direct Type)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Watts Industries, Inc.; Water Products Div.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze, provide chrome-plated finish if connected to chrome plated or stainless steel piping for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves: (Pilot type)

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CLA-VAL Automatic Control Valves.
 - b. Mifab Corp; Beeco.
 - c. Watts Industries, Inc.; Ames Fluid Control Systems.
 - d. Watts Industries, Inc.; Watts ACV.
 - e. Zurn Plumbing Products Group; Wilkins Div.
2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.

3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Taco, Inc.
 - g. Victaulic
 - h. Watts Industries, Inc.; Water Products Div.
2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: bronze,
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Flo Fab Inc.
 - c. ITT Industries; Bell & Gossett Div.
 - d. NIBCO INC.
 - e. TAC Americas.
 - f. Watts Industries, Inc.; Water Products Div.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 - e. Leonard Valve Company.
 - f. Powers; a Watts Industries Co.
 - g. Symmons Industries, Inc.
 - h. Taco, Inc.
 - i. Watts Industries, Inc.; Water Products Div.
 - j. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Rough bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Lawler Manufacturing Company, Inc.
 - c. Leonard Valve Company.
 - d. Powers; a Watts Industries Co.
 - e. Symmons Industries, Inc.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Exposed-mounting, thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Pressure Rating: 125 psig minimum, unless otherwise indicated.
9. Valve Finish: Chrome plated.

10. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. Honeywell Water Controls.
 - d. Lawler Manufacturing Company, Inc.
 - e. Leonard Valve Company.
 - f. Powers; a Watts Industries Co.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1016, thermostatically controlled water tempering valve.
3. Pressure Rating: 125 psig minimum, unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
 - a. Strainers NPS 2 and Smaller: 0.020 inch.
 - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
 - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Factory-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Icemaker Outlet Boxes:

1. Basis of Design: See plumbing fixture schedule.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing Co., Inc.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Oatey.
 - f. Plastic Oddities; a division of Diverse Corporate Technologies.
 - g. Symmons Industries, Inc.
 - h. Watts Industries, Inc.; Water Products Div.
 - i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
 - j. Zurn Plumbing Products Group; Light Commercial Operation.
3. Mounting: Recessed.
4. Material and Finish: Enameled-steel or epoxy-painted-steel or plastic box and faceplate.
5. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
6. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
7. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two 60-inch- long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
9. Drain Hose: One 48-inch- long, rubber household clothes washer drain hose with hooked end.
10. Operating Keys: Two with each wall hydrant.

2.8 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.9 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Metal bellows or Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- C. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install thermometers and water regulators if specified.
 2. Install cabinet-type units recessed in or surface mounted on wall as specified.

- F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- G. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- H. Install water hammer arresters in water piping according to PDI-WH 201.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Pressure vacuum breakers.
 - 2. Reduced-pressure-principle backflow preventers.
 - 3. Double-check backflow-prevention assemblies.
 - 4. Carbonated-beverage-machine backflow preventers.
 - 5. Dual-check-valve backflow preventers.
 - 6. Water pressure-reducing valves.
 - 7. Calibrated balancing valves.
 - 8. Primary, thermostatic, water mixing valves.
 - 9. Primary water tempering valves.
 - 10. Outlet boxes.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:

1. Test each backflow preventer according to authorities having jurisdiction and the device's reference standard.

- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 22 1119

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

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SECTION 22 1316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipe, tube, and fittings.
 - 2. Specialty pipe fittings.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. PVC: Polyvinyl chloride plastic.

1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.
- B. Seismic Performance: Soil, waste, and vent piping and support and installation shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. For piping with a seismic importance factor of 1.0 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."
 - 2. For piping with a seismic importance factor of 1.5 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."

1.5 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products 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."

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For waste and vent piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-sewer" for plastic sewer piping; "NSF-drain" for plastic drain piping, and "NSF-tubular" for plastic continuous waste piping.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of sanitary waste service.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: All cast-iron waste, vent and sewer pipe and fittings shall conform to the requirements of CISPI Standard 301 and ASTM A 888. All products shall be marked with the collective trademark of the Cast Soil Pipe Institute and shall be listed by NSF International or receive prior approval of the engineer. All cast-iron pipe and fittings shall be American made and tested. Non-compliant import cast-iron products will not be permitted. Any non-compliant cast-iron product installed by the contractor on this project will be replaced at the contractor's expense and shall include all repairs, patching, painting and other incidental work required to return the project to its pre-remediation state.

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. AB&I Foundry
 - b. Charlotte Pipe
 - c. Tyler Pipe

- B. CISPI, Hubless-Piping Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. ANACO.
 - b. Ideal
 - c. Mission Rubber Company; a division of MCP Industries, Inc.
 - d. Tyler Pipe.

- 2. Standards: ASTM C 1277 and CISPI 310.
 - 3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.
 - 4. Listing: Couplings shall be listed by NSF International. Each coupling shall be embossed with the NSF seal.

- C. Heavy-Duty, Hubless-Piping Couplings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Husky SD 4000.
 - b. Clamp-All Corp HI-TORQ 125.
2. Standards: ASTM C 1277 and ASTM C 1540.
3. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
- B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Adhesive Primer: ASTM F 656.
 1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Solvent Cement: ASTM D 2564.
 1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 DOUBLE-CONTAINMENT PIPE AND FITTINGS

- A. Piping Materials:
 1. PVC Double-Containment Pipe and Fittings:
 - a. PVC Carrier Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.
 - 1) Piping Color: White.
 - b. PVC Containment Pipe: ASTM D1785, Schedule 40 with ASTM D2466 fittings.
 - 1) Piping Color: Clear.
 - c. Supports: Molded supports or disks as supplied by the double containment pipping system manufacturer for the size and piping type specified.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.
- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Install piping to allow application of insulation.
- I. Install seismic restraints on piping. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert.
- L. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping.

2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.
- N. Install underground PVC piping according to ASTM D 2321.
- O. Install PVC Double-Containment as required by the manufacturer:
1. All installers should be trained by manufacturer or manufacturer's rep to ensure that proper installation techniques and considerations are followed.
- P. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping. Comply with requirements for cleanouts specified in Division 22 Section "Sanitary Waste Piping Specialties."
 2. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 3. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- Q. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 22 Section "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."
- 3.3 JOINT CONSTRUCTION
- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe

and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger and support devices and installation specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
 2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
 3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
 4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
 5. Vertical Piping: MSS Type 8 or Type 42, clamps.
 6. Install individual, straight, horizontal piping runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
 7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 8. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support horizontal piping and tubing within 12 inches of each fitting and coupling or valve and coupling.
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6 and NPS 8: 60 inches with 3/4-inch rod.
 5. NPS 10 and NPS 12: 60 inches with 7/8-inch rod.
 6. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.

- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Install hangers for double-containment PVC piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/2 and NPS 3: 48 inches with 3/8-inch rod.
 - 2. NPS 4: 48 inches with 1/2-inch rod.
 - 3. NPS 5 and NPS 6: 48 inches with 5/8-inch rod.
 - 4. NPS 8 and NPS 10: 48 inches with 3/4-inch rod.
 - 5. NPS 12 and NPS 14: 48 inches with 7/8-inch rod.
- I. Install supports for vertical double-containment PVC piping every 48 inches.
- J. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
 - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
 - 5. Comply with requirements for cleanouts and drains specified in Division 22 Section "Sanitary Waste Piping Specialties."
 - 6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- E. Make fixture and equipment connections according to the following unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final

connection to each piece of equipment.

3.6 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 - 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 - 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 - 3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
 - 4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
 - 5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 6. Prepare reports for tests and required corrective action.

3.8 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 3 and smaller shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, soil and waste piping NPS 4 and larger shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- D. Aboveground, vent piping NPS 3 and smaller shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- E. Aboveground, vent piping NPS 4 and larger shall be the following:
 - 1. Hubless, cast-iron soil pipe and fittings CISPI hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.
- F. Aboveground Grease, soil, waste and vent piping shall be any of the following:
 - 1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
 - 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- G. Aboveground, soil and waste piping installed above operating rooms, delivery rooms, trauma rooms, nurseries, central kitchens, sterile processing and Class 1 and 2 imaging rooms shall be the following:

1. Double-Containment piping with solvent cement joints.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- H. Underground Grease, soil, waste and vent piping shall be any of the following:
1. Hubless, cast-iron soil pipe and fittings heavy-duty hubless-piping couplings; and coupled joints.
 2. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. Rated for High Temperatures.
- I. Underground, soil, waste, and vent piping NPS 3 and smaller shall be the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high temperatures.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- J. Underground, soil and waste piping NPS 4 and larger shall be the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints. All underground waste piping in boiler room shall be rated for high temperatures.
 2. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- K. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION 22 1316

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SECTION 22 1319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Channel drainage systems.
 - 4. Roof flashing assemblies.
 - 5. Through-penetration firestop assemblies.
 - 6. Miscellaneous sanitary drainage piping specialties.
 - 7. Flashing materials.
- B. Related Sections include the following:
 - 1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.

1.3 SEISMIC REQUIREMENTS

- A. Component Importance Factor. All plumbing components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
 - 1. The component is required to function for life-safety purposes after an earthquake.
 - 2. The component contains hazardous materials.
 - 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.
- C. Seismic Performance: Plumbing equipment, hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

1.4 DEFINITIONS

- A. FOG: Fats, oils, and greases.
- B. FRP: Fiberglass-reinforced plastic.
- C. HDPE: High-density polyethylene plastic.
- D. PE: Polyethylene plastic.
- E. PP: Polypropylene plastic.
- F. PVC: Polyvinyl chloride plastic.

1.5 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.
 - 1. Wiring Diagrams: Power, signal, and control wiring.
- B. Manufacturer Seismic Qualification Certification: Submit certification that FOG disposal systems, grease interceptors, grease removal devices, oil interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. For components with a seismic importance factor of 1.0 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."
 - b. For components with a seismic importance factor of 1.5 the term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Sun Drainage Products
- 2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
- 3. Size: Same as connected drainage piping
- 4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 5. Closure: Countersunk, brass plug.
- 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- 7. Closure: Stainless-steel plug with seal.

B. Metal Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Oatey.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Light Commercial Operation.
 - g. Zurn Plumbing Products Group; Specification Drainage Operation.
 - h. Sun Drainage Products
2. Standard: ASME A112.36.2M for adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Adjustable housing.
5. Body or Ferrule: Cast iron.
6. Clamping Device: Required.
7. Outlet Connection: Inside calk.
8. Closure: Brass plug with tapered threads.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top Loading Classification: Heavy Duty.
13. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
14. Standard: ASME A112.3.1.
15. Size: Same as connected branch.
16. Housing: Stainless steel.
17. Closure: Stainless steel with seal.
18. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Sun Drainage Products
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.

4. Body: Hub-and-spigot, cast-iron soil pipe T-branch as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. Basis-of-Design Product: See Schedule at end of this Section:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
 - g. Sun Drainage Products
3. Standard: ASME A112.6.3.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Not required.
7. Outlet: Bottom.
8. Trap Material: Cast iron>.
9. Trap Pattern: Deep-seal P-trap.
10. Trap Features: Barrier type trap seal. Trap Guard or equivalent.

2.3 THROUGH-PENETRATION FIRESTOP ASSEMBLIES

A. Through-Penetration Firestop Assemblies:

1. 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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProSet Systems Inc.
3. Standard: UL 1479 assembly of sleeve and stack fitting with firestopping plug.
4. Size: Same as connected soil, waste, or vent stack.

5. Sleeve: Molded PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
6. Stack Fitting: ASTM A 48/A 48M, gray-iron, hubless-pattern, wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
7. Special Coating: Corrosion resistant on interior of fittings.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping.
2. Size: Same as connected waste piping.
 - a. NPS 2: 4-inch- minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Floor-Drain, Trap-Seal:

1. Description: Barrier type trap seal. Trap Guard or equivalent.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch > above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

F. Vent Cap Filters:

1. Description: Activated carbon filter in housing for installation at vent terminal as manufactured by Sweet Filter.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
 1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
 2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
 3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.
- C. Fasteners: Metal compatible with material and substrate being fastened.
- D. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 MOTORS

- A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."
 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 CONCRETE BASES

- A. Anchor grease removal devices to concrete bases.
 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
 2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- C. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- D. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- E. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- F. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- G. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
 - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
 - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- H. Assemble plastic channel drainage system components according to manufacturer's written instructions. Install on support devices so that top will be flush with adjacent surface.
- I. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- J. Install floor-drain, trap-seal device in inlet to floor drains that require trap-seal protection.
1. Size: Same as floor drain inlet.
- K. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- L. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- M. Install vent cap filters on each vent pipe passing through roof.
- N. Install wood-blocking reinforcement for wall-mounting-type specialties.
- O. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- P. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.
- G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled grease removal devices and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.7 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 22 1319

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SECTION 23 0100 - MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

- A. The General Conditions of the Contract, with the amendments, supplements, forms and requirements in Division 1, and herewith made a part of this Division.
- B. All sections of Division 21, 22, & 23 shall comply with the Mechanical General Requirements. The standards established in this section as to quality of materials and equipment, the type and quality of workmanship, mode of operations, safety rules, code requirements, etc., shall apply to all sections of this Division as though they were repeated in each Division.
- C. Mechanical equipment that is pre-purchased if any will be assigned to the Mechanical Contractor. By assignment to the Mechanical Contractor, the Mechanical Contractor shall accept and installed the equipment and provide all warranties and guarantees as if the Mechanical Contractor had purchased the equipment.

1.2 SCOPE OF WORK

- A. The project described herein is the INTERMOUNTAIN HEALTHCARE BEAR RIVER HOSPITAL – MRI REPLACEMENT. This work shall include all labor, materials, equipment, fixtures, and devices for the entire mechanical work and a complete operating and tested installation as required for this project.
- B. This Division will schedule the boiler inspection and pay for all costs associated with certifying the boiler with the state.

1.3 CODES & ORDINANCES

- A. All work shall be executed in accordance with all underwriters, public utilities, local and state rules and regulations applicable to the trade affected. Should any change in the plans and Specifications be required to comply with these regulations, the Contractor shall notify the Architect before the time of submitting his bid. After entering into contract, the Contractor will be held to complete all work necessary to meet these requirements without extra expense to the Owner. Where work required by drawings or specifications is above the standard required, it shall be done as shown or specified.
- B. Applicable codes:
 - 1. Utah Boiler and Pressure Vessel Rules and Regulations-2019 Edition
 - 2. International Building code- 2021 Edition
 - 3. International Mechanical Code- 2021 Edition

4. International Plumbing Code- 2021 Edition
5. International Fire Code- 2021 Edition
6. International Energy Code- 2021 Edition
7. International Fuel Gas Code- 2021 Edition
8. National Electrical Code- 2020 Edition

1.4 INDUSTRY STANDARDS

- A. All work shall comply with the following standards.
1. Associated Air Balance council (AABC)
 2. Air Conditioning and Refrigeration Institute (ARI)
 3. Air Diffusion council (ADC)
 4. Air Movement and Control Association (AMCA)
 5. American Gas Association (AGA)
 6. American National Standards Institute (ANSI)
 7. American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE)
 8. American Society of Mechanical Engineers (ASME)
 9. American Society of Testing Materials (ASTM)
 10. American Water Works Association (AWWA)
 11. Cooling Tower Institute (CTI)
 12. ETL Testing Laboratories (ETL)
 13. Institute of Electrical and Electronic Engineers (IEEE)
 14. Hydronics Institute (HI)
 15. Manufacturers Standardization Society of the Valve and Fitting Industry (MSS)
 16. National Fire Protection Association (NFPA)
 17. National Electrical Code (NEC)
 18. National Electrical Manufacturers Association (NEMA)
 19. National Electrical Safety code (NESC)
 20. Utah safety Standard (OSHA), Utah State Industrial Council.
 21. Sheet Metal and Air Conditioning Contractor's National Association (SMACNA)
 22. Underwriters Laboratories (UL)
 23. Tubular Exchanger Manufacturers Association, Inc. (TEMA)
 24. Heat Exchanger Institute (HEI)
 25. Hydraulic Institute (HI)
 26. Thermal Insulation Manufacturer=s Association (TIMA)
 27. Scientific Apparatus Makers Association (SAMA)
- B. Compliance Verification:
1. All items required by code or specified to conform to the ASME code shall be stamped with the ASME seal.
 2. Form U-1, the manufacturer=s data report for pressure vessels, is to be included in the Operation and Maintenance Manuals. National Board Register (NBR) numbers shall be provided where required by code.
 3. Manufactured equipment which is represented by a UL classification and/or listing, shall bear the UL or equivalent ETL label.

1.5 UTILITIES & FEES

- A. All fees for permits required by this work will be paid by this division. The contractor shall obtain the necessary permits to perform this work. Unless noted otherwise, all systems furnished and or installed by this Contractor, shall be complete with all utilities, components, commodities and accessories required for a fully functioning system. This Contractor shall furnish smoke generators when required for testing, furnish glycol for glycol piping systems, full load of salt to fill brine tank for water softening system, furnish cleaners and water treatment additives.

1.6 SUBMITTALS AND SHOP DRAWINGS

- A. General: As soon as possible after the contract is awarded, but in no case more than 45 calendar days thereafter, the Contractor shall submit to the Architect manufacturer's data on products and materials to be used in the installation of mechanical systems for this project. The review of the submitted data will require a minimum of 14 days. The first day starts after the day they are received in the engineer's office to which the project is being constructed from. If the Contractors schedule requires return of submitted literature in less than the allotted time, the Contractor shall accelerate his submittal delivery date. The Contractor shall resubmit all items requiring re-review within 14 days of returned submittals. Refer to each specification section for items requiring submittal review. If the re-submittal is returned a 2nd time for correction the Contractor will provide the specific equipment that is specified on the drawings and/or the specifications. Written approval of the Owner's Representative shall be obtained before installing any such equipment or materials for the project.
- B. Review by the Owner's Representative is for general conformance of the submitted equipment to the project specification. In no way does such review relieve this Contractor of his obligation to furnish equipment and materials that comply in detail to the specification nor does it relieve the Contractor of his obligation to determine actual field dimensions and conditions that may affect his work. Regardless of any items overlooked by the submittal review, the requirements of the contract drawings and specifications must be followed and are not waived or superseded in any way by the review.
- C. By description, catalog number, and manufacturer's names, standards of quality have been established by the Architect and the Engineer for certain manufactured equipment items and specialties that are to be furnished by this Division. Alternate products and equipment may be proposed for use only if specifically named in the specifications or if given written prior approval in published addenda. Design equipment is the equipment listed on the drawings or if not listed on the drawings is the equipment first named in the specifications.
- D. If the Engineer is required to do additional design work to incorporate changes caused by submitting equipment or products, different than the design equipment specified, as defined above, the contractor shall reimburse the engineer for additional time and expenses at the engineer's current, recognized, hourly rates.
- E. Submittal Format: At the contractor's discretion, project submittals may be in either of the formats described in the following paragraphs, but mixing the two formats is not acceptable.

1. Hardcopy Submittal Format: Six (6) copies of the descriptive literature covering products and materials to be used in the installation of mechanical systems for this project will be provided for review. The submittals shall be prepared in an orderly manner, contained in a 3-ring loose-leaf binder with index and identification tab for each item or group of items and for each specification section. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within 120 days of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.
 - a. Submitted literature shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.
 - b. Submitted literature shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.
 - c. Submitted literature shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.
2. Electronic Submittal Format: Identify and incorporate information in each electronic submittal file as follows:
 - a. All items shall be submitted at one time except automatic temperature control drawings and seismic restraint drawings which may be submitted separately within 120 days of the contract award date. Partial submittals will not be reviewed until the complete submittal is received.
 - b. Submitted electronic file shall bear the Contractor's stamp, indicating that he has checked all equipment being submitted; that each item will fit into the available space with the accesses shown on the drawings; and, further, that each item conforms to the capacity and quality standards given in the contract documents.
 - c. Submitted electronic file shall clearly indicate performance, quality, and utility requirements; shall show dimension and size of connection points; and shall include derating factors that were applied for each item of equipment to provide capacity at job site elevation. Temperature control submittals shall include piping and wiring diagrams, sequence of operation and equipment. Equipment must fit into the available space with allowance for operation, maintenance, etc. Factory piped and wired equipment shall include shop drawings for all internal wiring and piping furnished with the unit.
 - d. Submitted electronic file shall clearly show all required field install wiring, piping, and accessory installations required by the Contractor to provide a complete operating system.

- e. 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.
- f. Name file with submittal number or other unique identifier, including revision identifier.
- g. Electronic file shall be completely electronically searchable or it will be rejected.
- h. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by:
 - 1) Architect.
- i. Transmittal Form for Electronic Submittals:
 - 1) Use one of the following options acceptable to the Owner;
 - a) Software-generated form from electronic project management software.
 - b) Electronic form.
 - 2) The Electronic Submittal shall contain the following information:
 - a) Project name.
 - b) Date.
 - c) Name and address of Architect.
 - d) Name of Construction Manager.
 - e) Name of Contractor.
 - f) Name of firm or entity that prepared submittal.
 - g) Names of subcontractor, manufacturer, and supplier.
 - h) Category and type of submittal.
 - i) Submittal purpose and description.
 - j) Specification Section number and title.
 - k) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l) Drawing number and detail references, as appropriate.
 - m) Location(s) where product is to be installed, as appropriate.
 - n) Related physical samples submitted directly.
 - o) Indication of full or partial submittal.
 - p) Transmittal number, numbered consecutively.
 - q) Submittal and transmittal distribution record.
 - r) Other necessary identification.
 - s) Remarks.
- j. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - 1) Project name.
 - 2) Number and title of appropriate Specification Section.
 - 3) Manufacturer name.
 - 4) Product name.

1.7 DRAWINGS AND MEASUREMENTS

- A. Construction Drawings: The contract document drawings show the general design, arrangements, and extent of the system. In certain cases, the drawings may include details that show more nearly exact locations and arrangements; however, the locations, as shown diagrammatically, are to be regarded as general.
- B. It shall be the work of this Section to make such slight alterations as may be necessary to make adjustable parts fit to fixed parts, leaving all complete and in proper shape when done. All dimensions given on the drawings shall be verified as related to this work and with the Architect's office before work is started.
- C. This Section shall carefully study building sections, space, clearances, etc., and then provide offsets in piping or ductwork as required to accommodate the building structure without additional cost to the Owner. In any case and at any time during the construction process, a change in location required by obstacles or the installation of other trades not shown on the mechanical plans shall be made without charge.
- D. The drawings shall not be scaled for roughing in measurements nor shall they be used as shop drawings. Where drawings are required for these purposes or where drawings must be made from field measurements, the Contractor shall take the necessary measurements and prepare the drawings. Shop drawings of the various subcontractors shall be coordinated to eliminate all interferences and to provide sufficient space for the installation of all equipment, piping, ductwork, etc.
- E. The drawings and specifications have been prepared to supplement each other and they shall be interpreted as an integral unit with items shown on one and not the other being furnished and installed as though shown and called out on both.
- F. Coordination Drawings: The contractor shall provide coordination drawings for mechanical rooms, fan rooms, equipment rooms, and congested areas to eliminate conflicts with equipment, piping, or work of other trades. The drawings shall be a minimum scale of 1/4 inch= 1 foot and of such detail as may be required by the Engineer to fully illustrate the work. These drawings shall include all piping, conduit, valves, equipment, and ductwork.
- G. Sheet-metal shop drawings will be required for all ductwork in the entire building. These drawings will show all ductwork in the entire building and shall be coordinated with architectural, structural and electrical portions of the project. The contractor shall specifically obtain copies of the structural shop drawings and shall coordinate the ductwork shop drawings with approved structural members. These drawings shall be submitted to the engineer for review prior to any fabrication. The contractor is responsible for all modifications necessary to accommodate duct installation within the structural, architectural and electrical restrictions. These drawings, once reviewed by the engineer, will be made available to all mechanical, electrical, and fire sprinkler subcontractors to coordinate installation of their work.

1.8 CONTRACTOR'S USE OF BUILDING EQUIPMENT

- A. The Contractor may use equipment such as electric motors, fans, heat exchangers, filters, etc., with the written permission of the Owner. As each piece of equipment is used (such as electric motors and fans), maintenance procedures approved by the manufacturer are to be followed. A careful record is to be kept of the length of the time the equipment is used, maintenance procedures followed, and any difficulty encountered. The record is to be submitted to the Owner upon acceptance. All fan belts and filter media (such as bearings) shall be carefully inspected just prior to acceptance. Any excessive wear noted shall require replacement. New filter media shall be installed in air handlers at the time systems are turned over to the owner.

1.9 EXISTING CONDITIONS

- A. The Contractor shall carefully examine all existing conditions that might affect the mechanical system and shall compare these conditions with all drawings and specifications for work included under this contract. He shall, at such time, ascertain and check all conditions that may affect his work. No allowance shall subsequently be made in his behalf for an extra expense incurred as a result of his failure or neglect to make such examination. This Contractor shall include in his bid proposal all necessary allowances to repair or replace any item that will remain or will be removed, and any item that will be damaged or destroyed by new construction.
- B. The Contractor shall remove all abandoned piping, etc., required by new construction and cap or plug openings. No capping, etc., shall be exposed in occupied areas. All openings of items removed shall be sealed to match adjacent surfaces.
- C. The Contractor shall verify the exact location of all existing services, utilities, piping, etc., and make connections to existing systems as required or as shown on the drawings. The exact location of each utility line, together with size and elevation, shall be established before any on-site lines are installed. Should elevation or size of existing main utility lines make connections to them impossible as shown on drawings, then notification of such shall immediately be given to the Owners Representative for a decision.

1.10 EQUIPMENT CAPACITIES

- A. Capacities shown for equipment in the specifications and on the drawings are the minimum acceptable. No equipment shall be considered as an alternate that has capacities or performance less than that of design equipment.
- B. All equipment shall give the specified capacity and performance at the job-site elevation. Manufacturers' standard ratings shall be adjusted accordingly. All capacities and performances listed on drawings or in specifications are for job-site conditions.

1.11 SEISMIC REQUIREMENTS FOR EQUIPMENT

- A. All equipment shall be furnished structurally adequate to withstand seismic forces as outlined in the International Building Code. Refer to section Mechanical Vibration Controls and Seismic Restraints. Equipment bases shall be designed for direct attachment of seismic snubbers and/or seismic anchors.

1.12 COOPERATION WITH OTHER TRADES

- A. The Contractor shall refer to other drawings and parts of this specification that cover work of other trades that is carried on in conjunction with the mechanical work such that all work can proceed without interference resulting from lack of coordination.
- B. The Contractor shall properly size and locate all openings, chases, sleeves, equipment bases, and accesses. He shall provide accurate wiring diagrams to the Electrical Contractor for all equipment furnished under this Division.
- C. The ceiling cavity must be carefully reviewed and coordinated with all trades. In the event of conflict, the installation of the mechanical equipment and piping shall be in the following order: plumbing, waste, and soil lines; supply, return, and exhaust ductwork; water piping; medical gases; fire protection piping; and pneumatic control piping.
- D. The mechanical Contractor shall insure that the installation of all piping, ducts and equipment is in compliance with Articles 110-16 and 384-4 of the National Electrical Code relative to proper clearances in front of and over all electrical panels and equipment. No piping or ductwork will be allowed to run over electrical panel.

1.13 RESPONSIBILITY OF CONTRACTOR

- A. The Contractor is responsible for the installation of a satisfactory piece of work in accordance with the true intent of the drawings and specifications. He shall provide, as a part of his work and without expense, all incidental items required even though these items are not particularly specified or indicated. The installation shall be made so that its several component parts will function together as a workable system and shall be left with all equipment properly adjusted and in working order. The Contractor shall familiarize the Owner's Representative with maintenance and lubrication instructions as prepared by the Contractor and shall explain and fully instruct him relative to operating, servicing, and maintenance of them.
- B. If a conflict arises between the drawings and the specifications the most stringent procedure/action shall be followed. A clarification to the engineer will help to determine the course of action to be taken. If a conflict arises between specification sections the engineer will determine which course of action is to be followed.

1.14 PIPE AND DUCT OPENINGS AND EQUIPMENT RECESSES

- A. Pipe and duct chases, openings, and equipment recesses shall be provided by others only if shown on architectural or structural drawings. All openings for the mechanical work, except where plans and specifications indicate otherwise, shall be provided as work of this Division. Include openings information with coordination drawings.
- B. Whether chases, recesses, and openings are provided as work of this Division or by others, this Contractor shall supervise their construction and be responsible for the correct size and location even though detailed and dimensioned on the drawings. This Contractor shall pay for all necessary cutting, repairing, and finishing if any are left out or incorrectly made. All necessary openings thru existing walls, ceilings, floors, roofs, etc. shall be provided by this Contractor unless indicated otherwise by the drawing and/or specifications.

1.15 UNFIT OR DAMAGED WORK

- A. Any part of this installation that fails, is unfit, or becomes damaged during construction, shall be replaced or otherwise made good. The cost of such remedy shall be the responsibility of this Division.

1.16 WORKMANSHIP

- A. Workmanship shall be the best quality of its kind for the respective industries, trades, crafts, and practices, and shall be acceptable in every respect to the Owner's representative. Nothing contained herein shall relieve the Contractor from making good and perfect work in all details in construction.

1.17 SAFETY REGULATION

- A. The Contractor shall comply with all local, Federal, and OSHA safety requirements in performance with this work. (See General Conditions). This Contractor shall be required to provide equipment, supervision, construction, procedures, and all other necessary items to assure safety to life and property.

1.18 ELECTRICAL SERVICES

- A. All equipment control wiring and all automatic temperature control wiring including all necessary contacts, relays, and interlocks, whether low or line voltage, except power wiring, shall be furnished and installed as work of this Division unless shown to be furnished by Division 26. All such wiring shall be in conduit as required by electrical codes. Wiring in the mechanical rooms, fans rooms and inaccessible ceilings and walls shall be installed in conduit as well. Installation of any and all wiring done under Division 21, 22 and 23 shall be in accordance with the requirements of Division 26, Electrical.

- B. All equipment that requires an electrical connection shall be furnished so that it will operate properly and deliver full capacity on the electrical service available.
- C. Refer to the electrical control equipment and wiring shown on the diagrams. Any changes or additions required by specific equipment furnished shall be the complete responsibility of the Contractor furnishing the equipment.
- D. The Mechanical Contractor must coordinate with the Electrical Contractor to insure that all required components of control work are included and fully understood. No additional cost shall accrue to the Owner as a result of lack of such coordination.

1.19 WORK, MATERIALS, AND QUALITY OF EQUIPMENT

- A. Unless otherwise specified, all materials shall be new and of the best quality of their respective kinds and all labor shall be done in a most thorough and workmanlike manner.
- B. Products or equipment of any of the manufacturers cited herein or any of the products approved by the Addenda may be used. However, where lists of products are cited herein, the one first listed in the design equipment used in drawings and schedules to establish size, quality, function, and capacity standards. If other than design equipment is used, it shall be carefully checked for access to equipment, electrical and control requirements, valving, and piping. Should changes or additions occur in piping, valving, electrical work, etc., or if the work of other Contractors would be revised by the alternate equipment, the cost of all changes shall be borne as work of this Division.
- C. The Execution portions of the specifications specify what products and materials may be used. Any products listed in the Product section of the specification that are not listed in the Execution portion of the specification may not be used without written approval by the Engineer.
- D. The access to equipment shown on the drawings is the minimum acceptable space requirements. No equipment that reduces or restricts accessibility to this or any other equipment will be considered.
- E. All major items of equipment are specified in the equipment schedules on the drawings or in these specifications and shall be furnished complete with all accessories normally supplied with the catalog item listed and all other accessories necessary for a complete and satisfactory installation.
- F. All welders shall be certified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code, latest Edition.

1.20 PROTECTION AGAINST WEATHER AND STORING OF MATERIALS

- A. All equipment and materials shall be properly stored and protected against moisture, dust, and wind. Coverings or other protection shall be used on all items that may be damaged or rusted or may have performance impaired by adverse weather or moisture conditions. Damage or defect developing before acceptance of the work shall be made good at the Contractor's expense.

- B. All open duct and pipe openings shall be adequately covered at all times.

1.21 INSTALLATION CHECK

- A. An experienced, competent, and authorized representative of the manufacturer or supplier of each item of equipment indicated in the equipment schedule and the seismic supplier shall visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from any undue stress imposed by connecting piping or anchor bolts; and, (4) has been operated under full load conditions and that it operated satisfactorily.
- C. All costs for this work shall be included in the prices quoted by equipment suppliers.

1.22 EQUIPMENT LUBRICATION

- A. The Contractor shall properly lubricate all pieces of equipment before turning the building over to the Owner. A linen tag shall be attached to each piece of equipment, showing the date of lubrication and the lubricant used. No equipment shall be started until it is properly lubricated.
- B. Necessary time shall be spent with the Owner's Representative to thoroughly familiarize him with all necessary lubrications and maintenance that will be required of him.
- C. Detergent oil as used for automotive purposes shall not be used for this work.

1.23 CUTTING AND PATCHING

- A. No cutting or drilling in structural members shall be done without written approval of the Architect. The work shall be carefully laid out in advance, and cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces necessary for the mechanical work shall be carefully done. Any damage to building, piping, or equipment shall be repaired by professional plasterers, masons, concrete workers, etc., and all such work shall be paid for as work of this Division.
- B. When concrete, grading, etc., is disturbed, it shall be restored to original condition as described in the applicable Division of this Specification.

1.24 EXCAVATION AND BACKFILLING

- A. All necessary excavations and backfilling for the Mechanical phase of this project shall be provided as work of this Division. Trenches for all underground pipelines shall be excavated to the required depths. The bottom of trenches shall be compacted hard and graded to obtain required fall. Backfill shall be placed in horizontal layers, not exceeding 12 inches in thickness, and properly moistened. Each layer shall be compacted, by suitable equipment, to a density of not less than 95 percent as determined by ASTM D-1557. After pipelines have been tested, inspected, and approved, the trench shall be backfilled with selected material. Excess earth shall be hauled from the job site. Fill materials approved by the Architect shall be provided as work of this Division.
- B. No trenches shall be cut near or under any footings without consultation first with the Architect's office. Any trenches or excavations more than 30 inches deep shall be tapered, shored, covered, or otherwise made absolutely safe so that no vehicle or persons can be injured by falling into such excavations, or in any way be harmed by cave-ins, shifting earth, rolling rocks, or by drowning. This protection shall be extended to all persons approaching excavation related to this work whether or not such persons are authorized to be in the vicinity of the construction.

1.25 ACCESS

- A. Provide access doors in walls, ceilings and floors by this division unless otherwise noted. For access to mechanical equipment such as valves, dampers, VAV boxes, fans, controls, etc. Refer to Division 8 for door specifications. All access doors shall be 24" x 24" unless otherwise indicated or required. Coordinate location of doors with the Architect prior to installation. . If doors are not specified in Division 8, provide the following: Doors in ceilings and wall shall be equal to JR Smith No. 4760 bonderized and painted. Doors in tile walls shall be equal to JR Smith No. 4730 chrome plated. Doors in floors shall be equal to JR Smith No. 4910
- B. Valves: Valve must be installed in locations where access is readily available. If access is compromised, as judged by the Mechanical Engineer, these valves shall be relocated where directed at the Contractors expense.
- C. Equipment: Equipment must be installed in locations and orientations so that access to all components requiring service or maintenance will not be compromised. If access is compromised, as judged by the Mechanical Engineer, the contractor shall modify the installation as directed by the Engineer at the Contractors expense.
- D. It is the responsibility of this division to install terminal boxes, valves and all other equipment and devices so they can be accessed. If any equipment or devices are installed so they cannot be accessed on a ladder a catwalk and ladder system shall be installed above the ceiling to access and service this equipment.

1.26 CONCRETE BASES AND INSERTS

- A. Bases: The concrete bases shall be provided and installed as work by this division. This Division shall be responsible for the proper size and location of bases and shall furnish all required anchor bolts and sleeves with templates to be installed as work of Division 3, Concrete.
- B. All floor-mounted mechanical equipment shall be set on 6-inch high concrete bases, unless otherwise noted or shown on drawings. Such bases shall extend 6 inches beyond equipment or mounting rails on all sides or as shown on the drawings and shall have a 1-inch beveled edge all around.
- C. Inserts: Where slotted or other types of inserts required for this work are to be cast into concrete, they shall be furnished as work of this Division
- D. Concrete inserts and pipe support systems shall be equal to Unistrut P3200 series for all piping where more than one pipe is suspended at a common location. Spacing of the inserts shall match the size and type of pipe and of ductwork being supported. The Unistrut insert and pipe support system shall include all inserts, vertical supports, horizontal support members, clamps, hangers, rollers, bolts, nuts, and any other accessory items for a complete pipe-supporting system.

1.27 CLEANING AND PAINTING

- A. Cleaning: After all tests and adjustments have been made and all systems pronounced satisfactory for permanent operation, this Contractor shall clean all exposed piping, ductwork, insulated members, fixture, and equipment installed under this Section and leave them ready for painting. He shall refinish any damaged finish and leave everything in proper working order. The Contractor shall remove all stains or grease marks on walls, floors, glass, hardware, fixtures, or elsewhere, caused by his workman or for which he is responsible. He shall remove all stickers on plumbing fixtures, do all required patching up and repair all work of others damaged by this division of the work, and leave the premises in a clean and orderly condition.
- B. Painting: Painting of exposed pipe, insulated pipe, ducts, or equipment is work of Division 9, Painting.
- C. Mechanical Contractor: All equipment which is to be furnished in factory prefinished conditions by the mechanical Contractor shall be left without mark, scratch, or impairment to finish upon completion of job. Any necessary refinishing to match original shall be done. Do not paint over nameplates, serial numbers, or other identifying marks.
- D. Removal of Debris, Etc: Upon completion of this division of the work, remove all surplus material and rubbish resulting from this work, and leave the premises in a clean and orderly condition.

1.28 CONTRACT COMPLETION

- A. Incomplete and Unacceptable Work: If additional site visits or design work is required by the Engineer or Architect because of the use of incomplete or unacceptable work by the Contractor,

then the Contractor shall reimburse the Engineer and Architect for all additional time and expenses involved.

- B. Maintenance Instructions: The Contractor shall furnish the Owner complete printed and illustrated operating and maintenance instructions covering all units of mechanical equipment, together with parts lists.
- C. Instructions To Owner's Representatives: In addition to any detailed instructions called for, the mechanical Contractor must provide, without expense to the Owner, competent instructors to train the Owner's representatives who will be in charge of the apparatus and equipment, in the care, adjustment, and operation of all parts on the heating, air conditioning, ventilating, plumbing, fire protection, and automatic temperature control equipment. Instruction dates shall be scheduled at time of final inspection. A written report specifying times, dates, and name of personnel instructed shall be forwarded to the Architect. A minimum of four 8-hour instruction periods shall be provided. The instruction periods will be broken down to shorter periods when requested by the Owner. The total instruction hours shall not reduced. The ATC Contractor shall provide 4 hours of instructions. The remaining hours shall be divided between the mechanical and sheet metal Contractor.
- D. Guarantee: By the acceptance of any contract award for the work herein described or shown on the drawings, the Contractor assumes the full responsibility imposed by the guarantee as set forth herein and in the General Conditions, and should protect himself through proper guarantees from equipment and special equipment Contractors and from subcontractors as their interests may appear.
- E. The guarantee so assumed by the Contractor and as work of this Section is as follows:
 - 1. That the entire mechanical system, including plumbing, heating, and air-conditioning system shall be quiet in operation.
 - 2. That the circulation of water shall be complete and even.
 - 3. That all pipes, conduit, and connections shall be perfectly free from foreign matter and pockets and that all other obstructions to the free passage of air, water, liquid, sewage, and vent shall be removed.
 - 4. That he shall make promptly and free of charge, upon notice from the Owner, any necessary repairs due to defective workmanship or materials that may occur during a period of one year from date of Substantial Completion.
 - 5. That all specialties, mechanical, and patent devices incorporated in these systems shall be adjusted in a manner that each shall develop its maximum efficiency in the operation of the system; i.e., diffusers shall deliver the designed amount of air shown on drawings, thermostats shall operate to the specified limits, etc.
 - 6. All equipment and the complete mechanical, ductwork, piping and plumbing systems shall be guaranteed for a period of one year from the date of the Architect's Certificate of Substantial Completion, this includes all mechanical, ductwork, piping and plumbing equipment and products and is not limited to boiler, chillers, coils, fans, filters etc. Any equipment supplier not willing to comply with this guarantee period shall not submit a bid price for this project. The Contractor shall be responsible for a 100-percent guarantee for the system and all items of equipment for this period. If the contractor needs to provide temporary heating or cooling to the building and or needs to insure systems are installed

properly and or to meet the project schedule the guaranteed of all systems and equipment shall be as indicated above, on year from the date of the Architect's Certificate of Substantial Completion.

7. All filters used during construction shall be replaced just before equipment is turned over to the Owner, and all required equipment and parts shall be oiled. Any worn parts shall also be replaced.
8. If any systems or equipment is used for temporary heating or cooling the systems shall be protected so they remain clean. I.e. if the ductwork systems are used temporary filters and a filter holder (not duct-taped to ducts or grilles) shall be installed to insure the systems and the equipment remain clean.

1.29 CURBS

- A. Unless otherwise noted in these specifications or on the documents all roof curbs for all equipment are to be provided by Division 22 and 23.

1.30 TEST RUN

- A. The Mechanical Contractor shall operate the mechanical system for a minimum of 30 days to prove the operation of the system.

1.31 EQUIPMENT STARTUP AND CHECKOUT:

- A. Each major piece of equipment shall be started and checked out by an authorized representative of the equipment manufacturer. A certificate indicating the equipment is operating to the satisfaction of the manufacturer shall be provided and shall be included in the commissioning report.
- B. This contractor shall coordinate commissioning procedures and activities with the commissioning agent.

1.32 DEMOLITION

- 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:
- B. Proceed with 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.
- C. 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, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

- D. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
- E. 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.
- F. Maintain adequate ventilation when using cutting torches.
- G. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
- H. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
- I. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- J. Dispose of demolished items and materials promptly.
- K. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- L. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.
- M. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- N. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- O. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- P. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

END OF SECTION 23 0100

SECTION 23 0500 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Painting and finishing.
10. Concrete bases.
11. Supports and anchorages.
12. Link-Seal

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, and crawlspaces.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces, mechanical equipment rooms, accessible pipe shafts, accessible plumbing chases, and accessible tunnels.
- 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 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. 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

- A. Product Data: For the following:
 - 1. Transition fittings.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Escutcheons.
- B. Welding certificates.

1.5 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 HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.6 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 to prevent sagging and bending.

1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC 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. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

- A. 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. Manufacturers:
 - a. Eslon Thermoplastics.
- B. 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. Manufacturers:
 - a. Thompson Plastics, Inc.

2.5 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.

- E. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- F. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure as required to suit system pressures.
- G. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- H. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
 - 1. Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Watts Industries, Inc.; Water Products Div

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 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: Stainless steel. 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.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

- B. Steel Pipe: ASTM A 53, 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.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.
- D. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.
- E. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, non-shrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.10 LINK-SEAL MODULAR SEAL PRESSURE PLATES

- A. Link-Seal® modular seal pressure plates shall be molded of glass reinforced Nylon Polymer with the following properties:
 - 1. Izod Impact - Notched = 2.05ft-lb/in. per ASTM D-256
 - 2. Flexural Strength @ Yield = 30,750 psi per ASTM D-790
 - 3. Flexural Modulus = 1,124,000 psi per ASTM D-790
 - 4. Elongation Break = 11.07% per ASTM D-638
 - 5. Specific Gravity = 1.38 per ASTM D-792
- B. Models LS200-275-300-315 shall incorporate the most current Link-Seal® Modular Seal design modifications and shall include an integrally molded compression assist boss on the top (bolt entry side) of the pressure plate, which permits increased compressive loading of the rubber sealing element. Models 315-325-340-360-400-410-425-475-500-525-575-600 shall incorporate an integral recess known as a "Hex Nut Interlock" designed to accommodate commercially available fasteners to insure proper thread engagement for the class and service of metal hardware. All pressure plates shall have a permanent identification of the manufacturer's name molded into it.
- C. For fire service, pressure plates shall be steel with 2-part Zinc Dichromate Coating.
- D. Link-Seal® Modular Seal Hardware: All fasteners shall be sized according to latest Link-Seal® modular seal technical data. Bolts, flange hex nuts shall be:
 - 1. 316 Stainless Steel per ASTM F593-95, with a 85,000 psi average tensile strength.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying 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: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge and set screw.
- M. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- 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.
 - a. 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:

- a. PVC Steel Pipe Sleeves: For pipes smaller than NPS 6.
 - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
 - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
 - 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of HVAC systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. 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.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
 - 7. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.9 LINK SEAL

- A. Provide Link Seal at all piping penetrations from the outside.

END OF SECTION 23 0500

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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 requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when the requirements in equipment schedules, other specification sections, drawing notes or in other contract documents are more stringent.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

- B. 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. Motors 3/4 HP and larger: Polyphase.
- D. Motors smaller than 3/4 HP: Single phase.
- E. All motors shall have ASTM Grade 5 hardware that is Yellow Zinc-dichromate plated.

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Rotor: Random-wound, squirrel cage.
- E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating.
- G. Insulation: Class F.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors smaller than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
5. Shaft Grounding Ring: Microfiber type.
 - a. Provide grounded discharge path for VFD induced voltage in the shaft to prevent arcing in the motor bearings.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 Electronically Commutated Motor (ECM)

1. Motor enclosures: Open type
2. Motor to be a DC electronic commutation type motor (ECM).
 - a. AC induction type motors are not acceptable.
3. Permanently lubricated motor with heavy duty ball bearing
4. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
5. Speed controllable to 20% of full speed (80% turndown).
 - a. Potentiometer dial mounted at the motor speed controller
 - b. 0-10 VDC signal.
6. 85% efficient at all speeds minimum.
7. Motors smaller than 2.0 hp.

2.6 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split phase.
 3. Capacitor start, inductor run.
 4. Capacitor start, capacitor run.
- B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. 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, unless otherwise indicated.

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0513

SECTION 23 0517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves.
 - 2. Sleeve-seal systems.
 - 3. Grout.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Products & Systems, Inc.
 2. CALPICO, Inc.
 3. Metraflex Company (The).
 4. Pipeline Seal and Insulator, Inc.
 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Stainless steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.

- a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079216 "Interior Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078400 "Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 1. Exterior Concrete Walls above Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
 - c.
 2. Exterior Concrete Walls below Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 3. Concrete Slabs-on-Grade:
 - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

- b. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
- 5. Interior Partitions:
 - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
 - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 0517

SECTION 23 0519 - METERS AND GAGES FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
 - 6. Test-plug kits.
 - 7. Flowmeters.
- B. Related Sections:
 - 1. Division 23 Section "Steam and Condensate Heating Piping" for steam and condensate meters.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Palmer Wahl Instrumentation Group.
 - b. Trerice, H. O. Co.
 - c. Weiss Instruments, Inc.
 - d. Weksler.
2. Standard: ASME B40.200.
3. Case: Die Cast aluminum or brass; nominal size unless otherwise indicated.
4. Case Form: Adjustable angle type unless otherwise indicated, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Copper-plated steel, aluminum, stainless steel, or brass designed for thermowell installation. Stem shall be of length to match thermowell insertion length.
 - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 THERMOWELLS

A. Thermowells:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge Div.
 - b. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
 - c. Ernst Gage Co.
 - d. Marsh Bellofram.
 - e. Miljoco Corp.
 - f. NANMAC Corporation.
 - g. Noshok, Inc.
 - h. Palmer - Wahl Instruments Inc.

- i. REO TEMP Instrument Corporation.
 - j. Tel-Tru Manufacturing Company.
 - k. Trerice, H. O. Co.
 - l. Weiss Instruments, Inc.
 - m. Weksler
 - n. WIKA Instrument Corporation.
 - o. Winters Instruments.
2. Manufacturers: Same as manufacturer of thermometer being used.
3. Standard: ASME B40.200.
4. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
5. Material for Use with Copper Tubing: Brass.
6. Material for Use with Steel Piping: Brass.
7. Type: Stepped shank unless straight or tapered shank is indicated.
8. External Threads: NPS 1/2, NPS 3/4, NPS 1 or NPS 1-1/4 ASME B1.20.1 pipe threads.
9. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
10. Bore: Diameter required to match thermometer bulb or stem.
11. Insertion Length: Length required to match thermometer bulb or stem.
12. Lagging Extension: Include on thermowells for insulated piping and tubing.
13. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. KOBOLD Instruments, Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Trerice, H. O. Co.
 - k. Weiss Instruments, Inc.
 - l. Weksler
 - m. WIKA Instrument Corporation.
 - n. Winters Instruments - U.S.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated. NPS 1/4 or NPS 1/2.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMETEK, Inc.; U.S. Gauge.
 - b. Ashcroft Inc.
 - c. Ernst Flow Industries.
 - d. KOBOLD Instruments, Inc.
 - e. Marsh Bellofram.
 - f. Miljoco Corporation.
 - g. Noshok.
 - h. Palmer Wahl Instrumentation Group.
 - i. REOTEMP Instrument Corporation.
 - j. Trerice, H. O. Co.
 - k. Weiss Instruments, Inc.
 - l. Weksler
 - m. WIKA Instrument Corporation.
 - n. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Liquid-filled, cast aluminum or drawn steel; diameter with back flange for panel surface mounting or front flange for panel recessed mounting. Flanges to include pre-drilled screw holes.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated. NPS 1/4 or NPS 1/2.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Satin faced, nonreflective aluminum with permanently etched scale markings graduated in psi .
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.4 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with ASME B1.20.1 pipe threads. Include extension for use on insulated piping. NPS 1/4 or NPS 1/2 .
 - 1. Surge-dampening device: porous-metal-type.
- B. Siphons:
 - 1. Loop-shaped section: Brass pipe with pipe threads. NPS 1/4 or NPS 1/2.
- C. Valves:
 - 1. Needle: Brass, with NPS 1/4 or NPS 1/2 ASME B1.20.1 pipe threads.

2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Flow Design, Inc.
 - 2. MG Piping Products Co.
 - 3. National Meter, Inc.
 - 4. Peterson Equipment Co., Inc.
 - 5. Sisco Manufacturing Company, Inc.
 - 6. Trerice, H. O. Co.
 - 7. Twin City Hose.
 - 8. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - 9. Welsler.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: or , ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating:
- F. Core Inserts: Self-sealing synthetic rubber;
 - 1. EPDM (Nordel) for air, water or glycol operation between 30 and 275 deg F.
 - 2. CR (Neoprene) for air, water, glycol, oil, or gas operation between -30 to 200 deg F.

2.6 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. MG Piping Products Co.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Furnish the number of test-plug kits given below with the number of thermometers given below, with each kit having one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

1. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F .
2. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F .
3. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least to 200 psig.
4. Carrying Case: Metal or plastic, with formed instrument padding.
5. One test-plug kit with:
 - a. Two thermometers.

2.7 FLOWMETERS

A. Orifice Flowmeters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB; Instrumentation and Analytical.
 - b. Armstrong Pumps Inc.; S. A. Armstrong Limited.
 - c. Badger Meter, Inc.; Industrial Div.
 - d. Bell & Gossett; ITT Industries.
 - e. Meriam Process Technologies.
 - f. Spirax Sarco
2. Description: Flowmeter with sensor, hoses or tubing, quick connect hose fittings, valves, indicator, and conversion chart.
3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
4. Sensor: Wafer-orifice-type, calibrated, flow-measuring element; for installation between pipe flanges.
 - a. Design: Differential-pressure-type measurement:
 - 1) For HVAC hot and chilled water.

- b. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate.
 - c. Minimum Pressure Rating: 300 psig.
 - d. Minimum Temperature Rating: 250 deg F .
- 5. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.
 - a. Scale: Gallons per minute.
 - b. Accuracy: Plus or minus 2 percent between 20 and 80 percent of scale range .
- 6. Conversion Chart: Flow rate data compatible with sensor and indicator.
- 7. Operating Instructions: Include complete instructions with each flowmeter.

B. Venturi Flowmeters:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pump
 - b. Badger Meter, Inc.; Industrial Division
 - c. Bailey-Fischer & Porter Co.
 - d. Flow Design, Inc.
 - e. Gerand Engineering Co.
 - f. Hyspan Precision Products, Inc.
 - g. Leeds & Northrup.
 - h. McCrometer, Inc.
 - i. Preso Meters; a division of Racine Federated Inc.
 - j. Victaulic Company.
 - k. Spirax Sarco
- 2. Description: Flowmeter with calibrated flow-measuring element, hoses or tubing, quick connect hose fittings, valves, indicator, and conversion chart.
- 3. Flow Range: Sensor and indicator shall cover operating range of equipment or system served.
- 4. Sensor: Venturi-type, calibrated, flow-measuring element; for installation in piping.
 - a. Design: Differential-pressure-type measurement for water.
 - b. Construction: Bronze, brass, or factory-primed steel, with brass fittings and attached tag with flow conversion data.
 - c. Minimum Pressure Rating: 250 psig .
 - d. Minimum Temperature Rating: 250 deg F .
 - e. End Connections for NPS 2 and Smaller: Threaded.
 - f. End Connections for NPS 2-1/2 and Larger: Flanged or welded.
 - g. Flow Range: Flow-measuring element and flowmeter shall cover operating range of equipment or system served.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells: with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions to most readable position.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install needle-valve and snubber in piping for each pressure gage for fluids. Exception: Steam.
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic boiler.
 - 2. Two inlets and two outlets of each chiller.
 - 3. Inlet and outlet of each hydronic coil in air-handling units.
 - 4. Two inlets and two outlets of each hydronic heat exchanger.
 - 5. Inlet and outlet of each thermal-storage tank.
 - 6. Inlet and outlet of each piece of steam equipment.
- J. Install pressure gages in the following locations:
 - 1. Inlet and discharge of each pressure-reducing valve.
 - 2. Inlet and outlet of each chiller chilled-water and condenser-water connection.
 - 3. Suction and discharge of each pump.

3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
 - 1. Test plug: With EPDM self-sealing rubber inserts.
- B. Thermometers at inlets and outlets of each chiller shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
- C. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
- D. Thermometers at inlet and outlet of each hydronic coil at fan coils, cabinet heaters, unit heaters and reheat coils and as shown on details shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
 - 2. Test plug with EPDM self-sealing rubber inserts.
- E. Thermometers at inlets and outlets of each hydronic heat exchanger shall be the following:
 - 1. Industrial-style, liquid-in-glass type.
- F. Thermometer stems shall be of length to match thermowell insertion length.

3.5 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water Piping: 0 to 100 deg F .
- B. Scale Range for Condenser-Water Piping: 0 to 150 deg F.
- C. Scale Range for Heating, Hot-Water Piping: 30 to 240 deg F.
- D. Scale Range for Steam and Steam-Condensate Piping: 30 to 240 deg F.

3.6 PRESSURE-GAGE SCHEDULE

- A. Pressure gages at inlet and discharge of each pressure-reducing valve shall be the one of following:

1. Dry-case type, direct-mounted, metal case.
- B. Pressure gages at suction and discharge of each pump shall be one of the following:
 1. Liquid-filled, direct-mounted, metal case.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Chilled-Water, Condenser-Water, Heating, Hot-Water, Steam and Condensate Piping shall be twice the normal operating pressure of the measured system with gage ranges as follows:
 1. 30 in. Hg to 15 psi .
 2. 0 to 30 psi .
 3. 0 to 100 psi .
 4. 0 to 160 psi .
 5. 0 to 200 psi .
 6. 0 to 300 psi .
 7. 0 to 600 psi .

3.8 FLOWMETER SCHEDULE

- A. Flowmeters for Chilled-Water Piping: Venturi type.
- B. Flowmeters for Heating, Hot-Water Piping: Venturi type.
- C. Flowmeters for Glycol Heating, Hot-Water Piping: Venturi type.
- D. Flowmeters for Condenser-Water Piping: Venturi type.

END OF SECTION 23 0519

SECTION 23 0523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Bronze ball valves.
 - 2. Iron, single-flange butterfly valves.
 - 3. Bronze lift check valves.
 - 4. Bronze swing check valves.
 - 5. Iron swing check valves.
 - 8. Bronze globe valves.
 - 9. Iron globe valves.
 - 10. Lubricated plug valves.
 - 11. Chainwheels.

- B. Related Sections:

- 1. Section 230553 "Identification for HVAC Piping and Equipment" for valve tags and schedules.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

- G. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve indicated. Body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions. Include list indicating valve and its application.
- B. Maintenance data for valves to be included in the operation and maintenance data specified in Division 1. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve as listed in SUMMARY from a single source and from a single manufacturer.
- B. Compliance:
1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 2. ASME B31.1 for power piping valves.
 3. ASME B31.9 for building services piping valves.
 4. MSS Compliance: Comply with the various MSS Standard Practice documents referenced.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
1. Protect internal parts against rust and corrosion.
 2. Protect threads, flange faces, and weld ends.
 3. Set angle, and globe valves closed to prevent rattling.
 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 5. Set butterfly valves closed or slightly open.
 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
1. Maintain valve end protection.
 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
 - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
 - 5. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 2. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 3. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. For, globe, and check valves: below 421 deg. F for ball valves.
 - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. APCO Willamette Valve and Primer Corp.
 - 2. Babbitt Steam Specialty Company.

3. Bray Controls.
4. Center Line.
5. Cla-Val Company.
6. Conbraco Industries Inc.
7. Crane Co.; Crane Valve Group.
8. Fisher Valve by Emerson.
9. Flo Fab Inc.
10. Flow-Tek Inc.
11. Grinnell Corporation.
12. Hammond Valve.
13. Jamesbury; a subsidiary of Metso Automation.
14. Jomar International LTD.
15. Keystone Valve USA, Inc.
16. Kitz Corp.
17. Metraflex Company.
18. Milwaukee Valve Company.
19. Mueller Steam Specialty.
20. NIBCO Inc.
21. Red-White Valve Corp.
22. Spence Strainers International.
23. Stockham Valves and Fittings, Inc.
24. Tyco Fire/Shurjoint Piping Products.
25. Tyco/Pentair LTD.
26. Val-Matic Valve & Mfg. Corp.
27. Victaulic Company.
28. Watts Regulator Company.

2.4 BRONZE BALL VALVES

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:

1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.5 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 150 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

B. 175 CWP, Iron, Single-Flange (Lug) Butterfly Valves:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 175 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

C. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron or Stainless Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 200 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

D. 250 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Nylon 11 coated ductile Iron or Stainless Steel Disc:

1. Description:

- a. Standard: MSS SP-67, Type I.
- b. CWP Rating: 250 psig.

- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Nylon 11 coated ductile iron.

2.6 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valve:

1. Description:

- a. Standard: MSS SP-80.
- b. CWP Rating: 200 psig.
- c. Body Design: Vertical flow.
- d. Body Material: ASTM B 61, ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze, Type 1.

2.7 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Bronze Disc:

1. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 300 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.8 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Description:

- a. Standard: MSS SP-71, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. Body Design: Clear or full waterway.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.

- g. Gasket: Asbestos free.

2.9 BRONZE GLOBE VALVES

A. Class 150, Bronze Globe Valves with Nonmetallic Disc:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Teflon impregnated, asbestos free.
- h. Handwheel: Malleable iron.

2.10 IRON GLOBE VALVES

A. Class 125, Iron Globe Valves:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Stem: Brass alloy. OS & Y.
- f. Disc: Renewable bronze seat.
- g. Trim: Bronze.
- h. Packing and Gasket: Teflon impregnated, asbestos free.
- i. Handwheel: Cast iron

2.11 LUBRICATED PLUG VALVES

A. Class 125, Regular-Gland, Lubricated Plug Valves with Threaded Ends:

1. Description:

- a. Standard: MSS SP-78, Type II.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. Pattern: Regular or short.
- d. Body Material: ASTM A 48 or ASTM A 126, cast iron with lubrication-sealing system.
- e. Plug: Cast iron or bronze with sealant groove.

2.12 CHAINWHEELS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
 - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
 - 2. Attachment: For connection to ball, butterfly, and plug valve stems.
 - 3. Sprocket Rim with Chain Guides: Ductile or cast iron, of type and size required for valve. Include zinc coating.
 - 4. Chain: Hot-dip, galvanized steel, of size required to fit sprocket rim.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine piping system for compliance³ with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves as indicated, according to manufacturer's written instructions.
- B. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- C. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- D. Locate valves for easy access and provide separate support where necessary.

- E. Install valves in horizontal piping with stem at or above center of pipe.
- F. Install valves in position to allow full stem movement.
- G. Install chainwheels on operators for ball, butterfly globe and plug valves NPS 4 and larger and more than 96 inches above floor.
- H. Extend the chainwheels for chains to 60 inches above finished floor.
- I. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.
 - 4. Install all check valves a minimum of five pipe diameters downstream of pump discharge or elbow to avoid flow turbulence. In extreme cases add flow straighteners as required to correct the turbulence.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
 - 3. Throttling Service except Steam: Globe valves.
 - 4. Throttling Service, Steam: Globe valves.
 - 5. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with bronze disc.
 - b. NPS 2-1/2 and Larger: Iron swing check valves with lever and weight or with spring or iron, metal-seat check valves.
 - 6. Drain Service (except Steam): Two-Piece, Full Port Bronze Ball Valves with Bronze Trim. To be installed with NPS 3/4 hose thread outlet and hose cap with chain.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 CHILLED-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
3. Ball Valves:
 - a. Piece: Two
 - b. Port: Full.
 - c. Material/Trim: Bronze with:
 - 1) Bronze trim.
4. Bronze Swing Check Valves:
 - a. Class 150
 - b. Bronze disc.
6. Bronze Globe Valves:
 - a. Class 125
 - b. Bronze disc.

B. Pipe NPS 2-1/2 and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
 - a. 200 CWP,
 - b. Seat: EPDM.
 - c. Disc: Ductile-iron.
3. Iron Swing Check Valves: Class 125, metal seats.
4. Iron Globe Valves: Class 125.
5. Lubricated Plug Valves: Class 125, regular gland, flanged.

3.6 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
3. Ball Valves:
 - a. Piece: Two
 - b. Port: Full.
 - c. Material/Trim: Bronze with:

- 1) Bronze trim.
 4. Bronze Swing Check Valves:
 - a. Class 150
 - b. Bronze disc.
 6. Bronze Globe Valves:
 - a. Class 125
 - b. Bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 2. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12:
 - a. 200 CWP,
 - b. Seat: EPDM.
 - c. Disc: Ductile-iron.
 3. Iron Swing Check Valves: Class 125, metal seats.
 5. Iron Globe Valves: Class 125.

END OF SECTION 23 0523

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SECTION 23 0529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Metal pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.

- B. Related Sections:

- 1. Division 05 for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 3. Section 230548 "Vibration and Seismic Controls for HVAC" for vibration isolation devices.
 - 4. Section 233113 "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.

- c. ERICO/Michigan Hanger Co. ; ERISTRUT Div.
 - d. FNW/Ferguson Enterprises
 - e. GS Metals Corp.
 - f. Hilti, Inc.insert manufacturer's name.
 - g. Power-Strut Div. Tyco International.
 - h. Thomas & Betts Corporation.
 - i. Tolco Inc.
 - j. Unistrut; an Atkore International company.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 3. Standard: MFMA-4.
 4. Channels: Continuous slotted steel channel with inturned lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Metallic Coating:
 - a. Electroplated zinc.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International; a subsidiary of Mueller Water Products, Inc.
 - b. Empire Industries, Inc.
 - c. ERICO International Corporation.
 - d. FNW/Ferguson Enterprises
 - e. Haydon Corporation.
 - f. NIBCO INC.
 - g. PHD Manufacturing, Inc.
 - h. PHS Industries, Inc.
2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Coating:
 - a. Zinc.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping:
1. Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- C. Insulation-Insert Material for Hot Piping:
1. Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Nonstaining, noncorrosive, and nongaseous.
 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Comply with SEI/ASCE 7 and with requirements for seismic-restraint devices in Section 230548 "Vibration and Seismic Controls for HVAC."
- B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- C. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. 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.
- G. Install lateral bracing with pipe hangers and supports to prevent swaying.
- H. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- K. Insulated Piping:
 - 1. Attach clamps and spacers to piping.

- a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

- A. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use padded hangers for piping that is subject to scratching.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.

3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
 10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
 17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
 2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use powder-actuated fasteners instead of building attachments where required in concrete construction.

END OF SECTION 23 0529

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE

- A. Provide engineered vibration isolation and restraint systems in accordance with the requirements of this section including design, engineering, materials, testing, inspections and reports.
- B. Mechanical equipment with moving parts shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration and mechanically transmitted sound to the building structure.
- C. All mechanical equipment, piping and ductwork shall be restrained as required by Federal, State and Local building codes to preserve the integrity of nonstructural building components during seismic events to minimize hazards to occupants and reduce property damage.

1.3 SUMMARY

- A. This Section includes the following:
 - 1. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Open-spring isolators.
 - 5. Housed-spring isolators.
 - 6. Restrained-spring isolators.
 - 7. Housed-restrained-spring isolators.
 - 8. Pipe-riser resilient supports.
 - 9. Resilient pipe guides.
 - 10. Air-spring isolators.
 - 11. Restrained-air-spring isolators.
 - 12. Elastomeric hangers.
 - 13. Spring hangers.
 - 14. Snubbers.
 - 15. Restraint channel bracings.
 - 16. Restraint cables.
 - 17. Seismic-restraint accessories.

18. Mechanical anchor bolts.
19. Adhesive anchor bolts.
20. Vibration isolation equipment bases.
21. Restrained isolation roof-curb rails.
22. Certification of seismic restraint designs.
23. Installation supervision.
24. Design of attachment of housekeeping pads.
25. All components requiring IBC compliance and certification.
26. All inspection and test procedures for components requiring IBC compliance.
27. Restraint of all mechanical equipment, pipe and ductwork, within, on, or outdoors of the building and entry of services to the building, up to but not including, the utility connection, is part of this Specification.
28. Seismic certification of equipment

B. Related Requirements:

1. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for devices for plumbing equipment and systems.

1.4 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.
- C. ASCE: American Society of Civil Engineers
- D. OSHPD: Office of Statewide Health Planning and Development for the State of California.
- E. Ip: Importance Factor.
- F. ESSENTIAL FACILITIES, (Occupancy Category IV, IBC-2018)
 1. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.
- G. LIFE SAFETY
 1. All systems involved with fire protection, including sprinkler piping, jockey pumps, fire pumps, control panels, service water supply piping, water tanks, fire dampers, smoke exhaust systems and fire alarm panels.
 2. All mechanical, electrical, plumbing or fire protection systems that support the operation of, or are connected to, emergency power equipment, including all lighting, generators, transfer switches and transformers.
 3. All medical and life support systems.

4. Hospital heating systems and air conditioning systems for maintaining normal ambient temperature.
5. Automated supply, exhaust, fresh air and relief air systems on emergency control sequence, including air handlers, duct, dampers, etc., or manually-operated systems used for smoke evacuation, purge or fresh air relief by the fire department.
6. Heating systems in any facility with Occupancy Category IV, IBC-2009 where the ambient temperature can fall below 32 degrees Fahrenheit.

H. HIGH HAZARD

1. All gases or fluids that must be contained in a closed system which are flammable or combustible. Any gas that poses a health hazard if released into the environment and vented Fuel Cells.

1.5 REFERENCE CODES AND STANDARDS

- A. Codes and Standards: The following shall apply and conform to good engineering practices unless otherwise directed by the Federal, State or Local authorities having jurisdiction.

1. IBC
2. ASCE 7
3. NFPA 13 (National Fire Protection Association)
4. IBC 2018 replaces all references to IBC 2006, 2009, 2012.

- B. The following guides may be used for supplemental information on typical seismic installation practices. Where a conflict exists between the guides and these construction documents, the construction documents will preside.

1. FEMA (Federal Emergency Management Agency) manuals 412, Installing Seismic Restraints for Mechanical Equipment and 414, Installing Seismic Restraints for Ductwork and Pipe.
2. SMACNA (Sheet Metal and Air-conditioning Contractors' National Association) Seismic Restraint Manual Guidelines for Mechanical Systems, 3rd ed.
3. ASHRAE (American Society for Heating, Refrigerating and Air-conditioning Engineers) A Practical Guide to Seismic Restraint
4. MSS (Manufacturers Standardization Society of the Valve and Fittings Industry) MSS SP-127, Bracing for Piping Systems, Seismic – Wind – Dynamic, Design, Selection, Application.

1.6 ISOLATOR AND RESTRAINT MANUFACTURER'S RESPONSIBILITIES:

- A. Provide project specific vibration isolation and seismic restraint design prepared by a registered design professional in the state where the project is being constructed, and manufacturer certifications that the components are seismically qualified.
 - 1. Provide calculations to determine restraint loads resulting from seismic forces as required by IBC, Chapter 16 and ASCE 7, latest editions. Seismic calculations shall be certified by an engineer licensed in the state where the project is being constructed.
- B. Provide installation instructions and shop drawings for all materials supplied under this section of the specifications.
 - 1. Provide seismic restraint details with specific information relating to the materials, type, size, and locations of anchorages; materials used for bracing; attachment requirements of bracing to structure and component; and locations of transverse and longitudinal sway bracing and rod stiffeners.
 - 2. Provide seismic bracing layout drawings indicating the location of all seismic restraints.
 - a. Each piece of rotating isolated equipment shall be tagged to clearly identify quantity and size of vibration isolators and seismic restraints.
- C. Provide, in writing, the special inspection requirements for all Designated Seismic Systems as indicated in Chapter 17 of the IBC.
- D. Provide training for installation, operation and maintenance of isolation and restraint systems.

1.7 PERFORMANCE REQUIREMENTS

- A. Flood-Restraint Loading: Per the structural drawings and specifications.
- B. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: Per the structural drawings and specifications.
 - 2. Assigned Occupancy Category as Defined in the IBC: Per the structural drawings and specifications.
 - a. Component Importance Factor: 1.5.
 - 1) Life safety components required to function after an earthquake.
 - 2) Components containing hazardous or flammable materials in quantities that exceed the exempted amounts for an open system listed in Chapter 4.
 - 3) For structures with an Occupancy Category IV, components needed for continued operation of the facility or whose failure could impair the continued operation of the facility.
 - 4) Storage racks in occupancies open to the general public (e.g., warehouse retail stores).
 - b. Component Importance Factor: 1.0.
 - 1) All other components

- c. Component Response Modification Factor: Per the structural drawings and specifications.
 - d. Component Amplification Factor: Per the structural drawings and specifications.
- 3. Design Spectral Response Acceleration at Short Periods: Per the structural drawings and specifications.
- 4. Design Spectral Response Acceleration at 1-Second Period: Per the structural drawings and specifications.

1.8 ACTION SUBMITTALS

A. Product Data: For the following:

- 1. Submittals shall include catalog cut sheets and installation instructions for each type of anchor and seismic restraint used on equipment or components being isolated and/or restrained.
- 2. Submittals for mountings and hangers incorporating springs shall include spring diameter and free height, rated load, rated deflection, and overload capacity for each vibration isolation device.
- 3. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- 4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Shop Drawings:

- 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. “Basis for Design” report: Statement from the registered design professional that the design complies with the requirements of the ASCE 7-10 Chapter 13, IBC 2018 chapter 1908 and ACI 318. In addition, the basis for compliance must also be noted, as listed below:
 - a. Project specific design documentation prepared and submitted by a registered design professional (ASCE 7, 13.2.1.1)

- b. Submittal of the manufacturer's certification that the isolation equipment is seismically qualified by:
 - c. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
 - d. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 - e. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
2. Seismic restraint load ratings must be certified and substantiated by testing or calculations under direct control of a registered professional engineer. Copies of testing and calculations must be submitted as part of submittal documents. OSHPD pre-approved restraint systems are exempt from this requirement if their pre-approval is current and based upon the IBC 2009 (i.e. OPA-07 pre-approval numbers).
3. Include design calculations and details for selecting vibration isolators, seismic restraints, and vibration isolation bases complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
4. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Division 23 Sections for equipment mounted outdoors.
5. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
6. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
7. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
 - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

- c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.9 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.
 - 1. Submittal drawings and calculations must be stamped by a registered professional engineer in the State where the project is being constructed who is responsible for the seismic restraint design.
 - 2. Calculations and restraint device submittal drawings shall specify anchor bolt type, embedment, concrete compressive strength, minimum spacing between anchors, and minimum distances of anchors from concrete edges. Concrete anchor locations shall not be near edges, stress joints, or an existing fracture. All bolts shall be ASTM A307 or better.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control test reports.

1.10 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

1.11 SEISMIC CERTIFICATION OF EQUIPMENT

- A. Component Importance Factor. All plumbing and mechanical components shall be assigned a component importance factor. The component importance factor, I_p , shall be taken as 1.5 if any of the following conditions apply:
 - 1. The component is required to function for life-safety purposes after an earthquake.
 - 2. The component contains hazardous materials.
 - 3. The component is in or attached to an Occupancy Category IV structure and it is needed for continued operation of the facility or its failure could impair the continued operation of the facility.
- B. All other components shall be assigned a component importance factor, I_p , equal to 1.0.
- C. For equipment or components where $I_p = 1.0$.
 - 1. Submit manufacturer's certification that the equipment is seismically qualified by:
 - a. An engineered analysis conforming to the requirements of Chapter 13 of ASCE 7.
 - b. Testing by a nationally recognized testing standard procedure such as ICC-ES AC 156. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 - c. Experience data conforming to a nationally recognized procedure. The substantiated seismic design capacities shall exceed the seismic demands determined by Section 13.3 of ASCE 7.
 - 2. The equipment and components listed below are considered rugged and shall not require Special Seismic Certification:
 - a. Valves (not in cast-iron housings, except for ductile cast iron).
 - b. Pneumatic operators.
 - c. Hydraulic operators.
 - d. Motors and motor operators.
 - e. Horizontal and vertical pumps (including vacuum pumps).
 - f. Air compressors
 - g. Refrigerators and freezers.
 - h. Elevator cabs.
 - i. Underground tanks.
 - j. Equipment and components weighing not more than 20 lbs. supported directly on structures (and not mounted on other equipment or components) with supports and attachments in accordance with Chapter 13, ASCE 7.
 - 3. Rugged equipment and components in this section are for factory assembled discrete equipment and components only and do not apply to site assembled or field assembled equipment or equipment anchorage. The list is based in part on OSHPD Code Application Notice 2-1708A.5.

- D. Special Certification requirements for Designated Seismic Systems (i.e. $I_p = 1.5$): Seismic Certificates of Compliance supplied by manufacturers shall be submitted for all components that are part of Designated Seismic Systems. In accordance with the ASCE 7, certification shall be via one of the following methods:
1. For active mechanical and electrical equipment that must remain operable following the design earthquake:
 - a. Testing as detailed by part C.1.b above.
 - b. Experience data as detailed by part C.1.c above.
 - c. Equipment that is considered “rugged” per part C.2 above.
 2. Components with hazardous contents shall be certified by the manufacturer as maintaining containment following the design earthquake by:
 - a. Testing as detailed by part C.1.b above.
 - b. Experience data as detailed by part C.1.c above.
 - c. Engineering analysis utilizing dynamic characteristics and forces. Tanks (without vibration isolators) designed by a registered design professional in accordance with ASME Boiler and Pressure Vessel Code, and satisfying the force and displacement requirements of Sections 13.3.1 and 13.3.2 of ASCE 7 having an importance factor, $I_p = 1.0$ shall be considered to satisfy the Special Seismic Certification requirements on the basis of ASCE 7 Section 13.6.9.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
 2. CalDyn (California Dynamics Corporation).
 3. ISAT (International Seismic Application Technology).
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. Vibro-Acoustics
 7. VMC (Vibration Mountings & Controls, Inc.)
- B. Elastomeric Isolation Pads P1:
1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 2. Size: Factory or field cut to match requirements of supported equipment.
 3. Pad Material: Oil and water resistant with elastomeric properties.

4. Surface Pattern: Ribbed pattern.
 5. Load-bearing metal plates adhered to pads.
- C. Double-Deflection, Elastomeric Isolation Mounts M1:
1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded, or with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts M2:
1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. Spring Isolators S1: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators S2: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch-thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation. Baseplates shall limit floor load to 500 psig.
 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Housed Restrained Spring Isolators S3: Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:
1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric pad: For high frequency absorption at the base of the spring.
- H. Elastomeric Hangers H1:
1. Description: Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods
 - a. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- I. Spring Hangers H2: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and Insert in Compression.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

- b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- J. Spring Hangers with Vertical-Limit Stop H3: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
 - 1. Description: Combination Coil-Spring and Elastomeric-Insert Hanger with spring and insert in Compression and vertical limit stop.
 - a. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - f. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - g. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - h. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- K. Pipe Riser Resilient Support R1:
 - 1. Description: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick neoprene.
 - a. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
 - b. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.
- L. Resilient Pipe Guides R2:
 - 1. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

- a. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

M. Horizontal Thrust Restraints T1: Modified specification S2 isolator.

1. Horizontal thrust restraints shall consist of a modified specification S2 spring mounting. Restraint springs shall have the same deflection as the isolator springs.
2. The assembly shall be preset at the factory and fine tuned in the field to allow for a maximum of 1/4" movement from stop to maximum thrust.
3. The assemblies shall be furnished with rod and angle brackets for attachment to both the equipment and duct work or the equipment and the structure.
4. Restraints shall be attached at the center line of thrust and symmetrically on both sides of the unit.

2.2 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. CalDyn (California Dynamics Corporation).
 3. ISAT (International Seismic Application Technology).
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. Vibro-Acoustics
 7. VMC (Vibration Mountings & Controls, Inc.)
- B. Restrained Vibration Isolation Roof-Curb Rails: RC1:
- C. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.
- D. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic forces.
- E. Lower Support Assembly: The lower support assembly shall be a formed sheet-metal section containing adjustable and removable steel springs that support upper frame. 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.
- F. 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.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic and wind restraint.
 - a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
 - b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch-thick.

H. 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.

I. All roof curbs shall be at least 8-inches (MIN) above the roof membrane.

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. CalDyn (California Dynamics Corporation).
3. ISAT (International Seismic Application Technology).
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibro-Acoustics
7. VMC (Vibration Mountings & Controls, Inc.)

B. Steel Bases and Rails SB1: 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.
 - a. Include supports for suction and discharge elbows for pumps.
2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

- C. Inertia Base IB1: 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 2-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 4. 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 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. CalDyn (California Dynamics Corporation).
 - 3. ISAT (International Seismic Application Technology).
 - 4. Kinetics Noise Control.
 - 5. Mason Industries.
 - 6. Vibro-Acoustics
 - 7. VMC (Vibration Mountings & Controls, Inc.)
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.
 - 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: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - 2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
 - 3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.
- D. Channel Support System: MFMA-4, 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 603 galvanized or 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. Cables located in exterior or other wet locations such as wash-down areas shall be stainless steel.
- F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or reinforcing steel angle clamped to hanger rod.
- G. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- 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.
- M. All post installed anchors utilized in the seismic design must be qualified for use in cracked concrete and approved for use with seismic loads.
- N. Expansion anchors shall not be used for anchorage of equipment with motors rated over 10 HP with the exception of undercut expansion anchors. Spring or internally isolated equipment are exempt from this requirement.
- O. All beam clamps utilized for vertical support must also incorporate retention straps.
- P. All seismic brace arm anchorages to include concrete anchors, beam clamps, truss connections, etc., must be approved for use with seismic loads.

2.5 FACTORY FINISHES

- A. Finish: Manufacturer's standard paint applied to factory-assembled and tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in 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 COORDINATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 03 Section "Cast-in-Place Concrete."
- B. Coordinate size, shape, reinforcement and attachment of all housekeeping pads supporting vibration/seismically rated equipment. Concrete shall have a minimum compressive strength of 4,000 psi or as specified by the project engineer. Coordinate size, thickness, doweling, and reinforcing of concrete equipment housekeeping pads and piers with vibration isolation and seismic restraint device manufacturer to ensure adequate space, embedment and prevent edge breakout failures. Pads and piers must be adequately doweled in to structural slab.
- C. Housekeeping pads shall have adequate space to mount equipment and seismic restraint devices.
- D. Housekeeping Pads must be adequately reinforced and adequately sized for proper installation of equipment anchors and shall also be large enough and thick enough to ensure adequate edge distance and embedment depth for restraint anchor bolts to avoid housekeeping pad breakout failure. Refer seismic restraint manufacturer's written instructions.

- E. Coordinate with vibration/seismic restraint manufacturer and the structural engineer of record to locate and size structural supports underneath vibration/seismically restrained equipment (e.g. roof curbs, cooling towers and other similar equipment). Installation of all seismic restraint materials specified in this section shall be accomplished as per the manufacturer's written instructions. Adjust isolators and restraints after piping systems have been filled and equipment is at its operating weight, following the manufacturer's written instructions.

3.3 APPLICATIONS

- A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES and per the seismic restraint manufacturer's design.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.4 VIBRATION-CONTROL DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.
- C. Isolate all mechanical equipment 0.75 hp and over per the isolator and seismic restraint schedule and these specifications. Vibration isolators shall be selected in accordance with the equipment, pipe or duct weight distribution so as to produce reasonably uniform deflections
- D. All isolation materials and seismic restraints shall be of the same vendor and shall be selected and certified using published or factory certified data
- E. Installation of all vibration isolation materials, flexible connectors and supplemental equipment bases specified in this section shall be accomplished as per the manufacturer's written instructions with mountings adjusted to level equipment. Any variance or non-compliance with the manufacturer's instructions shall be reviewed and approved in writing by the manufacturer or corrected by the contractor in an approved manner.
- F. Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stresses or misalignment.
- G. Locate isolation hangers as near to the overhead support structure as possible.

- H. No rigid connections between isolated components and the building structure shall be made that degrades the noise and vibration control system herein specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls. "Components" includes, but is not limited to, mechanical equipment, piping and ducts.
- I. Coordinate work with other trades to avoid rigid contact with the building.
- J. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineers attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
- K. Bring to the architects/engineers attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.
- L. Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense.
- M. Use horizontal thrust restraints T1 to protect Air handling equipment and centrifugal fans against excessive displacement which results from high air thrust when thrust forces exceed 10% of the equipment weight.
- N. Isolated equipment, duct and piping located on roofs must be attached to the structure. Supports (e.g., sleepers) that are not attached to the structure will not be acceptable.
- O. On completion of installation of all isolation materials and before startup of isolated equipment all debris shall be cleared from areas surrounding and from beneath all isolated equipment, leaving equipment free to move on the isolation supports.
- P. All floor mounted isolated equipment shall be protected with specification M1, M2, S1, S2 or S3 isolator.
- Q. Horizontal Pipe Isolation: All HVAC pumped water, pumped condensate, glycol, and refrigerant piping size 1-1/4" and larger within mechanical rooms shall be isolated. Outside equipment rooms this piping shall be isolated for the greater of 50' or 100 pipe diameters from rotating equipment. For the first three (3) support locations from externally isolated equipment provide specification H2 or H3 hangers or specification S1, S2 or S3 mounts with the same deflection as equipment isolators (max 2"). All other piping within the equipment rooms shall be isolated with the same specification isolators with a 3/4" minimum deflection. Steam piping size 1-1/4" and larger which is within an equipment room and connected to rotating equipment shall be isolated for three (3) support locations from the equipment. Provide specification H2 or H3 hangers, or specification S1 or S2 mounts with the same deflection as equipment isolators but a minimum of 3/4".
- R. Install full line size flexible pipe connectors at the inlet and outlet of each pump, cooling tower, condenser, chiller, coiling connections and where shown on the drawings. All connectors shall

be suitable for use at the temperature, pressure, and service encountered at the point of installation and operation. End fitting connectors shall conform to the pipefitting schedule. Control rods or protective braid must be used to limit elongation to 3/8". Flexible connectors shall not be required for suspended in-line pumps.

- S. All plumbing pumped water, piping size 1-1/4" and larger within mechanical rooms shall be isolated the same as HVAC piping above. Isolators are not required for any plumbing pumped water, pumped condensate, and steam piping outside of mechanical rooms unless listed in the isolation schedule.
- T. Pipe Riser Isolation: The operating weight of all variable temperature vertical pipe risers 1-1/4" and larger, requiring isolation where specifically shown and detailed on riser drawings shall be fully supported by specification M1, M2 or R1 supports. S1, S2, S3, H2 or H3 steel spring deflection isolators with minimum 3/4-inch minimum shall be in those locations where added deflection is required due to pipe expansion and contraction. Spring deflection shall be a minimum of 4 times the anticipated deflection change. Springs shall be selected to keep the riser in tension. Height saving brackets used with isolators having 2.5" deflection or greater shall be of the precompression type to limit exposed bolt length. Specification R1 riser supports shall be installed near the center point of the riser to anchor the riser when spring isolation is used. Specification R2 riser guides may be used in conjunction with spring isolators per design calculations. Pipe risers up through 16" shall be supported at intervals of every third floor of the building. Pipe risers 18" and over, every second floor. Wall sleeves for take-offs from riser shall be sized for insulation O.D. plus two times the anticipated movement to prevent binding. Horizontal take-offs and at upper and lower elbows shall be supported with spring isolators as required to accommodate anticipated movement. In addition to submittal data requirements previously outlined, riser diagrams and calculations shall be submitted for approval. Calculations must show anticipated expansion and contraction at each support point, initial and final loads on the building structure, and spring deflection changes. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist if installed per design proposed.
- U. Where riser pipes pass through cored holes, core diameters shall be a maximum of 2" larger than pipe O.D. including insulation. Cored holes must be packed with resilient material or firestop as provided by other sections of this specification or local codes. Where seismic restraint is required specification isolator S3 shall support risers and provide longitudinal restraint at floors where thermal expansion is minimal and will not bind isolator restraints.
- V. Duct Isolation: Isolate all duct work with a static pressure 2" W.C. and over in equipment rooms and to minimum of 50 feet from the fan or air handler. Use specification type H2 or H3 hangers or type S1 or S2 floor mounts.

3.5 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. On projects with Seismic Site Class A or B, seismic design or restraint is not required.

2. On projects with Seismic Design Category C: Components with an importance factor of 1.0 do not require seismic design or restraint.
3. 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.
4. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
5. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
6. Suspended Equipment: All suspended equipment that meets any of the following conditions requires seismic restraints as specified by the supplier:
 - a. Rigidly attached to pipe or duct that is 75 lbs. and greater,
 - b. Items greater than 20 lbs and distribution systems weighing more than 5 lbs/lineal foot, with an importance factor of 1.0 hung independently or with flexible connections.
 - c. Possibility of consequential damage.
 - d. For importance factors greater than 1.0 all suspended equipment requires seismic restraint regardless of the above notes.
 - e. Wall mounted equipment weighing more than 20 lbs.
 - f. Exemptions:
 - 1) Equipment weighing less than 20 lbs and distribution systems weighing less than 5 lbs/lineal foot, with an $I_p = 1.0$ and where flexible connections exist between the component and associated ductwork, piping or conduit.
7. Base Mounted Equipment: All base mounted equipment that meets any of the following conditions requires attachments and seismic restraints as specified by the supplier:
 - a. Connections to or containing hazardous material,
 - b. With an overturning moment.
 - c. Weight greater than 400 lbs.
 - d. Mounted on a stand 4 ft. or more from the floor
 - e. Possibility of consequential damage.
 - f. For importance factors greater than 1.0 all base mounted items require seismic restraints regardless of the above notes.
 - g. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
 - h. Exemptions:
 - 1) Floor or curb-mounted equipment weighing less than 400 lbs and not resiliently mounted, where the Importance Factor, $I_p = 1.0$, the components are mounted at 4 feet or less above a floor level, flexible connections

between the components and associated duct work, piping and conduit are provided and there is no possibility of consequential damage.

8. Roof Mounted Equipment:
 - a. To be installed on a structural frame, seismically rated roof curb, or structural curb frame mechanically connected to the structure. Items shall not be mounted onto sleepers or pads that are not mechanically and rigidly attached to the structure. Restraint must be adequate to resist both seismic and wind forces.
 - b. Roof curbs shall be installed directly to building structural steel or concrete roof deck and not to top of steel deck or roofing material.
 - c. Exemptions:
 - 1) Curb-mounted mushroom, exhaust and vent fans with curb area less than nine square feet are excluded.
9. Rigid Mounted Equipment:
 - a. Anchor floor and wall mounted equipment to the structure as per the stamped seismic certifications / drawings.
 - b. For equipment with high center of gravity additional cable restraints shall be furnished, as required by isolation manufacturer, to limit forces and motion caused by rocking.
 - c. Suspended equipment shall be restrained using seismic cable restraints, or struts, and hanger rods as per the stamped seismic certifications / drawings.
10. Vibration Isolated Equipment:
 - a. Seismic control shall not compromise the performance of noise control, vibration isolation or fire stopping systems.
 - b. Equipment supported by vibration-isolation hangers shall be detailed and installed with approximately a 1/8" gap between the isolation hangers and the structure. Isolators at restraint locations must be fitted with uplift limit stops.
- B. 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.
- C. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
- D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- E. Installation and adjustment of all seismic restraints specified in this section shall be accomplished as per the manufacturer's written instructions. Any deviation from the manufacturer's instructions shall be reviewed and approved by the manufacturer.
- F. Piping Restraints:
 1. Comply with requirements in ASCE 7-10 Chapter 13.

2. Branch lines may not be used to brace main lines.
3. All piping requires restraint unless it meets any of the exemptions listed below.
4. Exemptions:
 - a. All high deformability pipe 3" or less in diameter suspended by individual hanger rods where $I_p = 1.0$.
 - b. High deformability pipe or conduit in Seismic Design Category C, 2" or less in diameter suspended by individual hanger rods where $I_p = 1.5$.
 - c. High deformability pipe in Seismic Design Category D, E or F, 1" or less in diameter suspended by individual hanger rods where $I_p = 1.5$.
 - d. All clevis supported pipe runs installed less than 12" from the top of the pipe to the underside of the support point and trapeze supported pipe suspended by hanger rods having a distance less than 12" in length from the underside of the pipe support to the support point of the structure.
 - e. Piping systems, including their supports, designed and constructed in accordance with ASME B31.
 - f. Piping systems, including their supports, designed and constructed in accordance with NFPA, provided they meet the force and displacement requirements of Section 13.3.1 and 13.3.2 (ASCE 7).
- G. Install flexible metal hose loops in piping which crosses building seismic joints, sized for the anticipated amount of movement.
- H. Install flexible piping connectors 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.
- I. Where pipe sizes reduce below dimensions required for seismic, the final restraint shall be installed at the transition location.
- J. Restraint Spacing For Piping: Sizes shown are maximum. Actual spacing determined by calculation.
 1. For non-ductile piping (e.g., cast iron, PVC) space transverse supports a maximum of 20' o.c., and longitudinal supports a maximum of 40' o.c.
 2. For piping with hazardous material inside (e.g., natural gas, medical gas) space Transverse supports a maximum of 20' o.c., and longitudinal supports a maximum of 40' o.c.
 3. For pipe risers, restrain the piping at floor penetrations using the same spacing requirements as above.
 4. For all other ductile piping see Table "A" below
- K. Seismic Restraint of Ductwork: Seismically restrain per specific code requirements, all ductwork listed below (unless otherwise indicated on the drawings), using seismic cable restraints: (Ductwork not meeting criteria listed below is to be "Exempt")

1. Restrain rectangular ductwork with cross sectional area of 6 square feet or larger. Duct with and an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
2. Restrain round ducts with diameters of 33" or larger. Duct with an importance factor of 1.5 must be braced with no exceptions regardless of size or distance requirements.
3. Restrain flat oval ducts the same as rectangular ducts of the same nominal size.
4. Duct must be reinforced at the restraint locations. Reinforcement shall consist of an additional angle on top of the ductwork that is attached to the support hanger rods. Ductwork is to be attached to both upper angle and lower trapeze. Additional reinforcing is not required if duct sections are mechanically fastened together with frame bolts and positively fastened to the duct support suspension system.
5. A group of ducts may be combined in a larger frame so that the combined weights and dimensions of the ducts are less than or equal to the maximum weight and dimensions of the duct for which bracing details are selected.
6. Walls, including gypsum board non-bearing partitions, which have ducts running through them, may replace a typical transverse brace. Provide channel framing around ducts and solid blocking between the duct and frame.
7. If ducts are supported by angles, channels or struts, ducts shall be fastened to it at seismic brace locations in lieu of duct reinforcement.
8. All ductwork weighing more than 17 lb/ft.
9. Exemptions:
 - a. Duct runs supported at locations by two rods less than 12 inches in length from the structural support to the structural connection to the ductwork. This exemption does not apply to ducts with an importance factor of 1.5.
10. See Table "A" below for restraint spacing.

L. Exemptions do not apply for:

1. Life Safety or High Hazard Components
 - a. Including gas, fire protection, medical gas, fuel oil and compressed air needed for the continued operation of the facility or whose failure could impair the facility's continued operation, Occupancy Category IV, IBC-2009 as listed in Section 1.3 B regardless of governing code for HVAC, Plumbing, Electrical piping or equipment. (A partial list is illustrated.) High Hazard is additionally classified as any system handling flammable, combustible or toxic material. Typical systems not excluded are additionally listed below.
2. Piping
 - a. Fuel oil, gasoline, natural gas, medical gas, steam, compressed air or any piping containing hazardous, flammable, combustible, toxic or corrosive materials. Fire protection standpipe, risers and mains. Fire Sprinkler Branch Lines must be end tied.

3. Duct

- a. Smoke evacuation duct or fresh air make up connected to emergency system, emergency generator exhaust, boiler breeching or as used by the fire department on manual override.

4. Equipment

- a. Previously excluded non life safety duct mounted systems such as fans, variable air volume boxes, heat exchangers and humidifiers having a weight greater than 75 lbs require independent seismic bracing.

M. Spacing Chart For Suspended Components:

Table "A" Seismic Bracing (Maximum Allowable Spacing Shown- Actual Spacing to Be Determined by Calculation)			
Equipment	On Center Transverse	On Center Longitudinal	Change Of Direction
Duct			
All Sizes	30 Feet	60 Feet	4 Feet
Pipe Threaded, Welded, Soldered Or Grooved			
To 16"	40 Feet	80 Feet	4 Feet
18" – 28"	30 Feet	60 Feet	4 Feet
30" – 40"	20 Feet	60 Feet	4 Feet
42" & Larger	10 Feet	30 Feet	4 Feet

- N. Roof mounted duct is to be installed on sleepers or frames mechanically connected to the building structure. Roof anchors and seismic cables or frames shall be used to resist seismic and wind loading. Wind loading factors shall be determined by the registered design professional.
- O. Where duct sizes reduce below dimensions required for seismic restraint the final restraint shall be installed at the transition location.
- P. Install cables so they do not bend across edges of adjacent equipment or building structure.
- Q. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- R. 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.
- S. 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.
- T. Seismically Rated Beam Clamps are required where welding to or penetrations to steel beams are not approved.

U. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.6 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. Comply with requirements in Division 23 Section "Hydronic Piping" for piping flexible connections.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
1. A representative of the vibration isolation system manufacturer shall review the project installation and provide documentation indicating conformance to vibration isolation design intent
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.
1. The installing contractor shall submit a report upon request to the building architect and/or engineer, including the manufacturer's representative's final report, indicating that all seismic restraint material has been properly installed, or steps that are to be taken by the contractor to properly complete the seismic restraint work as per the specifications.

3.8 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust leveling devices as required to distribute loading uniformly on isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.
 1. Adjust active height of spring isolators.
- C. 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.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

EQUIPMENT ISOLATION SCHEDULE									
LOCATION EQUIPMENT (1)	A' CRITICAL (35'-50' SPAN)			B' UPPER STORY (20'-35' SPAN)			C' GRADE		
	ISOL ATOR TYPE	MINIM UM DEFLE CTION (IN)	BASE TYPE	ISOL ATOR TYPE	MINIM UM DEFLE CTION (IN)	BASE TYPE	ISOLA TOR TYPE	MINIM UM DEFLE CTION (IN)	BASE TYPE
AIR HANDLING UNITS FLOOR MOUNTED									
UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S3	2.5	SB1	S3	1.5		S3	0.75	
SUSPENDED									
UP TO 15 HP	H3	1.75		H3	1		H3	1	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1	
HIGH PRESSURE FAN SECTIONS									
UP TO 30 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
40 HP & OVER	S1	3.5	IB1	S3	2.5	IB1	S3	1.5	IB1
CENTRIFUGAL FANS									
CL. I & II UP TO 54-112" W.D.									
UPT015HP	S3	1.5	SB1	S3	0.75	SB1	S3	0.75	SB1
20-50 HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	SB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	SB1
CL. I & II 60" W.D. & OVER									
ALL CL. III FANS									
UPT015HP	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
20-50 H P	S1	2.5	IB1	S1	2.5	IB1	S3	1.5	IB1
60 HP & OVER	S1	3.5	IB1	S1	2.5	IB1	S3	1.5	IB1

CABINET FANS, FANS SECTIONS									
FLOOR MTD. UP TO 15 HP	S3	1.5		S3	0.75		S3	0.75	
20 HP & OVER	S1	2.5	IB1	S3	1.5		S3	0.75	
SUSPENDED UP TO 15 HP	H3	1.75		H3	1		H3	0.75	
20 HP & OVER	H3	2.5	SB1	H3	1.75		H3	1.75	
PUMPS									
FLOOR MTD. UP TO 15 HP	S3	0.75	IB1	S3	0.75	IB1	SRVD	0.4	IB1
7-112 HP & OVER	S3	1.5	IB1	S3	1.5	IB1	S3	0.75	IB1
SUSPENDED INLINE	H3	1.75		H3	1.75		H3	1	
REFRIGERATION UNITS									
RECIPROCATING COMPRESSORS	S1	2.5	IB1	S3	1.5	IB1	S3	0.75	IB1
RECIPROCATING COND. UNITS & CHILLERS	S1	2.5	IB1	S3	1.5		S3	0.75	
HERMETIC CENTRIFUGALS	S3	2.5		S3	1.5		P1	0.15	
OPEN CENTRIFUGALS	S1	2.5	IB1	S3	1.5	IB1	P1	0.15	
ABSORPTION MACHINES	S3	1.5		S3	0.75		P1	0.15	
AIR COOLED CONDENSERS									
UP TO 50 TONS	S3	1.5		S3	0.75		P1	0.15	
OVER 50 TONS	S3	2.5		S3	1.5		P1	0.15	

NOTES:

1) Thrust restraints required on all high-pressure fan section, suspended axial-flow fans and on floor-mounted axial fans operating at 3.0" S.P. or greater.

END OF SECTION 23 0548

SECTION 23 0550 - OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All pertinent sections of Division 21, 22, & 23 Mechanical General Requirements, are part of the work of this Section. Division 1 is part of this and all other sections of these specifications.
 - 1. Testing and Balancing is specified in section 230593.
 - 2. Training and Instructions to Owner's Representative is specified in section 230100.

1.2 SCOPE OF WORK

- A. Submission of Operating and Maintenance Manuals complete with Balancing reports. (Coordinate with Division 1).
- B. Coordination of work required for system commissioning.
- C. Provide a hard copy and an electronic copy on CD of the O and M manual fully searchable in PDF format.

1.3 SUBMITTALS

- A. Submit product data in accordance with Division 1 and Section 230100. Submit the following:
 - 1. Sample of O and M manual outline.
 - 2. Hard copy and an electronic copy on CD of the O and M manual fully searchable in PDF format. Both the hard copy and the electronic copy are to be fully indexed. The electronic copy shall also have a linked index.

PART 2 - PRODUCTS

2.1 O & M MANUALS

- A. The operating and maintenance manuals shall be as follows:
 - 1. Binders shall be red buckram with easy-view metal for size 8-1/2 x 11-inch sheets, with capacity expandable from 2 inches to 3-1/2 inches as required for the project. Construction shall be rivet-through with library corners. No. 12 backbone and lining

shall be the same material as the cover. The front cover and backbone shall be foil-stamped in white as follows: (coordinate with Division 01)

OPERATING AND MAINTENANCE
MANUAL
FOR THE

(INSERT PROJECT NAME)

(INSERT PROJECT COMPLETION YEAR)

VOLUME No. ()

VAN BOERUM & FRANK ASSOCIATES, INC.
MECHANICAL ENGINEER

(INSERT ARCHITECT)

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE MANUALS:

- A. Work under this section shall be performed in concert with the contractor performing the system testing and balancing. Six (6) copies of the manuals shall be furnished to the Architect for distribution to the owner.
- B. The "Start-Up and Operation" section is one of the most important in the manual. Information in this section shall be complete and accurately written and shall be verified with the actual equipment on the job, such as switches, starters, relays, automatic controls, etc. A step-by-step start-up procedure shall be described.
- C. The manuals shall include air and water-balancing reports, system commissioning procedures, start-up tests and reports, equipment and system performance test reports, warranties, and certificates of training given to the owner's representatives.

An index sheet typed on AICO Gold-Line indexes shall be provided in the front of the binder. The manual shall include the following:

SYSTEM DESCRIPTIONS

START-UP PROCEDURE AND OPERATION OF SYSTEM

MAINTENANCE AND LUBRICATION TABLE

OPERATION AND MAINTENANCE BULLETINS

AUTOMATIC TEMPERATURE CONTROL DESCRIPTION OF OPERATION,
INTERLOCK AND CONTROL DIAGRAMS, AND CONTROL PANELS.

AIR AND WATER SYSTEM BALANCING REPORTS

EQUIPMENT WARRANTIES AND TRAINING CERTIFICATES

SYSTEM COMMISSIONING REPORTS

EQUIPMENT START-UP CERTIFICATES

END OF SECTION 23 0550

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SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Equipment labels.
 - 2. Danger, Warning and Caution signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Danger tags.
 - 8. Warning tags.
 - 9. Caution tags.
 - 10. Specialty Gas.
 - 11. Ceiling grid.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.

- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Minimum Thickness, predrilled or stamped holes for attachment hardware:
 - a. Brass, 0.032-inch .
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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.
4. Fasteners: Stainless-steel;
 - a. Rivets or self-tapping screws
5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, and having predrilled holes for attachment hardware, 1/16 inch thick.
2. Letter Color:
 - a. Black.
3. Background Color:
 - a. White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel;
 - a. Rivets or self-tapping screws
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where

equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 DANGER, WARNING AND CAUTION SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; 1/16 inch thick.
- B. Danger signs, colors:
 - 1. Letter Color:
 - a. White.
 - 2. Background Color:
 - a. Red.
- C. Warning signs, colors:
 - 1. Letter Color:
 - a. Black.
 - 2. Background Color:
 - a. Orange.
- D. Caution signs, colors:
 - 1. Letter Color:
 - a. Black.
 - 2. Background Color:
 - a. Yellow.
- E. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- F. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- G. 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.
- H. Fasteners: Stainless-steel;
 - 1. Rivets or self-tapping screws
 - 2. Rivets.
- I. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- J. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. 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.
 - 1. 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.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, having predrilled holes for attachment hardware; 1/16 inch thick.
- B. Letter Color:
 - 1. White.
- C. Background Color:
 - 1. Black.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel;
 - 1. Rivets or self-tapping screws
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil Material:
 - a. Aluminum .
 2. Stencil Paint:
 - a. Exterior, gloss, alkyd enamel black unless otherwise indicated.
 - b. Paint may be in pressurized spray-can form.
 3. Identification Paint:
 - a. Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material, predrilled or stamped holes for attachment hardware, minimum thickness:
 - a. Brass, 0.032-inch
 2. Fasteners: Brass;
 - a. Wire-link or beaded chain; or S-hook
- B. Valve Schedules:
 1. For each piping system, on 8-1/2-by-11-inch bond paper, tabulate;
 - a. Valve number.
 - b. Piping system.
 - c. System abbreviation (as shown on valve tag).
 - d. Location of valve (room or space).
 - e. Normal-operating position (open, closed, or modulating).
 - f. Variations for identification.
 - g. Mark valves for emergency shutoff and similar special uses.
 2. Valve-tag schedule:
 - a. Shall be included in operation and maintenance data.

2.7 DANGER TAGS

- A. Danger Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size:
 - a. 3 by 5-1/4 inches minimum
 - 2. Fasteners:
 - a. Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," and "DO NOT OPERATE."
 - 4. Color: Red background with white lettering.

2.8 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size:
 - a. 3 by 5-1/4 inches minimum
 - 2. Fasteners:
 - a. Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "WARNING" and "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

2.9 CAUTION TAGS

- A. Caution Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size:
 - a. 3 by 5-1/4 inches minimum
 - 2. Fasteners:
 - a. Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "CAUTION," and "DO NOT OPERATE."
 - 4. Color: Orange background with black lettering.

2.10 SPECIALTY GAS

- A. All piping for specialty gases shall be identified and marked consistent with the discipline and industry governing the same and ANSI standards.

2.11 CEILING GRID

- A. Provide red lettering on the ceiling tile grid of the locations of all fire dampers, smoke dampers and fire/smoke dampers. Size of lettering and verbiage is to conform to IBC and NFPA standards.
- B. Provide valve identification for all HVAC valves located above the ceiling on the ceiling grid below the valve.
- C. Provide VAV box identification for all VAV boxes located above the ceiling on the ceiling grid below the VAV box.
- D. Provide identification for control devices and low voltage power sources (ATC Controls) located above the ceiling on the ceiling grid below the VAV box.

PART 3 - EXECUTION

3.1 PREPARATION

- A. 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.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified in Division 09.
- B. Stenciled Pipe Label Option:
 - 1. Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option.
 - 2. Install stenciled pipe labels with painted, color-coded bands or rectangles on each piping system.
 - a. Identification Paint: Use for contrasting background.
 - b. Stencil Paint: Use for pipe marking.

- C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 5. Near major equipment items and other points of origination and termination.
 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Pipe Label Color Schedule: (See Drawing Schedules)
1. Piping Background Color shall be applied to all exposed piping (either over bare pipe of the insulation) in mechanical rooms. Identifying lettering and arrows shall then be added as indicated above, and as necessary to be visible from anywhere in the room.
 2. For duct in mechanical rooms, chases and other exposed areas, as well as piping routed in other exposed areas such as chases, background color shall be applied in a two foot (2'0") wide band with identifying lettering and a flow direction arrow.
 3. Background and lettering shall be semi-gloss enamel paint by DeVoe (Mirrolac), Pratt and Lambert, Glidden, Rust-Oleum, Sherwin Williams or approved equal. The colors specified herein shall not be varied.

Color	Sherwin Williams	Pratt & Lambert	Rust-Oleum
Red	SW4081 Safety Red	1007 Vibrant Red	964 Federal Safety Red
Orange	SW4083 Safety Orange	S4507 Safety Orange	956 Federal Safety Orange
Yellow	SW4084 Safety Yellow	1732 Spectrum Yellow	944 Federal Safety Yellow
Green	SW4085 Safety Green	Safety Green	933 Federal Safety Green
Blue	SW4086 Safety Blue	1228 Anchors Aweigh	925 Federal Safety Blue
Purple	SW4080 Plum	Bright Medium	Bright Medium

Silver (Aluminum)	B59S11 Silver Brite	--	--
Black	Black	Effecto Black	634 Black
White	White	Effecto White	2766 White
Brown	SW4001 Bolt Brown	2278 Char Brown	--

- a. Identifying lettering shall be painted or stenciled on duct or pipe over the background color. Self-adhesive or glue-one type labels are acceptable. Letters shall be 2" high for duct and larger piping 3" or more, 1" high for 1-14" to 2-1/2" pipe, and 1/2" high for 1" pipe and smaller.
- b. Arrows to indicate direction of flow shall be painted over the background color in the same color as the lettering. The arrow shall point away from the lettering. On large piping 3" or more in diameter, the "shaft" of the arrow shall be 2" long and 1" wide. Smaller piping, 2-1/2" or less, shall have arrows with a shaft 1/2" wide and 2" long. Use a double-headed arrow if the flow can be in either direction.
- c. Piping shall be identified as follows:

Medium in Pipe		Background Color	Identifying Lettering	Lettering Color
Refrigerant:				
	Freon	Black	Freon	White
Steam:				
	Low Pressure (0-15psig)	Orange <i>(Note: No bands for Low Pressure)</i>	Low-Press. Steam	Black
	High Pressure (over 15 psig)	Orange <i>(Note: Two Black bands for High Pressure)</i>	High-Press. Steam	White
Water:				
	Boiler Blow-Off	Yellow	Blow-Off Water	Black
	Chilled Water Supply	Blue	Chilled Water Supply	White
	Chilled Water Return	Blue	Chilled Water Return	White
	Condenser Water Supply	Light Blue	Condenser Water Supply	White
	Condenser Water Return	Light Blue	Condenser Water Return	Black
	Condensate Return	Orange	Condensate Return	Black

		<i>(Note: One white band required for Steam Condensate Return)</i>		
	Heating Water Supply	Red	Heating Water Supply	White
	Heating Water Return	Red	Heating Water Return	White
	Glycol Heating Water Supply	Yellow	Glycol HW Supply	White
	Glycol Heating Water Return	Yellow	Glycol HW Return	White
	Industrial Water (Hot and/or Cold)	Brown	Industrial Water	White

3.4 DUCT LABEL INSTALLATION

- A. Install plastic-laminated duct labels with permanent adhesive on air ducts in the following color codes:
 1. Blue : For cold-air supply ducts.
 2. Yellow : For hot-air supply ducts.
 3. Green : For exhaust-, outside-, relief-, return-, and mixed-air ducts.
 4. ASME A13.1 Colors and Designs: For hazardous material exhaust.
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION (See Drawing Schedules.)

- A. 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.

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 23 0553

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 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Constant-flow hydronic systems.
 - b. Variable-flow hydronic systems.
 - c. Primary-secondary hydronic systems.
 - 3. Various HVAC Equipment.
 - a. Motors.
 - b. Chillers.
 - c. Condensing Units.
 - d. Heat Transfer Coils.
 - 4. Domestic Heater Systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within the following number of days of the Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article;
 - 1. 30 days.
- B. Certified TAB reports.
- C. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
 - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB and shall be the same as the TAB Contractor.
 - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician and shall be the same as the TAB Contractor.
- B. Certify TAB field data reports and perform the following:
 - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
 - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by:
 - 1. Architect.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on the following distribution systems have been satisfactorily completed:
 - 1. Air and water.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following:
 - 1. BTC Service.
 - 2. Certified Test & Balance.
 - 3. RS Analysis.
 - 4. QT&B Inc.
 - 5. BCS TAB (Building Control Systems)
- B. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- C. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- D. Examine the approved submittals for HVAC systems and equipment.
- E. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- F. Examine:

1. Ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in:
 - a. Section 233113 "Metal Ducts"
 2. Verify ceiling plenums and underfloor air plenums used for supply, return or relief air are properly separated from adjacent areas.
 3. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- G. Examine equipment performance data including fan and pump curves.
1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- H. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- I. Examine test reports specified in individual system and equipment Sections.
- J. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- M. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine system pumps to ensure absence of entrained air in the suction piping.
- P. Examine operating safety interlocks and controls on HVAC equipment.
- Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Hydronic systems are filled, clean, and free of air.
 - 3. Automatic temperature-control systems are operational.
 - 4. Equipment and duct access doors are securely closed.
 - 5. Balance, smoke, and fire dampers are open.
 - 6. Isolating and balancing valves are open and control valves are operational.
 - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
 - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in this section and:
 - 1. AABC's "National Standards for Total System Balance"
 - 2. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 - 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) .

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
 - 2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
 - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

- a. Report the cleanliness status of filters and the time static pressures are measured.
 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 6. Obtain approval from one of the following entities for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance:
 - a. Architect.
 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
 - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
 - 3. Measure total system airflow. Adjust to within indicated airflow.
 - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
 - 6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - 7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
 - 8. Record final fan-performance data.
- C. Pressure-Dependent, Variable-Air-Volume Systems without Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
 - 1. Balance variable-air-volume systems the same as described for constant-volume air systems.
 - 2. Set terminal units and supply fan at full-airflow condition.
 - 3. Adjust inlet dampers of each terminal unit to indicated airflow and verify operation of the static-pressure controller. When total airflow is correct, balance the air outlets

- downstream from terminal units the same as described for constant-volume air systems.
4. Readjust fan airflow for final maximum readings.
 5. Measure operating static pressure at the sensor that controls the supply fan if one is installed, and verify operation of the static-pressure controller.
 6. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
 - a. If air outlets are out of balance at minimum airflow, report the condition but leave the outlets balanced for maximum airflow.
 7. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
- D. Pressure-Dependent, Variable-Air-Volume Systems with Diversity: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set system at maximum indicated airflow by setting the required number of terminal units at minimum airflow. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
 2. Adjust supply fan to maximum indicated airflow with the variable-airflow controller set at maximum airflow.
 3. Set terminal units at full-airflow condition.
 4. Adjust terminal units starting at the supply-fan end of the system and continuing progressively to the end of the system. Adjust inlet dampers of each terminal unit to indicated airflow. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
 5. Adjust terminal units for minimum airflow.
 6. Measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data, and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against the approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
 1. Open all manual valves for maximum flow.
 2. Check liquid level in expansion tank.
 3. Check makeup water-station pressure gage for adequate pressure for highest vent.

4. Check flow-control valves for specified sequence of operation, and set at indicated flow.
5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
6. Set system controls so automatic valves are wide open to heat exchangers.
7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures except for positive-displacement pumps:
 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - a. If impeller sizes must be adjusted to achieve pump performance, obtain approval from the following entity and comply with requirements in Section 232123 "Hydronic Pumps.”:
 - 1) Architect.
 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
 - a. Monitor motor performance during procedures and do not operate motors in overload conditions.
 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
 4. Report flow rates that are not within plus or minus 10 percent of design.
- B. Measure flow at all automatic flow control valves to verify that valves are functioning as designed.
- C. Measure flow at all pressure-independent characterized control valves, with valves in fully open position, to verify that valves are functioning as designed.
- D. Set calibrated balancing valves, if installed, at calculated presettings.
- E. Measure flow at all stations and adjust, where necessary, to obtain first balance.

1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- F. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.
- G. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
 1. Determine the balancing station with the highest percentage over indicated flow.
 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
 3. Record settings and mark balancing devices.
- H. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- I. Measure the differential-pressure-control-valve settings existing at the conclusion of balancing.
- J. Check settings and operation of each safety valve. Record settings.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals and proceed as specified above for hydronic systems.

3.10 PROCEDURES FOR PRIMARY-SECONDARY HYDRONIC SYSTEMS

- A. Balance the primary circuit flow first and then balance the secondary circuits.

3.11 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number.
 2. Motor horsepower rating.
 3. Motor rpm.
 4. Efficiency rating.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper

operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.12 PROCEDURES FOR CHILLERS

- A. Balance water flow through each evaporator and condenser to within specified tolerances of indicated flow with all pumps operating. With only one chiller operating in a multiple chiller installation, do not exceed the flow for the maximum tube velocity recommended by the chiller manufacturer. Measure and record the following data with each chiller operating at design conditions:
1. Evaporator-water entering and leaving temperatures, pressure drop, and water flow.
 2. For water-cooled chillers, condenser-water entering and leaving temperatures, pressure drop, and water flow.
 3. Evaporator and condenser refrigerant temperatures and pressures, using instruments furnished by chiller manufacturer.
 4. Power factor if factory-installed instrumentation is furnished for measuring kilowatts.
 5. Kilowatt input if factory-installed instrumentation is furnished for measuring kilowatts.
 6. Capacity: Calculate in tons of cooling.
 7. For air-cooled chillers, verify condenser-fan rotation and record fan and motor data including number of fans and entering- and leaving-air temperatures.

3.13 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
1. Entering- and leaving-water temperature.
 2. Water flow rate.
 3. Water pressure drop.
 4. Dry-bulb temperature of entering and leaving air.
 5. Wet-bulb temperature of entering and leaving air for cooling coils.
 6. Airflow.
 7. Air pressure drop.
- B. Measure, adjust, and record the following data for each electric heating coil:
1. Nameplate data.
 2. Airflow.
 3. Entering- and leaving-air temperature at full load.
 4. Voltage and amperage input of each phase at full load and at each incremental stage.
 5. Calculated kilowatt at full load.
 6. Fuse or circuit-breaker rating for overload protection.
- C. Measure, adjust, and record the following data for each steam coil:
1. Dry-bulb temperature of entering and leaving air.
 2. Airflow.

3. Air pressure drop.
4. Inlet steam pressure.

D. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.14 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.15 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare progress reports on the following interval to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors;
1. Weekly.

3.16 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
 - a. Indicated versus final performance.
 - b. Notable characteristics of systems.
 - c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor-, return-, and exhaust-air dampers.
 - b. Conditions of filters.
 - c. Cooling coil, wet- and dry-bulb conditions.
 - d. Face and bypass damper settings at coils.
 - e. Fan drive settings including settings and percentage of maximum pitch diameter.
 - f. Inlet vane settings for variable-air-volume systems.
 - g. Settings for supply-air, static-pressure controller.
 - h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.

4. Pipe and valve sizes and locations.
 5. Terminal units.
 6. Balancing stations.
 7. Position of balancing devices.
- E. Apparatus-Coil Test Reports:
1. Coil Data:
 - a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 2. Test Data (Indicated and Actual Values):
 - a. Air flow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
 - l. Refrigerant expansion valve and refrigerant types.
 - m. Refrigerant suction pressure in psig.
 - n. Refrigerant suction temperature in deg F.
 - o. Inlet steam pressure in psig.
- F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.

- g. Sheave make, size in inches, and bore.
- h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
- g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

- a. System and air-handling-unit number.
- b. Location and zone.
- c. Traverse air temperature in deg F.
- d. Duct static pressure in inches wg.
- e. Duct size in inches.
- f. Duct area in sq. ft..
- g. Indicated air flow rate in cfm.
- h. Indicated velocity in fpm.
- i. Actual air flow rate in cfm.
- j. Actual average velocity in fpm.
- k. Barometric pressure in psig.

H. Air-Terminal-Device Reports:

1. Unit Data:

- a. System and air-handling unit identification.
- b. Location and zone.
- c. Apparatus used for test.
- d. Area served.
- e. Make.
- f. Number from system diagram.

- g. Type and model number.
- h. Size.
- i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm.
- b. Air velocity in fpm.
- c. Preliminary air flow rate as needed in cfm.
- d. Preliminary velocity as needed in fpm.
- e. Final air flow rate in cfm.
- f. Final velocity in fpm.
- g. Space temperature in deg F.

I. Instrument Calibration Reports:

1. Report Data:

- a. Instrument type and make.
- b. Serial number.
- c. Application.
- d. Dates of use.
- e. Dates of calibration.

3.17 INSPECTIONS

A. Initial Inspection:

- 1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
- 2. Check the following for each system:
 - a. Measure airflow of at least 10 percent of air outlets.
 - b. Measure water flow of at least 5 percent of terminals.
 - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
 - d. Verify that balancing devices are marked with final balance position.
 - e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

- 1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by:
 - a. Architect.

2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of:
 - a. Architect.
 3. The following entity shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day:
 - a. Architect.
 4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
 5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
 2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.18 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 0593

SECTION 23 07 13 - DUCT 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 insulating the following duct services:
 - 1. Indoor, supply and return air.
- B. Related Sections:
 - 1. Section 230716 "HVAC Equipment Insulation."
 - 2. Section 230719 "HVAC Piping Insulation."
 - 3. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation

materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide

insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; Commercial Board.
- b. Fibrex Insulations Inc.; FBX.
- c. Johns Manville; 800 Series Spin-Glas.
- d. Knauf Insulation; Insulation Board.
- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Board: Structural-grade, press-molded, xonolite calcium silicate, fireproofing board suitable for operating temperatures up to 1700 deg F. Comply with ASTM C 656, Type II, Grade 6. Tested and certified to provide a:

- a. 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction

1. Products: Subject to compliance with requirements, provide the following :

- a. Johns Manville; Super Firetemp M.

B. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a:

- a. 2-hour fire rating by an NRTL acceptable to authorities

1. Products: Subject to compliance with requirements, provide one of the following :

- a. CertainTeed Corp.; FlameChek.
- b. Johns Manville; Firetemp Wrap.
- c. Nelson Fire Stop Products; Nelson FSB Flameshield Blanket.
- d. Thermal Ceramics; FireMaster Duct Wrap.
- e. 3M; Fire Barrier Wrap Products.
- f. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Aeroflex USA, Inc.; Aero seal.

- b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - D. FSK Jacket Adhesive, and ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.4 MASTICS
- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.

3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- ### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- ### A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- ### B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- ### C. Metal Jacket:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.

- b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
- a. Sheet and roll stock ready for shop or field sizing
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft.

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
- a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, provide one of the following:
- a. ABI, Ideal Tape Division; 488 AWF.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120.
 - d. Venture Tape; 3520 CW.
2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals.
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
3. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch-diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CWP-1.
 - 2) GEMCO; CD.
 - 3) Midwest Fasteners, Inc.; CD.
 - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; CHP-1.
 - 2) GEMCO; Cupped Head Weld Pin.
 - 3) Midwest Fasteners, Inc.; Cupped Head.
 - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
 - 2) GEMCO; Perforated Base.
 - 3) Midwest Fasteners, Inc.; Spindle.

- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) GEMCO; Nylon Hangers.
 - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
 - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
 - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
 - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- 5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
 - 2) GEMCO; Peel & Press.
 - 3) Midwest Fasteners, Inc.; Self Stick.
 - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 - c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive-backed base with a peel-off protective cover.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 1. Install insulation continuously through hangers and around anchor attachments.
 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at:
 - a. 2 inch o.c.
 - b. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation,

- install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078400 "Firestopping" firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078400 "Firestopping."

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:
 - a. 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

- b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
 - 5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
 - 6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
- 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for:
 - a. 50 percent coverage of duct and plenum surfaces.
 - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

- a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.7 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
 1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
 2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where FSK jackets are indicated, install as follows:
 1. Draw jacket material smooth and tight.
 2. Install lap or joint strips with same material as jacket.
 3. Secure jacket to insulation with manufacturer's recommended adhesive.
 4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.
- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078400 "Firestopping."

3.9 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency:
 - a. Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

- 3.12 Insulation shall have an R value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.13 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Supply-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.
- B. Return-air duct insulation shall be one of the following:
 - 1. Flexible Elastomeric: 1 inch thick.
 - 2. Mineral-Fiber Blanket: 1 inch thick and 0.75-lb/cu. ft. nominal density.

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SECTION 23 0719 - HVAC PIPING 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 insulating the following HVAC piping systems:
 - 1. Condensate drain piping.
 - 2. Chilled-water piping.
 - 3. Heating hot-water piping.
- B. Related Sections:
 - 1. Section 230713 "Duct Insulation."
 - 2. Section 230716 "HVAC Equipment Insulation."

1.3 DEFINITIONS:

- A. Refer to Section 230500 "Common Work Results for HVAC".

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
 - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 3. Detail removable insulation at piping specialties.
 - 4. Detail application of field-applied jackets.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
 - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
 - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.8 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.9 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Insulation for below-ambient service requires a vapor-barrier.
- C. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- E. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- F. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553,
 - 1. Type II and ASTM C 1290, Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 2. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; SoftTouch Duct Wrap.
- b. Johns Manville; Microlite.
- c. Knauf Insulation; Friendly Feel Duct Wrap.
- d. Manson Insulation Inc.; Alley Wrap.
- e. Owens Corning; SOFTR All-Service Duct Wrap.

I. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

- a. Johns Manville; Micro-Lok.
- b. Knauf Insulation; 1000-Degree Pipe Insulation.
- c. Manson Insulation Inc.; Alley-K.
- d. Owens Corning; Fiberglas Pipe Insulation.
- e. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A:
 - 1) with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

J. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied:

1. ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2. Products: Subject to compliance with requirements, provide one of the following:

- a. CertainTeed Corp.; CrimpWrap.
- b. Johns Manville; MicroFlex.
- c. Knauf Insulation; Pipe and Tank Insulation.
- d. Manson Insulation Inc.; AK Flex.
- e. Owens Corning; Fiberglas Pipe and Tank Insulation.

K. Prefabricated Thermal Insulating Fitting Covers: Comply with ASTM C 450 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

1. Products: Subject to compliance with requirements, provide the following:

- a. Ramco Insulation, Inc.; Super-Stik.

B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, provide the following:

- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
 - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
 - b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.

2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
5. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 - 2. Adhesive: As recommended by jacket material manufacturer.
 - 3. Color: Color-code jackets based on system:
 - a. White
 - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- C. Metal Jacket:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
 - b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing.
 - c. RPR Products, Inc.; Insul-Mate.
 - 2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
 - a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
 - b. Finish and thickness are indicated in field-applied jacket schedules.
 - c. Moisture Barrier for Indoor Applications:
 - 1) 1-mil- thick, heat-bonded polyethylene and kraft paper.
 - d. Moisture Barrier for Outdoor Applications:
 - 1) 3-mil- thick, heat-bonded polyethylene and kraft paper.
 - e. Factory-Fabricated Fitting Covers:
 - 1) Same material, finish, and thickness as jacket.
 - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
 - 3) Tee covers.

- 4) Flange and union covers.
- 5) End caps.
- 6) Beveled collars.
- 7) Valve covers.
- 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.8 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
 - c. Compac Corporation; 104 and 105.
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

- A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
 - 1. Verify that systems to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at
 - a. 2 inches o.c.
 - b. For below-ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
 - 1. Vibration-control devices.

2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 1. Comply with requirements in Section 078400 "Firestopping" for firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 - 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 - 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 - 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
 - 5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
 - 1. Install pipe insulation to outer diameter of pipe flange.
 - 2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
 - 3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
 - 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install mitered sections of pipe insulation.
 - 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

- A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 Insulation shall have a k value that meets the minimum requirements of the latest International Energy Conservation Code (IECC).

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric:
 - 1) 1/2 inch thick
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I:
 - 1) 1/2 inch thick

B. Chilled Water, above 40 Deg F:

1. NPS 1-1/2 inch and Smaller: Insulation shall be one of the following:
 - a. Flexible Elastomeric:
 - 1) 1-1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I:
 - 1) 1-1/2 inches thick.
2. NPS 2 inch and Larger: Insulation shall be one of the following:
 - a. Flexible Elastomeric:
 - 1) 1-1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I:
 - 1) 1-1/2 inches thick.
3. Insulation runouts not exceeding 48 inches in length for connection to equipment shall be one of the following:
 - a. Flexible Elastomeric: 1 inch thick.
 - b. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick

C. Heating-Hot-Water Supply and Return, 200 Deg F and Below:

1. NPS 1 1/2 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I:
 - 1) 1-1/2 inch thick
2. Greater than NPS 1-1/2 inch : Insulation shall be the following:

- a. Mineral-Fiber, Preformed Pipe, Type I or Pipe and Tank Insulation:
 - 1) 2 inches thick
- 3. Insulation for runouts not exceeding 48 inches in length for connection to equipment shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water and Glycol Chilled Water:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 3 inches thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 3 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.
- D. Piping, Exposed:
 - 1. PVC:
 - a. Thickness: 30 mils thick.
 - b. Jacket Color: (Mechanical Rooms and where exposed)
 - 1) Chilled Water Supply & Return: Blue
 - 2) Refrigerant Suction and hot-gas piping: Aluminum (outdoors); No jacketing on interior piping.
 - 3) Hot Water Supply & Return: Red

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. None.

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- D. Piping, Exposed:
 - 1. Aluminum, Stucco Embossed: 0.016 inch thick.

END OF SECTION 23 0719

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SECTION 23 0900 - BUILDING AUTOMATION SYSTEM

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. The Facility Management and Control System (FMCS) Contractor shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control as herein specified. The system shall include all required computer software and licenses, hardware, controllers, sensors, transmission equipment, system workstations, local panels, conduit, wire, installation, engineering, database and setup, supervision, commissioning, acceptance test, training, warranty service and, at the owner's option, extended warranty service. Licenses for all software shall be registered to Intermountain Health Care. Include all upgrades for a period of two years.
- B. The system shall only employ BACnet communications in an open architecture with the capabilities to support a multi-vendor environment. The system shall be capable of integrating third party systems and utilizing the following standard protocols.
 - 1. BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
- C. The FMCS shall utilize a JCI user interface and shall provide total integration with the existing JCI Metasys infrastructure with user access to all system data either locally over a secure Intranet within the building or by remote access by a standard Web Browser over the Internet.
- D. The FMCS shall demonstrate, with (3) proof sources, integration with HVAC industry open standard protocols, including BACnet and Internet standard SQL database and HTTP / HTML / XML text formats.
- E. All materials and equipment used shall be standard components, regularly manufactured with standard part numbers and owners manuals for this and/or other systems. One of a kind, third party or custom integrations devices designed specially for this project will not be allowed.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

- A. Drawings and general provisions of the Contract, including General and supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Products furnished but not installed under this section:

1. Valves, flow switches, flow sensors, thermowells and pressure taps to be installed under division 23.
 2. Automatic dampers to be installed under division 23.
- C. Coordination with electrical:
1. Installation of all line voltage power wiring by division 26.
 2. Each motor starter provided under Division 26, shall be furnished with individual control power transformer to supply 120 volt control power and auxiliary contacts (one N.O. and one N.C.) for use by this section.

1.3 QUALITY ASSURANCE

- A. The system shall be furnished, engineered, and installed by the manufacturers' locally authorized representative. The controls contractor shall have factory-trained technicians to provide instruction, routine maintenance, and emergency service within 24 hours upon receipt of request.
- B. At the time of bid, all FMCS Application Specific Controllers and Programmable Equipment Controllers shall be listed as follows:
1. Underwriters Laboratory, UL 916
 2. FCC Regulation, Part 15, Class B

1.4 SUBMITTALS

- A. Submit 6 complete sets of documentation in the following phased delivery schedule:
1. Valve and damper schedules
 2. Equipment data cut sheets
 3. VAV Schedules indicating connected air handler.
 4. System schematics, including:
 - a. sequence of operations
 - b. point names
 - c. point addresses
 - d. point to point wiring (identify both BacNET and hardwired points)
 - e. interface wiring diagrams
 - f. panel layouts
 - g. system riser diagrams
 - h. Obtain device ID and trunk ID's from Intermountain before adding engine to IH network. Coordinate instance numbers and indicate them in submittal.
 5. AutoCAD® compatible as-built drawings.

6. Control contractor to resubmit a narrative response to all review comments provided by engineering team and owner during initial submittal review phase.
7. Control graphics images shall be included in the submittals for owner review and approval.
- B. Upon project completion, submit operation and maintenance manuals, consisting of the following:
 1. Index sheet, listing contents in alphabetical order
 2. Manufacturer's equipment parts list of all functional components of the system, disk of system schematics, including wiring diagrams
 3. Description of sequence of operations
 4. As-Built interconnection wiring diagrams
 5. User's documentation containing product, system architectural and programming information.
 6. Trunk cable schematic showing remote electronic panel locations, and all trunk data
 7. List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)
 8. Identify control points trending and alarms per IH recommended list.
 9. Point naming and description in accordance with IH standards.
 10. Conduit routing diagrams
 11. Copy of the warranty/guarantee
 12. Operating and maintenance cautions and instructions
 13. Recommended spare parts list
 14. Device locations and labeling of each point on the controller.
 15. Save backup for new controller programming on the server and indicate server path.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls, Metasys Extended Architecture, furnished and installed by the local branch office.
 1. Controls installation may be performed by a local subcontractor of JCI.

2.2 The Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers. The FMCS shall incorporate LonWorks technology using Free Topology Transceivers (FTT-10), or BACnet MSTP485 or Ethernet in all unitary, terminal and other device controllers. The system shall include:

- A. Programmable Equipment Controllers (PEC's) for control of primary mechanical systems and distributed system applications. Controllers shall be fully programmable to create custom control solutions.

- B. Network Area Controllers (NAC's) for distributed system applications, databases and networking functions.
 - C. Application Specific Controllers (ASC's) for control of Fan coil terminal units, Unit Vent terminal units, Heat Pump units and other terminal equipment.
 - D. Graphical User Interface (GUI), which includes the hardware and software necessary for a user to interface with the control system and devices.
- 2.3 The controller network shall use twisted pair wiring or loop. The PEC and ASC network shall communicate at a minimum 78Kbps using BACnet or Lontalk. The GUI and NAC shall reside on an Ethernet backbone.
- 2.4 All components and controllers supplied under this contract shall be true "peer-to-peer" communicating devices.
- 2.5 NETWORK AREA CONTROLLER (NAC)
- A. The Network Area Controller (NAC) shall provide the interface between the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:
 - 1. Calendar functions
 - 2. Scheduling
 - 3. Trending
 - 4. Alarm monitoring and routing
 - 5. Time synchronization
 - 6. Integration of LonWorks controller data
 - 7. Integration of BACnet and MODBUS networks
 - B. The NAC shall provide multiple, concurrent user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it. The NAC shall be at the current revision at the time of installation.
 - C. The NAC shall support standard Web browser access via the Intranet/Internet. It shall be capable of supporting multiple users, expandable to fifty.
 - D. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.

1. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up, telephone connection, or wide-area network.
 2. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
 - a. To alarm
 - b. Return to normal
 - c. To fault
 3. Provide for the creation of an unlimited number of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
 4. Provide timed (schedule) routing of alarms by class, object, group, or node.
 5. Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.
- E. Alarms shall be annunciated in any of the following manners as user defined:
1. Screen message text
 2. Email of the complete alarm message to multiple recipients. A list of required alarm points to be provided by owner. Provide the ability to route and email alarms based on:
 - a. Day of week
 - b. Time of day
 - c. Recipient
 3. Pagers via paging services that initiate a page on receipt of email message
 4. Graphic with flashing alarm object(s)
 5. Cell phones
- F. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
 2. Location (building, floor, zone, office number, etc.)
 3. Equipment (air handler #, accessway, etc.)
 4. Acknowledge time, date, and user who issued acknowledgement.
- G. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.
- H. A log of all alarms shall be maintained by the NAC and/or a server and shall be available for review by the user.
- I. Provide a "query" feature to allow review of specific alarms by user defined parameters.
- J. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

K. An Error Log to record system errors shall be provided and available for review by the user.

L. Data Collection and Storage

1. The NAC shall collect data for any property of any object and store this data for future use.
 2. A list of required trends shall be provided by the owner. Coordinate trending requirements during submittal phase.
 3. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
 - a. Designating the log as interval or deviation.
 - b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
 - c. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
 - d. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
 - e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.
 4. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a standard Web Browser.
 5. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
 6. All log data shall be available to the user in the following data formats:
 - a. HTML
 - b. XML
 - c. Plain Text
 - d. Comma or tab separated values
 7. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
 - a. Archive on time of day
 - b. Archive on user-defined number of data stores in the buffer (size)
 - c. Archive when buffer has reached its user-defined capacity
- M. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date
 2. User ID
 3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.
- N. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time of day.
1. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
 2. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.6 PROGRAMMABLE EQUIPMENT CONTROLLERS (PEC)

- A. Programmable Equipment Controllers (PEC's) shall be stand-alone, multi-tasking, real-time digital control processors.
- B. The PEC's shall communicate via BACnet communication according to ASHRAE standard ANSI/ASHRAE 135-2004.
- C. The PEC must communicate peer-to-peer with all of the network application specific, programmable controllers.
- D. The PEC software database must be able to execute all of the specified mechanical system controls functions. The programming software shall be able to bundle software logic to simplify control sequencing. All values, which make up the PID output value, shall be readable and modifiable at a workstation or portable service tool. Each input, output, or calculation result shall be capable of being shared/bound with any controller or interface device on the network.
- E. Provide programming, engineering, and configuration tools used for the project duly licensed to the owner for owner's use.
- F. PEC's shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
- G. A single process shall be able to incorporate measured or calculated data from any and all other PEC's on the network. In addition, a single process shall be able to issue commands to points in any and all other PEC's on the network.
- H. Each PEC shall support firmware upgrades without the need to replace hardware.
- I. Each PEC shall continuously perform self-diagnostics, which include communication diagnosis and diagnosis of all components.

- J. In the event of the loss of normal power, there shall be an orderly shutdown of all PEC's to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - 1. Upon restoration of normal power, the PEC shall automatically resume full operation without manual intervention.
 - 2. All PEC's control programming and databases must be stored in Flash memory, therefore eliminating data loss, downtime and re-load time.
- K. Provide a separate PEC for each AHU or other HVAC system such that the inputs, calculations, and outputs shall reside on a single controller.

2.7 APPLICATION SPECIFIC CONTROLLERS (ASC)

- A. Each Application Specific Controller (ASC) shall operate as a stand-alone BacNet controller capable of performing its specified control responsibilities independent of other controllers in the network. Each ASC shall be a minimum 16-BIT microprocessor based, multi-tasking, multi-user, real time digital control processor.
- B. Controllers shall include all inputs and outputs necessary to perform the specified control sequences. Analog and digital outputs shall be industry standard signals such as 0-10V and 3-point floating control allowing for interface to a variety of industry standard modulating actuators. The ASC inputs and outputs shall consist of industry standards types. Inputs shall be electrically isolated from outputs, communications and power.
- C. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the network is not acceptable.
- D. The control program shall reside in the ASC. The application program and the configuration information shall be stored in non-volatile memory with no battery back-up required.
- E. After a power failure the ASC must run the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

2.8 GRAPHICAL USER INTERFACE SOFTWARE (GUI)

- A. Contractor to create new system graphics pages and integrate them with the existing Metasys interface.
- B. Command of points from multiple manufacturers shall be transparent to the operator.
- C. Mobile, Web Based, User Interface (MUI)
 - 1. General

- a. The mobile, web-based, user interface shall be HTML5-compliant and provide access to the system from smartphones, tablets, portable and desktop computers. User Interfaces that require software installation on the client device (e.g. Java, MicrosoftSilverlight®, Adobe® Flash®), or software downloads from an online app store shall not be acceptable for these purposes.
- b. The mobile user interface shall provide system operators with a simple location-based navigation approach to finding information, including the ability to search for any location by name and to bookmark a location in a standard browser.
- c. The same user interface elements shall be accessible from any type of personal computer or mobile device running any type of operating system supported (e.g. iOS, Android, Windows®). It shall automatically adapt and optimize the display for the screen size and touch screen navigation.

2. Navigation Trees

- a. A dedicated location based navigation tree shall be provided as part of the user interface in order to navigate to specific places within the facility on a hierarchical basis (typ. Facility, Building, Wing, Floor, Room.)
- b. The location-based tree shall use place names familiar to the operator without training or familiarization regarding special codes and conventions utilized in the generation of the BMS.
- c. Clicking or tapping on a location name in the tree shall display the home page associated with the space and simultaneously expand the tree to display the next level of spaces below the one selected.
- d. It shall be possible for qualified users to view a navigation tree of devices connected to the BMS network in order to enable troubleshooting of equipment and communications. Clicking or tapping on the Network Icon at the top of the Navigation Tree will access this alternate view. Users without the necessary access rights shall not see the Network Icon.
- e. A click or tap on a device in the network tree shall display a dashboard for that device including information regarding related equipment and access to a separate focus view of commandable points associated with the piece of hardware. A click or tap on such a point shall display a control dialogue box allowing the user to modify or command that point as indicated. The dialog box shall contain an annotation box for describing why the action was taken or special circumstances that apply.
- f. It shall be possible to restrict user access to any space in the Spaces Tree and thereby prevent manipulation of equipment associated with the space.

3. Dashboard Displays

- a. The user interface shall provide the ability to view equipment visualizations, floor plans, and/or other graphics on mobile or desktop client devices in a browser environment, without the need for additional plugins or software. Graphics shall be accessible via a space (for floorplans, campus maps, etc.) or equipment dashboard.
 - b. Standard dashboards shall be configured for each defined space including one of the following predefined or custom elements:
 - Equipment Serving Space
 - Potential Problem Areas
 - Equipment Summary
 - Graphic Display (if specified)
 - Schedule
 - c. Standard dashboards shall be configured for each system or device (typ. mechanical or electrical equipment) including the following predefined or custom elements:
 - Trend
 - Equipment Activity Summary
 - Equipment Relationships Summary
 - Equipment Data
 - Graphic Display (if specified)
 - Schedule
 - d. Users with appropriate permissions shall have access to a Dashboards Manager that can change the display order of Summaries and Data elements, add or remove elements and apply custom dashboards layouts to equipment and space by type.
 - e. Dashboard Manager shall apply dashboards to spaces or equipment based on the viewing platform (Desktop/Tablet or Phone) in order to tailor the user experience to the needs of the specific user base.
4. Alarm Management
- a. The user interface shall provide a single display of all potential issues in a facility including items currently in alarm, warning, override, out-of-service and offline.
 - b. The user interface shall provide notification of new alarms, visually and audibly.
 - c. The user interface shall provide the ability to view a summary of alarms, including a chart of the number of alarms in each of the defined alarm priority ranges. The priority ranges should be filterable.

- d. The user interface shall provide the capability to view multiple occurrences of the same alarm, ultimately providing the ability to acknowledge or discard all occurrences of the alarm in a single action.
 - e. The user interface shall provide the capability to view, and filter on, all alarms present in a well-defined mechanical system using the equipment serving equipment relationships.
 - f. The user interface shall provide the capability to acknowledge and discard all occurrences of at least 1000 alarms in one operation.
 - g. The user interface shall provide the user with the understanding of what physical space is being affected when an alarm occurs. The user interface shall provide the ability to filter alarms by physical space affected when the alarm occurred.
 - h. The user interface shall provide the capability to monitor alarms 24/7 without requiring an active login to the system, accessible via segregated web page. The user interface shall provide the capability to enable or disable the 24/7 alarm monitor mode if desired.
 - i. The user interface shall provide the capability to annotate alarms using a pre-defined selection list or by providing custom text.
 - j. The user interface shall provide the capability to filter down alarm list and bookmark the filtered list, allowing automatic filtering to be applied when the bookmark is accessed.
 - k. It shall be possible to export a .csv or .pdf copy of the currently displayed alarm list.
 - l. If an alarm is not acknowledged or discarded by recipients within a user-selected time, the alarm shall be sent to an additional set of recipients.
5. Send Announcement
- a. Administrative users should have the ability to alert staff of planned outages in advance. The communication avenues should include:
 - Email
 - A message shown on the login screen
 - A banner shown to logged in users
6. Equipment Activity Summary
- a. The user interface shall provide a filterable, single display, of all activity related to a specific piece of equipment including user changes, discarded user changes, pending

alarms, discarded alarms, and acknowledged alarms for at least one year of historical data.

- b. Items shall be listed in timed order with the latest activity at the top of the list.
 - c. Filters shall allow only specific activities for specific data points occurring within a specific time and date window to be displayed.
 - d. It shall be possible to export a .csv copy of the currently displayed summary by clicking or tapping on the export icon.
 - e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by tapping or clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.
 - f. Clicking on the information icon in front of any displayed activity listed in the summary shall expand the display to include the name of the user, server time, value prior to the activity, the ability to annotate the activity and a user selectable icon for displaying a trend graph of the point.
7. Equipment Relationships Summary
- a. The user interface shall provide a summary of all equipment and spaces related to the operation of the system or device currently selected for viewing.
 - b. The user interface shall include the capability to navigate to the home page of any related piece of equipment or space with a single click or tap on the desired element.
8. Equipment Data Summary
- a. The user interface shall provide a summary of all data pertaining to a particular piece of mechanical or electrical equipment in a tabular format. Clicking or tapping on any value in the summary shall display a related command panel allowing the user to command, override, or change service condition of the point selected and to annotate such actions for future reference.
 - b. It shall be possible to export a .pdf copy of the report with a single click on the associated export icon.
9. Equipment Serving Space Summary
- a. The user interface shall provide a summary of all mechanical and electrical equipment as defined in the points list that serves a selected space from the navigation tree.
 - b. The summary shall be capable of including a subset of the viewable points for each system representing the key elements of interest to operators without subjecting them to long lists of points irrelevant to basic operation.

- c. Clicking or tapping on any item in the summary shall navigate to the item's assigned home page in the user interface.
- d. It shall be possible to view a custom trend of information contained in the summary with a single click of the trend icon residing in the title header.
- e. It shall be possible to display specific systems and points by filtering equipment types desired.
- f. Because the data is intended to be a snapshot of the current conditions in the space it shall not dynamically update but a click or tap on the update icon at any time performs that function.

10. Potential Problem Areas

- a. The user interface shall provide a summary of all points in the system related to the space that are not operating correctly (e.g. alarm, off normal or not communicating correctly) in order to provide the operator with a quick update on current conditions.
- b. The information shall include:
 - Point status (via color)
 - Point name
 - Value of the point when the summary was taken
 - Equipment that contains the offending point
 - Space that is served by that equipment
- c. Data points in the summary may be filtered by one or more types of off-normal condition (e.g. above setpoint, offline and overridden).
- d. The summary may be exported in .csv format for inclusion in spreadsheets or other documents.

11. Equipment Summary

- a. The user interface shall provide a summary that allows the user to compare all similar equipment that serves the space as well as downstream (child) spaces in order to evaluate conditions quickly and determine patterns for troubleshooting purposes.
- b. Each unique equipment type shall be selectable and display a representative set of values along with the space(s) being served by the device. Equipment types can be selected from a dropdown menu in the summary.
- c. Clicking or tapping on a selected device in the summary shall navigate to the home page for that piece of equipment while clicking or tapping a data point shall display the command panel for that point.

- d. It shall be possible to export a .pdf copy of the currently displayed summary by clicking or tapping on the export icon.
- e. It shall be possible to create a custom trend graph containing the data shown in the currently displayed summary by clicking on the trend icon in the header bar and selecting the specific points to trend in the resulting selection panel.

12. Trend

- a. The user interface shall provide the capability to view historical trend data from multiple pieces of equipment in both bar and line formats.
- b. The user shall have the ability to navigate to a selection list of frequently viewed trends.
- c. Trend graphs shall have to ability to be smartly auto-generated based on equipment and space relationships.
- d. The user shall have the ability to view up to 3 graphs in a single screen and select which data points to plot on each to help with readability.
- e. Each graph shall include a dedicated selection icon to export a copy of the graphic and data in .pdf format or the data only as a .csv file.
- f. Trend graphs shall allow the plotting of non-trended point's default values.
- g. The user shall have the ability to add any trended to point a custom trend graph.
- h. The user shall have the ability to save trend graphs for reference later.
- i. The user shall be able to specify the duration of time and aggregation period for each trend line.
- j. The user shall have the ability to decide whether to show raw or aggregate trend data.

13. Graphics

- a. The user interface shall display an equipment visualization or graphic within the context of its associated space (building, floor, room, etc.) or equipment dashboard.
- b. Graphics shall include the ability to define individual information layers for operator selection in order to clarify systems status and simplify operation on mobile devices. Where desired a master layer may be defined to include important information about the facility on all graphic screens.
- c. Graphics shall support the use of photo-realistic symbols as well as color change and animation to match the status of the related system control point.

- d. It shall be possible to export a time stamped .pdf file of the graphic being viewed in order to communicate the current conditions in the space or the equipment being viewed and to provide a historic record.

14. Scheduling

- a. The user interface shall provide the capability to display, in a singular view, all of the effective schedules in the context of the space (building/floor/room, etc.) or equipment that the schedule effects. The software should have the ability to display an effective schedule, for the present, or a future date.
- b. The user interface shall provide a report of all schedules affecting a space or equipment. The report shall provide the user details of events that comprise the weekly schedule and exception schedule(s). The report shall provide a means of viewing individual breakout scheduling elements for Weekly Schedule, Exceptions and Default Commands.
- c. The user interface shall provide the capability to efficiently change or modify schedules in mass quantities. This includes the capability to add, in bulk, exceptions to schedules, in addition to assigning, in bulk, weekly schedules.

15. Command and Control

- a. It shall be possible to command system analog and binary points via a dropdown menu accessed by clicking or tapping on the value shown in any equipment summary or graphic display and completing the task in the resultant menu including an optional annotation.
- b. Commanding multiple points shall be possible on displays where multiple like system elements can be chosen.
- c. The user interface shall support users adding notes on their commands.
- d. The user interface shall support a choice of either permanent or temporary commands.

16. Cyber Health Dashboard

- a. The Cyber Health Dashboard shall provide a centralized view of potential cybersecurity related issues or system issues, grouped into critical issues, potential risks, and informational items.
- b. The Cyber Health Dashboard shall identify user account information, including:
 - 1. Total number of users
 - 2. Dormant users

3. Active users
 4. Locked users
 5. Temporary users
 6. Disabled users
 7. Users with Administrator role
 8. Policy related information
 - c. The Cyber Health Dashboard shall indicate out-of-date software.
 - d. The Cyber Health Dashboard shall identify when security certificates are set to expire.
 - e. The Cyber Healthy Dashboard shall provide insight into user activity such as number of successful logins, unsuccessful logins, and locked out accounts.
17. Search
- a. Typing a text string in the Search box shall display a list of all occurrences of that string in the mobile user interface. When a string is represented in the description of a space or network element, selecting it shall display its default dashboard.
 - b. Clicking or tapping on the Advanced Search Icon shall display the Advanced Search dialog box permitting the following:
 - Search by Space and Equipment, Equipment Definition or Network Reference
 - Filter the search by wildcard name or object type
 - Multi-selection of objects for commanding or the creation of reports including Trend, Alarm, Audit and Activity for a specific period of time

2.9 PROJECT SPECIFIC PAGES:

- A. Home page shall include a campus layout of the individual buildings at the site.
 1. All project graphic pages shall be included in the submittal for review and approval by the owner.
- B. Once an individual building is selected the following minimum web-based tree structure shall be provided:
 1. Documents Page: The document page shall include the O&M Manuals for the control system in PDF format along with AutoCAD drawings for each drawing provided in the

control system O&M Manual. This document page shall include links between the control diagrams and associated data sheet in PDF format, such that the system user shall be able to click on the control device and retrieve, in PDF format, the factory O&M sheets associated with that device.

2. Station Functions:

- a. Logging separate sheet of station functions for a particular selected building shall be the viewing of one or more logs or the creation of logs in which any value at any point, or the mode of any point, shall be selected via the web to be trended against any other point with an adjustable frequency in seconds, minutes, hours or days.
- b. The alarm acknowledgement via the web shall allow the viewing and acknowledgement of the alarms.
- c. Audit log shall be provided via the web to show the operator actions as well as other audit logs as specified in section 2.4 Network Area Controller (NAC) paragraph "M" Data Collection and Storage.

3. Floor Plans:

- a. AutoCAD drawings of floor plans shall be provided in the control system such that via the web the user shall be able to turn layers on and off on the mechanical floor plans. These floor plans shall also include an overlay of the temperature control as-built wiring for the project showing thermostat locations, communication runs, transformer locations, controller locations, etc.
- b. Floor Display Summaries. The operator shall be able to select floor plans displaying the following formats:
 - 1) All zone temperatures
 - 2) All zone heating percentages
 - 3) All zone cooling percentages
 - 4) All zone room names and numbers as per architectural matrix and owner input.
 - 5) All zones cfm delivered.

4. Systems:

- a. On selecting the systems menu, a tree structure shall allow the operator to select the air handlers, fan coil units, energy recovery ventilators, etc. systems associated with that building. The graphics shall also show the piping and ductwork associated with the air handler as well as the safeties, temperature sensors, humidity sensors, dampers, VFD's, associated with that fan system. See points lists for specifics. Each system in the points list shall be treated as a branch of the above tree.
- b. All devices that provide dynamic function in the primary equipment, i.e., fans, pumps, coils, dampers shall be dynamic in nature showing their operating status/percentage of capacity by movement on the web page.
- c. The set points for the various control loops shall be adjustable via the web page. Individual controlled devices, i.e., valves, dampers, fans shall be controlled via the

web page and be stopped or started or placed in a command state or percentage of value output.

2.10 FIELD DEVICES

- A. Provide automatic control valves, automatic control dampers, thermostats, clocks, sensors, controllers, and other components as required for complete installation. Except as otherwise indicated, provide manufacturer's standard control system components as indicated by published product information, designed and constructed as recommended by manufacturer.
- B. VAV Transformers: Install VAV transformers in electrical rooms located on each building level and as indicated on the plans.
- C. Temperature Sensors
 - 1. All temperature sensors shall meet the following specifications:
 - a. Accuracy: Plus or minus 0.2 percent at calibration point.
 - b. Wire: Twisted, shielded-pair cable.
 - c. Vibration and corrosion resistant
 - 2. Space temperature sensors shall meet the following specifications:
 - a. 10k ohm type 2 thermistors
 - 3. Insertion Elements in Ducts shall meet the following specifications:
 - a. Single point 10k ohm thermistor
 - b. Use where not affected by temperature stratification
 - c. The sensor shall reach more than 1/3 the distance from the duct wall
 - d. Junction box for wire splices
 - 4. Averaging Elements in Ducts shall meet the following specifications:
 - a. 72 inches (183 cm) long
 - b. Flexible
 - c. Use where prone to temperature stratification, in front of coils, or where ducts are larger than 9 sq. ft.
 - d. Junction box for wire splices
 - 5. Insertion Elements for Liquids shall meet the following specifications:
 - a. Platinum RTD with 4-20mA transmitter
 - b. Threaded mounting with matching well
 - c. Brass well with minimum insertion length of 2-1/2 inches for pipes up to 4" diameter
 - d. Brass well with insertion length of 6 inches for pipes up to 10" diameter
 - e. Junction box for wire splices
 - 6. Outside-Air Sensors Platinum RTD with 4-20mA transmitter:
 - a. Watertight enclosure, shielded from direct sunlight
 - b. Circulation fan
 - c. Watertight conduit fitting
- D. Where called for in the sequences of operations, provide the following feature on space sensors and thermostats:
 - 1) Security Sensors: Stainless-steel cover plate with insulated back and security screws

- 2) Space sensors with setpoint adjust: Plain white plastic cover with slide potentiometer to signal a setpoint adjustment to the DDC
 - 3) Space Sensors with LCD display:
 - a) Operator buttons for adjusting setpoints, setting fans speeds and overriding unit to on/off
 - b) Graphical LCD icons for signaling heating/cooling mode, fans speed, schedule mode, actual temperature and current setpoint
- E. Humidity Sensors: Humidity sensors shall be of the solid-state type using a capacitance-sensing element. The sensor shall vary the output voltage with a change in relative humidity. Room humidity sensors shall have a minimum range of 10% to 90% $\pm$ 5%. Supply air humidity sensors shall have a range of 10% to 90% $\pm$ 5%.
- F. Pressure Sensors: The differential pressure sensor shall be temperature compensated and shall vary the output voltage with a change in differential pressure. Sensing range shall be suitable for the application with linearity of 1.5% of full scale and offset of less than 1% of full scale. Sensor shall be capable of withstanding up to 150% of rated pressure without damage.
- G. Switches and Thermostats
1. The FMCS Contractor shall furnish all electric relays and coordinate with the supplier of magnetic starters for auxiliary contact requirements. All electric control devices shall be of a type to meet current, voltage, and switching requirement of their particular application. Relays shall be provided with 24 VAC coils and contacts shall be rated at 10 amps minimum.
 2. Duct Smoke Detectors: Duct smoke detectors shall be supplied by others with an integral auxiliary contact to be used by the FMCS contractor to provide a digital input to the FMCS.
 3. Low Temperature Detection Thermostats: Shall be the manual reset type. The thermostat shall operate in response to the coldest one-foot length of the 20-foot sensing element, regardless of the temperatures at other parts of the element. The element shall be properly supported to cover the entire downstream side of the coil with a minimum of three loops. Separate thermostats shall be provided for each 25 square feet of coil face area or fraction thereof.
 4. Differential Pressure Switches: Pressure differential switches shall have SPDT changeover contact, switching at an adjustable differential pressure setpoint.
 5. Current Sensing Relays: Motor status indications, where shown on the plans, shall be provided via current sensing relays. The switch output contact shall be rated for 30 VDC, .15 amps.
 6. Flow Switches: Motor status indications, where shown on the plans, shall be provided via flow switches. Flow switches shall be of the paddle type equipped with SPDT contacts to establish proof of flow.
 7. Carbon Monoxide Detector and Controller shall meet or exceed UL 2034 standard and OSHA standards for CO exposure. Controller shall be solid state sensor. Fan relay shall activate at 35 ppm of CO averaged over 5 minutes. Alarm relay shall activate at 100 ppm after 30 minutes. Approved manufacturers shall be Macurco, Inc or approved equal.

H. Control Valves

1. General: Control Valves shall be sized for a 3 to 5 psi pressure drop. Valves shall be packless, modulating, electrically or magnetically actuated, with a control rangeability of 100 to 1. These valves shall have equal percentage flow characteristics in relationship to valve opening.
2. ½ inch to 4 inch: Valves to be of characterized ball valve type. They shall be equipped with handwheel, or manual position mounted dial adjacent to valve, to allow manual positioning of valve in absence of control power. (Valves with a rangeability of less than 200 to 1 shall utilize two valves in a 1/3 – 2/3 parallel arrangement in order to achieve control rangeability).
3. 4 inches to 6 inches: Valves for heating shall be globe valves modulating electrically actuated, 2-way or 3-way as required, with a rangeability of 50 to 1. Valve body shall be flanged and shall be equipped with a handwheel, or manual position dial mounted adjacent to the valve, to allow manual positioning of the valve in the absence of control power. Valves for cooling shall be butterfly with a rangeability of 25 to 1.
4. Butterfly Valves: 2-way and 3-way butterfly valves shall be cast iron valve body, with stainless steel stem, and available with disc seal for bubble-tight shut off.
5. Steam Valves: Valves shall have an ANSI Class 250 lb. body, teflon v-ring packing rated to 377°F., stainless steel trim rated to 50 psi, with rangeability greater than 100:1, Class 4 leakage and close off rating, linear flow characteristics, via perforated throttling cylinder.

I. Damper Actuators

1. Actuators shall be of the push-pull or rotary type of modulating, 3-point floating, or 2-position control as required by the application. The actuator shall use an overload-proof synchronous motor or an electric motor with end switches to de-energize the motor at the end of the stroke limits. Control voltage shall be 24 VAC, 0-20 VDC, or 4-20 ma as required. Actuators shall be available with spring return to the normal position when required. Actuators shall have a position indicator for external indication of damper position. Actuators shall have manual override capability without disconnecting damper linkage.

J. Control Dampers

1. Motorized dampers, unless otherwise specified elsewhere, shall have damper frames using 13 gauge galvanized steel channel or 1/8" extruded aluminum with reinforced corner bracing. Damper blades shall not exceed ten (10) inches in width or 48" in length. Blades are to be suitable for high velocity performance. Damper bearings shall be as recommended by manufacturer for application. Bushings that turn in the bearing are to be oil impregnated sintered metal. All blade edges and top and bottom of the frame shall be provided with replaceable, butyl rubber or neoprene seals. Side seals may be spring-loaded stainless steel. The seals shall provide a maximum of 1% leakage at a wide open face velocity of 1500 FPM and 4: W.C. close-off pressure. The damper linkage shall provide a linear flow or equal percentage characteristic as required. Provide Ruskin RCD46 model or equal.

2. Control dampers shall be parallel or opposed blade type as scheduled on drawings or outdoor and return air mixing box dampers shall be parallel blade, arranged to direct air streams towards each other. All other dampers may be parallel or opposed blade types.

K. Airflow Measuring Station (AFMS)

1. Provide Ebtron-Gold airflow measuring stations (AFMS) as indicated on plans.
2. AFMS shall consist of single or multiple probes as required to achieve an airflow measurement accuracy of $\pm 3\%$ of reading.
3. AFMS probe assemblies must have multiple sensors that use instrument grade thermal dispersion, temperature compensation, thermistor sensing technology and digital electronics.
4. The AFMS manufacturer and/or their local representative shall recommend and approve the actual location for the AFMS and determine whether or not a honeycomb straightener is required.
5. Vortex shedding or pitot tube arrays and differential pressure sensing arrays with sensors that require auto-zeroing will not be accepted.
6. Ebtron is the basis of design and is powered by the low voltage controls. If line voltage power is required, it will be the responsibility of this section to coordinate and provide at no additional cost to the owner.
7. The AFMS shall provide the air temperature measurement for the air handler control sequences. Provide additional wiring to the AFMS necessary to monitor air temperature.

L. Hydronic Flow Meters

1. Provide Onicon electromagnetic flow meters as indicated on the plans for hydronic flow measurement.
2. Flow meter shall achieve a flow measurement accuracy of $\pm 0.2\%$ of reading from 1.6 to 33 ft/s and shall have a measurement flow range of 0.1 ft/s to 20 ft/s (200:1) turndown.
3. 1 inch to 10 inch: Flow meter to be inline type (Onicon FT-3000). Meter to include remote mounted digital display. Provide Onicon BTU meter (System 10) for a complete energy measurement system.
4. 12 inches and larger: Flow meter to be insertion type (Onicon FT-3500). Meter to include remote mounted digital display. Provide Onicon BTU meter (System 10) for a complete energy measurement system.
5. The flow measurement vendor shall recommend and approve the actual location for the flow measuring station. At a minimum the meter shall be installed with 5 diameters upstream / 3 diameters downstream of straight pipe run.

M. Room Air Differential Pressure Monitor and Display

1. Provide Bi-Directional through the wall pressure sensor for monitoring of single room or up to two critical rooms plus an ante room as indicated on the plans.
2. Pressure monitor has a range of $-0.20000''$ to $+0.20000''$ w.g. with an accuracy of $\pm 10\%$ of reading $\pm 0.00001''$ w.g.
3. Pressure monitor display on 4.3 inch flush-mounted color touchscreen capable of audible and visual alarms.

4. Monitor provides seamless integration to BMS via BACnet MS/TP, (BACnet IP also acceptable).
5. Door switch provides indication of open door and delays alarm to prevent nuisance alarms. Door switch coordination and wiring is the responsibility of this section.
6. TSI Pressura RPM10 and RPM20 are the basis of design and powered by low voltage controls. Setra SRCM are an acceptable alternative. If line voltage power is required, it will be the responsibility of this section to coordinate at no additional cost to the owner. Differences in manufacturer may be allowed pending owner approval.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work and the plans and the work of others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others.

3.2 INSTALLATION

- A. Provide all relays, switches, sources of emergency and UPS battery back-up electricity and all other auxiliaries, accessories and connections necessary to make a complete operable system in accordance with the sequences specified. All field wiring shall be by this contractor.
- B. Install controls so that adjustments and calibrations can be readily made. Controls are to be installed by the control equipment manufacturer.
- C. Mount surface-mounted control devices on brackets to clear the final finished surface on insulation.
- D. Install equipment level and plumb.
- E. Install control valves horizontally with the power unit up.

- F. Unless otherwise noted, install wall mounted thermostats and humidistat 60" above the floor measured to the center line of the instrument, or as otherwise directed by the Architect.
- G. Install averaging elements in ducts and plenums in horizontal crossing or zigzag pattern.
- H. Install outdoor sensors in perforated tube and sunshield.
- I. Install damper motors on outside of duct in protected areas, not in locations exposed to outdoor temperatures.
- J. Install labels and nameplates on each control panel listing the name of the panel referenced in the graphics and a list of equipment numbers served by that panel.
- K. Furnish hydronic instrument wells, valves, and other accessories to the mechanical contractor for installation.
- L. Furnish automatic dampers to mechanical contractor for installation.

3.3 ELECTRICAL WIRING SCOPE

- A. This contractor shall be responsible for power that is not shown on the electrical drawings, to controls furnished by this contractor. If power circuits are shown on the electrical drawings, this contractor shall continue the power run to the control device. If power circuits are not shown, this contractor shall coordinate with the electrical contractor to provide breakers at distribution panels for power to controls. This contractor is then responsible for power from the distribution panel.
 - 1. Coordinate panel locations. If enclosures for panels are shown on the electrical drawings, furnish the enclosures according to the electrician's installation schedule.
- B. This contractor shall not be responsible for power to control panels and control devices that are furnished by others, unless it is part of the control interlock wiring.
- C. Refer to Coordination section for what devices this contractor is responsible to mount and which are turned over to others to mount.
- D. This contractor shall be responsible for wiring of any control device that is furnished as part of this section of specification.
- E. Wiring for controls furnished by others:
 - 1. Provide control wiring for HVAC controls furnished by others. Wiring may include, but not limited to, the following items:
 - a. Thermostats
 - b. Condensers
 - c. Chiller control devices shipped loose
 - d. Leak detectors
 - e. Humidifier controls
 - f. Refrigerant leak monitoring systems

- g. Exhaust or Purge fans
 - h. Manual switches for HVAC equipment (not shown on electrical drawings)
 - i. Emergency ventilation switches (not shown on electrical drawings)
 - j. Emergency shutdown switches (not shown on electrical drawings)
 - 2. Provide control wiring for the following non-HVAC controls furnished by others if they are called for in this project:
 - a. Electrical vault fans
 - b. Emergency generator dampers
 - c. Water treatment
 - d. Interlock to fire suppression system
 - e. Leak detection system
 - f. Fuel oil monitoring system
 - g. Fuel oil fill system
- F. Interlock wiring shall be run in separate conduits from BAS associated wiring.
- G. Provide network wiring for equipment that is called to be integrated to the BAS.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. All low voltage control wiring shall be class 2. Control wiring that is not class 2 shall be run in separate conduits from class 2 wiring.
- B. Floor level network wiring between terminal units can be combined with thermostat and other low voltage wiring in the same conduit. All other network wiring shall be in dedicated conduits.
- C. Install raceways, boxes, and cabinets according to Division 26 Section "Raceways and Boxes."
- D. Install building wire and cable according to Division 26 Section "Conductors and Cables."
- E. Installation shall meet the following requirements:
 - 1. Conceal cable and conduit, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway or conduit.
 - 3. Install concealed cable using plenum rated cable.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. All wiring in lab areas shall be in conduit.
 - 8. All unsupported risers shall be rigid steel conduit. Supported risers shall be EMT.

- F. Concealed control conduit and wiring shall be provided in all spaces except in the Mechanical Equipment Rooms and in unfinished spaces. Install in parallel banks with all changes in directions made at 90 degree angles.
- G. Install conduit adjacent to machine to allow service and maintenance.
- H. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- I. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- J. Ground equipment.

3.5 COMMUNICATION WIRING

- A. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceway and enclosures containing Class 1 wiring.
- C. Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
- E. Cable bundling:
 - 1. RS485 cabling run open air in accessible areas can be bundled with other class 2 low voltage cabling.
 - 2. RS485 cabling run between terminal units in conduits above ceilings or under floors or in inaccessible areas can be bundled with other class 2 low voltage cabling.
 - 3. RS485 cabling run between floors shall be in a communication only conduit.
 - 4. RS485 conduit run long distances between utility rooms or between buildings shall be in a communication only conduit.
 - 5. Ethernet cabling shall be in a communication only conduit.
 - 6. Ethernet and RS485 can be run together.
 - 7. Fiber optics can be run with Ethernet and RS485 cabling as long as the conduit is bent to fiber optic standards and junction boxes are sized for fiber optic use.
- F. FLN or BACnet BACnet MS/TP Cabling
 - 1. RS485 cabling shall be used for BACnet MS/TP networks.
 - 2. RS485 shall use low capacitance, 20-24 gauge, twisted shielded pair.
 - 3. The shields shall be tied together at each device.
 - 4. The shield shall be grounded at one end only and capped at the other end.

5. Provide end of line (EOL) termination devices at each end of the RS485 network or subnetwork run, to match the impedance of the cable, 100 to 120ohm.
- G. Ethernet Cabling
 1. Ethernet shall not be run with any Class 1 or low voltage Class 2 wiring.
 2. CAT6, unshielded twisted pair (UTP) cable shall be used for BAS Ethernet.
 3. Solid wire shall be used for long runs, between mechanical rooms and between floors. Stranded cable can be used for patch cables and between panels in the same mechanical room up to 50 feet away.
 4. When the BAS Ethernet connects to an Owner's network switch, document the port number on the BAS As-builts.
- H. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
- I. All runs of communication wiring shall be unspliced length when that length is commercially available.
- J. All communication wiring shall be labeled to indicate origination and destination data.
- K. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."

3.6 FIBER OPTIC CABLE SYSTEM

- A. Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications.
- B. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.
- C. All terminations shall to be made into a patch panel, designed for such use. Free air terminations with patch panels are prohibited.

3.7 IDENTIFICATION

- A. Permanent warning labels shall be affixed to all equipment that can be automatically started by the DDC system.
 1. Labels shall use white lettering (12-point type or larger) on a red background.
 2. Warning labels shall read as follows: C A U T I O N This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

- B. Permanent warning labels shall be affixed to all motor starters and all control panels that are connected to multiple power sources utilizing separate disconnects.
 - 1. Labels shall use white lettering (12-point type or larger) on a red background.
 - 2. Warning labels shall read as follows: C A U T I O N This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.
- C. Control Equipment and Device labeling:
 - 1. Labels and tags shall match the unique identifiers shown on the as-built drawings.
 - 2. All Enclosures shall be labeled to match the as-built drawing by either control panel name or the names of the DDC controllers inside.
 - 3. All sensors and actuators not in occupied areas shall be tagged.
 - 4. Airflow measurement arrays shall be tagged to show flow rate range for signal output range, duct size, and pitot tube AFMS flow coefficient.
 - 5. Duct static pressure taps shall be tagged at the location of the pressure tap.
 - 6. Each device inside enclosures shall be tagged.
 - 7. Terminal equipment need only have a tag for the unique terminal number, not for each device. Match the unique number on:
 - a. First, the design drawings, or
 - b. Second, the control as-builts, or
 - c. Third, the DDC addressing scheme
 - 8. Tags on the terminal units shall be displayed on the Operator Workstation Graphics.
- D. Tags shall be mechanically printed on permanent adhesive backed labeling strips, 12 point height minimum.
- E. Manufacturers' nameplates and UL or CSA labels are to be visible and legible after equipment is installed.
- F. Identification of Wires
 - 1. Tag each wire with a common identifier on each end of the wire, such as in the control panel and at the device termination.
 - 2. Tag each network wire with a common identifier on each end.
 - 3. Tag each 120V power source with the panel and breaker number it is fed by.
- G. Identification of Conduits:
 - 1. Identify the low voltage conduit runs as BAS conduit, power feeds not included.
 - 2. Identify each electric box, junction box, utility box and wiring tray with a blue paint mark or blue permanent adhesive sticker.
 - 3. For conduit runs that run more than 8 ft between junction boxes in 1 room, place a blue identifier at least every 8 feet.
 - 4. Place a blue identifier on each side of where a conduit passed through a wall or other inaccessible path.
 - 5. Identify all BAS communication conduits the same as above.

3.8 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove malfunctioning units, replace with new units, and retest.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment, and retest.
 - 3. Calibration test controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
- B. Engage a factory-authorized service representative to perform startup service.
- C. Replace damaged or malfunctioning controls and equipment.
 - 1. Start, test, and adjust control systems.
 - 2. Demonstrate compliance with requirements, including calibration and testing, and control sequences.
 - 3. Adjust, calibrate, and fine tune circuits and equipment to achieve sequence of operation specified.

3.9 SYSTEM CHECKOUT AND STARTUP

- A. Inspect each termination in the MER control panels and devices to make sure all wires are connected according to the wiring diagrams and all termination are tight.
- B. After the controls devices and panels are installed and power is available to the controls, perform a static checkout of all the points, including the following:
 - 1. Inspect the setup and reading on each temperature sensor against a thermometer to verify its accuracy.
 - 2. Inspect the setup and reading on each humidity sensor against a hygrometer to verify its accuracy.
 - 3. Inspect the reading on each CO2 sensor using a calibration kit to verify the sensor range accuracy matches the DDC setup.
 - 4. Inspect the reading of each status switch to verify the DDC reads the open and close correctly.
 - 5. Command each relay to open and close to verify its operation.
 - 6. Command each 2-position damper actuator to open and close to verify operation.
 - 7. Command each 2-position valve to open and close to verify operation.
 - 8. Ramp each modulating actuator to 0%, 25%, 50%, 75% and 100% to verify its operation.
 - 9. Ramp each modulating output signal, such as a VFD speed, to verify its operation.
 - 10. Test each safety device with a real life simulation, for instance check freezestats with ice water, water detectors with water, etc.
- C. Document that each point was verified and operating correctly. Correct each failed point before proceeding to the dynamic startup.

- D. Verify that each DDC controller communicates on its respective network correctly.
- E. After all of the points are verified, and power is available to the mechanical system, coordinate a startup of each system with the mechanical contractor. Include the following tests:
 - 1. Start systems from DDC.
 - 2. Verify that each setpoint can be met by the system.
 - 3. Change setpoints and verify system response.
 - 4. Change sensor readings to verify system response.
 - 5. Test safety shutdowns.
 - 6. Verify time delays.
 - 7. Verify mode changes.
 - 8. Adjust filter switches and current switches for proper reactions.
 - 9. Adjust proportional bands and integration times to stabilize control loops.
- F. Perform all program changes and debugging of the system for a fully operational system.
- G. Verify that all graphics at the operator workstations correspond to the systems as installed. Verify that the points on the screens appear and react properly. Verify that all adjustable setpoints and manual commands operate from the operator workstations.
- H. After the sequence of operation is verified, setup the trends that are listed in the sequence of operations for logging and archiving for the commissioning procedure.

3.10 SYSTEM COMMISSIONING, DEMONSTRATION, AND TURNOVER

- A. The BAS Contractor shall prepare and submit for approval a complete acceptance test procedure including submittal data relevant to point index, functions, sequence, inter-locks, and associated parameters, and other pertinent information for the operating system. Prior to acceptance of the BAS by the Owner and Engineer, the BAS contractor shall completely test the BAS using the approved test procedure.
- B. After the BAS contractor has completed the tests and certified the BAS is 100% complete, the Engineer shall be requested, in writing, to approve the satisfactory operation of the system, sub-systems and accessories. The BAS contractor shall submit Maintenance and Operating manuals at this time for approval. An acceptance test in the presence of the Engineer and Owner's representative shall be performed. The Owner will then shake down the system for a fixed period of time (30 days).
- C. The BAS contractor shall fix punch list items within 30 days of acceptance.
- D. When the system performance is deemed satisfactory in whole or in part by these observers, the system parts will be accepted for beneficial use and placed under warranty.

3.11 PROJECT RECORD DOCUMENTS

- A. Project Record Documents: Submit three (3) copies of record (as-built) documents upon completion of installation. Submittal shall consist of:
 - 1. Project Record Drawings. As-built versions of the submittal shop drawings provided as AutoCAD compatible files in electronic format and as 11 x 17 inch prints.
 - 2. Testing and Commissioning Reports and Checklists. Completed versions of reports, checklists, and trend logs used to meet requirements in the Control System Demonstration and Acceptance section of this specification.
 - 3. Operation and Maintenance (O & M) Manual.
 - a. As-built versions of the submittal product data.
 - b. Names, addresses, and 24-hour telephone numbers of installing contractors and service representatives for equipment and control systems.
 - c. Operator's Manual with procedures for operating control systems, logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing setpoints and variables.
 - d. Programming manual or set of manuals with description of programming language and of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - e. Engineering, installation, and maintenance manual or set of manuals that explains how to design and install new points, panels, and other hardware; how to perform preventive maintenance and calibration; how to debug hardware problems; and how to repair or replace hardware.
 - f. Documentation of all programs created using custom programming language, including setpoints, tuning parameters, and object database.
 - g. Graphic files, programs, and database on electronic media.
 - h. List of recommended spare parts with part numbers and suppliers.
 - i. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware, including computer equipment and sensors.
 - j. Complete original original-issue copies of furnished software, including operating systems, custom programming language, operator workstation software, and graphics software.
 - k. Licenses, guarantees, and warranty documents for equipment and systems.
- B. Operating manual to serve as training and reference manual for all aspects of day-to-day operation of the system. As a minimum include the following:
 - 1. Sequence of operation for automatic and manual operating modes for all building systems. The sequences shall cross-reference the system point names.
 - 2. Description of manual override operation of all control points in system.
 - 3. BMS system manufacturers complete operating manuals.
- C. Provide maintenance manual to serve as training and reference manual for all aspects of day-to-day maintenance and major system repairs. As a minimum include the following:
 - 1. Complete as-built installation drawings for each building system.
 - 2. Overall system electrical power supply schematic indicating source of electrical power for each system component. Indicate all battery backup provisions.
 - 3. Photographs and/or drawings showing installation details and locations of equipment.
 - 4. Routine preventive maintenance procedures, corrective diagnostics troubleshooting procedures, and calibration procedures.

5. Parts list with manufacturer's catalog numbers and ordering information.
 6. Lists of ordinary and special tools, operating materials supplies and test equipment recommended for operation and servicing.
 7. Manufacturer's operation, set-up, maintenance and catalog literature for each piece of equipment.
 8. Maintenance and repair instructions.
 9. Recommended spare parts.
- D. Provide Programming Manual to serve as training and reference manual for all aspects of system programming. As a minimum include the following:
1. Complete programming manuals, and reference guides.
 2. Details of any custom software packages and compilers supplied with system.
 3. Information and access required for independent programming of system.

3.12 TRAINING

- A. During System commissioning and at such time as acceptable performance of the Building Automation System hardware and software has been established, the BAS contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction during normal working hours shall be performed by a competent building automation contractor representative familiar with the Building Automation System's software, hardware and accessories.
- B. At a time mutually agreed upon, during System commissioning as stated above, the BAS contractor shall give 16-hours of onsite training on the operation of all BAS equipment. Describe its intended use with respect to the programmed functions specified. Operator orientation of the automation system shall include, but not be limited to:
1. Explanation of drawings and operator's maintenance manuals.
 2. Walk-through of the job to locate all control components.
 3. Operator workstation and peripherals.
 4. DDC Controller and ASC operation/sequence.
 5. Operator control functions including scheduling, alarming, and trending.
 6. Explanation of adjustment, calibration and replacement procedures.
- C. Additional 8-hours of training shall be given after the 30 day shakedown period.
- D. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If the Owner requires such training, it will be contracted at a later date. Provide description of available local and factory customer training. Provide costs associated with performing training at an off-site classroom facility and detail what is included in the manufacturer's standard pricing such as transportation, meals, etc.

3.13 WARRANTY/GUARANTEE

- A. Conform to the warranty requirement of the Contract Documents, General Requirements and this section or a minimum of 12 months. Provide the strictest.
- B. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system demonstration.
- C. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours.
- D. During normal building occupied hours, failure of items that are critical for system operation shall be provided within 4 hours of notification from the Owner's Representative.
- E. This warranty shall apply equally to both hardware and software.

PART 4 - SEQUENCES OF OPERATION

- 4.1 See project drawings for sequences.

PART 5 - POINTS LIST

	Input / Output						Web Pages Graphics										Alarms				Trends Archive Size Verify w/ Owner					
	Digital Input	Digital Output	Analog Input	Analog Output	Hardwire Interlock	BAS Communication	Status	Temperature of Other Value	Cooling Percentage	Heating Percentage	Dynamic Flow Diagrams	O&M Manuals	Start/Stop	Status	Display Value	Adjust Value	Totalize	Operator Workstation	Remote Device/Email	Building Manager	User	Life Safety Alarm	Run Time / Totalize	30 Minute / Week	Samples	Samples
All VFD's (as available in VFD)																										
Start/Stop		X				X							X													
Status	X					X	X							X			X					X				
System Fault						X	X										X	X								
Speed				X		X		X							X										X	
Frequency Output				X		X									X											
Percent Output				X		X									X											
Current			X			X									X											
Torque			X			X									X											
Power			X			X									X								X			
Drive Temperature			X			X									X											
KWH			X			X									X										X	X
Runtime			X			X									X							X				
DC Bus Volts			X			X									X											
PID Feedback			X			X																				
Fault 1	X					X	X											X	X	X					X	
Fault 2	X					X	X											X	X	X					X	
Emergency Generator Load Shed		X																								
VAV BOX REHEAT																										
Space temperature			X					X							X									X		
Space temperature				X											X	X										

Construction Documents

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END OF SECTION 23 0900

SECTION 23 2113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:

1. Hot-water heating piping.
2. Glycol chilled-water piping (MRI Chiller).
3. Makeup-water piping.
4. Condensate-drain piping.
5. Air-vent piping.
6. Dielectric fittings.

1.3 SEISMIC REQUIREMENTS

- A. Seismic Performance: Pipe hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 1. For piping with a seismic importance factor of 1.0 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. For piping with a seismic importance factor of 1.5 the term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 1. Steel pipe and fittings.
 2. Copper pipe, tubing and fittings.
 3. Dielectric fittings.

B. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Other building services.
3. Structural members.

B. Qualification Data: For Installer.

C. Welding certificates.

D. Field quality-control reports: Written reports as specified in Part 3 of this section including:

1. Test procedures used.
2. Test results showing compliance with specified requirements.
3. Failed test results with corrective action taken to achieve compliance with specified requirements.

1.6 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
3. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

1.7 COORDINATION

- A. Coordinate layout and installation of hydronic piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for foundation wall penetrations.
- C. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- D. Coordinate pipe fitting pressure classes with products specified in related sections.
- E. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3 Sections.
- F. Coordinate installation of pipe sleeves for penetrations through exterior walls and floor assemblies. Coordinate with requirements for firestopping specified in Division 7 Section "Through-Penetration Firestop Systems" for fire and smoke wall and floor assemblies.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

- F. Wrought-Steel Fittings: ASTM A 234, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - 1. Material Group: 1.1.
 - 2. End Connections: Butt welding.
 - 3. Facings: Raised face.
- H. Forged Steel “Olet” Type Fittings, Welding, Socket-Welding and Threaded: ASME B16.11 and ASTM A105.
 - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 DIELECTRIC FITTINGS

- A. General: Assembly or fitting with insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.
 - 1. Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc. Capitol Manufacturing Co.
 - c. Capitol Manufacturing Company.
 - d. Central Plastics Company.
 - e. Elster Perfection.
 - f. Grinnell Mechanical Products.
 - g. Matco-Norca.
 - h. Pipeline Seal and Insulator, Inc.
 - i. Precision Plumbing Products, Inc.
 - j. Victaulic Company.
 - k. Watts Regulator Co.
 - l. Zurn Industries, LLC.
- B. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
- C. Insulating Material: Suitable for system fluid, pressure, and temperature.
- D. End Connections: Threaded, or flanged.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
- F. Dielectric Nipples or Waterways: Electroplated steel with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller shall be any of the following:
 - 1. Type L drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 - 2. Schedule 40, Grade B, Type 96 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
 - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
- C. Glycol cooling-water piping, aboveground, NPS 2 and smaller, shall be any of the following:
 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- D. Glycol cooling-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- E. Makeup-water piping installed aboveground shall be any of the following:
 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- F. Condensate-drain piping shall be the following:
 1. Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- G. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- H. Air-Vent Piping:
 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.
- I. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.

3.2 PIPING INSTALLATIONS

A. PRE-WORK / PRE-REQUISITES

1. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
2. The Contractor shall study the architectural, structural, mechanical, electrical and other drawings to eliminate conflict of piping with other structure lighting or other services.

B. CONDITION

1. All installed pipe lines shall be free from dents, scars, and burrs, with ends reamed smooth.
2. All piping shall be clean and free from acids and loose dirt when installed and shall be kept clean during the completion of the installation.
3. Install piping free of sags and bends.
4. All installed pipe lines shall remain straight against strains tending to cause distortion during system operation. The contractor shall make proper allowance for pipe line expansion and contraction so that no unsightly distortion, noise, damage or improper operation results therefrom.

C. SELECTION

1. Select system components with pressure rating equal to or greater than system operating pressure.
2. No street type fittings shall be used.
3. No short nipples shall be used except at drain valves.
4. Plugs of rags, wools, cottons, waste, or similar materials may not be used for plugging.

D. ROUTING/ARRANGEMENT

1. Piping installations shall be neatly organized.
2. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
3. Install groups of pipes parallel to each other.
4. Install piping spaced to permit application of insulation.
5. Install piping parallel and spaced to permit the servicing of valves.
6. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls or axis of the building.
7. Diagonal runs are prohibited unless specifically indicated otherwise.
8. Install fittings for all changes in direction.
9. No piping shall be run above any electrical panels, electrical equipment or access clearances for electrical for electrical panels or equipment. No piping shall be allowed to run through any electrical rooms.

10. Piping shall be arranged, placed and installed to facilitate equipment maintenance and shall be so arranged to not interfere with the installation of the air-conditioning equipment, ducts, or the removal of other equipment or devices. All specialties shall be so placed to permit easy operation and access.
11. All piping shall be so installed to insure noiseless circulation.
12. Install fittings for all branch connections.
13. Unless otherwise indicated, install branch connections to mains using mechanically formed tee fittings or forged steel branch fittings in main pipe, with the branch connected to the bottom of the main pipe.
14. For up-feed risers, connect the branch to the top of the main pipe.
15. Forged branch fittings shall be installed per the manufacturer's recommendations.

E. ACCESS / ARRANGEMENT

1. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal. All piping shall be so arranged to not block access to manholes, access openings, etc.
2. Install piping at indicated slopes. If not indicated, install piping at a uniform grade of 0.2 percent where possible, upward in direction of flow. Traps are to be avoided where-ever possible.
3. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
4. Install valves according to Section 230523 "General-Duty Valves for HVAC Piping."
5. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, at each coil on all sides of automatic valves where valves do not have union connections, elsewhere as indicated, and wherever necessary to prevent undue difficulty in making repairs or replacement. Unions are not required at flanged connections.
6. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated. Install flanges on valves, apparatus, and equipment having 2 ½ inch NPS and larger connections. Flanges or unions as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment.
7. Install shutoff valve immediately upstream of each dielectric fitting. Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
8. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

9. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
10. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Result for HVAC."
11. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾) nipple and ball valve in blow-down connection of strainers NPS 2) and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2).

F. DRAINAGE

1. Drain valves shall be installed at all low points in all piping systems to allow for complete drainage of piping systems.
2. Install drains, consisting of a tee fitting, NPS ¾ ball valve, and short NPS ¾ threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
3. All piping systems shall be installed so that they can be easily drained by means of drainage of low points of all piping without disconnecting pipe.
4. If not specifically indicated on the drawings, the frequency of draining shall determine whether drain caps, plugs, cocks, or valves are to be used.

G. IDENTIFICATION

1. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.

3.3 DIELECTRIC FITTING INSTALLATION

A. Make connections according to the following, unless otherwise indicated:

1. Install dielectric nipples or waterways in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install waterways, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install Dielectric Fittings into Hydronic Piping Systems: Install dielectric nipples, waterways or couplings to connect piping materials of dissimilar metals.
4. End Connections: Threaded, or flanged.

3.4 HANGERS AND SUPPORTS

- A. Comply with requirements in Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.
- B. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.
- C. Steel roof deck shall not be used to support loads from piping, ductwork or equipment, unless noted otherwise. Hanger loads less than 50 lbs. may be hung from the steel roof deck in cases when hanging from the steel roof deck cannot be avoided; the attachment method must distribute the load across the deck as approved by the Structural Engineer.
- D. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
 - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- E. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 - 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
 - 6. NPS 3 and Larger: Maximum span, 12 feet; minimum rod size, 1/2 inch.
- F. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 - 3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
 - 4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 - 6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 - 7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- G. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment.

3.7 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.

2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 2113

SECTION 23 2116 - HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes special-duty valves and specialties for the following:
 - 1. Hot-water heating piping.
 - 2. Makeup-water piping.
 - 3. Condensate-drain piping.
 - 4. Air-vent piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 2. Air-control devices.
 - 3. Hydronic specialties.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Pipe Welding: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code: Section IX.
 - 1. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 VALVES

- A. Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523 "General-Duty Valves for HVAC Piping. Gate valves are not allowed on this project.
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230900 "Instrumentation and Control for HVAC.
- C. Refer to Part 3 "Valve Applications" Article for applications of each valve.
- D. Bronze, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 and smaller:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Flow Design Inc.
 - d. Gerand Engineering Co.
 - e. Griswold Controls.
 - f. Taco.
 - g. Tour & Andersson; available through Victaulic Company.
 - h. Nexus Valve, Inc.
 - 2. Body: Bronze, ball or plug type with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Plug: Resin.
 - 5. Seat: PTFE.
 - 6. End Connections: Threaded or socket.
 - 7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 8. Handle Style: Lever, with memory stop to retain set position.
 - 9. CWP Rating: Minimum 125 psig.
 - 10. Maximum Operating Temperature: 250 deg F.
- E. Cast-Iron or Steel, Calibrated-Orifice or Venturi, Balancing Valves, NPS 2 ½ and larger:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.

- d. Flow Design Inc.
 - e. Gerand Engineering Co.
 - f. Grinnell.
 - g. Griswold Controls.
 - h. Taco.
 - i. Tour & Andersson; available through Victaulic Company.
 - j. Spence Engineering Company Inc.
 - k. Watts Regulator Co.
 - l. Nexus Valve, Inc.
- 2. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
 - 3. Ball: Brass or stainless steel.
 - 4. Stem Seals: EPDM O-rings.
 - 5. Disc: Glass and carbon-filled PTFE.
 - 6. Seat: PTFE.
 - 7. End Connections: Flanged or grooved.
 - 8. Pressure Gage Connections: Integral seals for portable differential pressure meter.
 - 9. Handle Style: Lever, with memory stop to retain set position.
 - 10. CWP Rating: Minimum 125 psig.
 - 11. Maximum Operating Temperature: 250 deg F.
- F. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Conbraco Industries, Inc.
 - e. Spence Engineering Company, Inc.
 - f. Watts Regulator Co.
 - 2. Body: Bronze or brass.
 - 3. Disc: Glass and carbon-filled PTFE.
 - 4. Seat: Brass.
 - 5. Stem Seals: EPDM O-rings.
 - 6. Diaphragm: EPT.
 - 7. Low inlet-pressure check valve.
 - 8. Inlet Strainer: Brass, removable without system shutdown.
 - 9. Valve Seat and Stem: Noncorrosive.
 - 10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- G. Diaphragm-Operated Safety Valves: ASME labeled.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Conbraco Industries, Inc.
 - e. Kunkle.
 - f. Spence Engineering Company, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Brass, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

H. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong Pumps, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Flow Design Inc.
 - d. Griswold Controls.
 - e. Taco
 - f. Nexus Valve, Inc.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Tamper proof, self-cleaning, and removable, for inspections and replacement.
 - a. Corrosion resistant.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Attached by chain and marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations:
 - a. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 200 deg F.

9. Fitted with pressure and temperature test valves.
10. Equipped with a readout kit including flow meter, probes, hoses, flow charts, and carrying case.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Body: Bronze.
3. Internal Parts: Nonferrous.
4. Operator: Screwdriver or thumbscrew.
5. Manually operated with ball valve in the down position.
6. Inlet Connection: NPS 1/2.
7. Discharge Connection: NPS 1/8.
8. CWP Rating: 150 psig.
9. Maximum Operating Temperature: 225 deg F.

B. Automatic Air Vents:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Bell & Gossett Domestic Pump.
 - c. Hoffman Specialty ITT; Fluid Handling Div.
 - d. Spirax-Sarco.
 - e. Spirovent.
 - f. Taco, Inc.
 - g. Honeywell-Baukman.
2. Body: Bronze or cast iron.
3. Internal Parts: Nonferrous.
4. Operator: Noncorrosive metal float.
5. Inlet Connection: NPS 1/2.
6. Discharge Connection: NPS 1/4.
7. CWP Rating: 150 psig.
8. Maximum Operating Temperature: 240 deg F.

C. Bladder -Type Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
2. Tank: Welded steel, rated for 125-psig working pressure and 240 deg F maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Bladder : Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
4. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.
5. Access: Drain fitting and taps for pressure gage.
6. Support:
 - a. Vertical tanks with steel legs or base.
 - b. Horizontal tanks with steel saddles.

D. Tangential-Type Air Separators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
 - e. Spirotherm
2. Tank: Welded steel; ASME constructed and labeled for 125-psig minimum working pressure and 240 deg F maximum operating temperature.
3. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
4. Tangential Inlet and Outlet Connections: Threaded for NPS 2 and smaller; flanged connections for NPS 2-1/2 and larger.
5. Blowdown Connection: Threaded.
6. Size: Match system flow capacity.

2.3 HYDRONIC PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Armstrong Machine Works.
 - b. Hoffman Specialty ITT; Fluid Handling Div.
 - c. Metraflex Co.
 - d. Mueller
 - e. Spirax Sarco.
 - f. Trane Co.
 - g. Tour & Andersson; available through Victaulic Company.
 - h. Watts Regulator Co.
 - i. Nexus Valve
2. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: Stainless-steel, or perforated stainless-steel basket:
 - a. 20-mesh strainer.
5. CWP Rating: 125 psig.

B. Basket Strainers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.
 - b. Metraflex Co.
 - c. Mueller
 - d. Spirax Sarco.
 - e. Tour & Andersson; available through Victaulic Company.
2. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
3. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
4. Strainer Screen: Perforated stainless-steel basket with 50 percent free area:
 - a. 40-mesh startup strainer.
5. CWP Rating: 125 psig.

C. Spherical, Rubber, Flexible Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amber-Booth.
 - b. Mason Industries.
 - c. Metraflex Co.
 - d. Flex-Weld.

- e. Fugate.
 - f. Twin City Hose.
 - g. Nexus Valve, Inc.
- 2. Body: Double-sphere fiber-reinforced EPDM rubber body.
 - 3. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
 - 4. Performance: Capable of misalignment.
 - 5. CWP Rating: 150 psig.
 - 6. Maximum Operating Temperature: 250 deg F.

D. Diverting Fittings:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump.
 - d. Taco, Inc.
- 2. Body: Cast Iron or Wrought Copper
- 3. Ends: Threaded or Soldered
- 4. Flow Direction: Indicated on fitting.
- 5. CWP Rating: 125 psig.
- 6. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Automatic air vents may cause damage to ceilings and other finished surfaces. Air vents aid in system filling. Air removal after initial startup is accomplished by air separator or boiler diptube. Manual air vents may be a better solution.
- C. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.
- D. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- E. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 and larger.
- F. Install tangential air separator in pump suction. Install blowdown piping with full-port ball valve; extend full size to nearest floor drain.
- G. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
 - 1. Install tank fittings that are shipped loose.
 - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- H. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 23 2116

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SECTION 23 2513 - WATER TREATMENT FOR CLOSED-LOOP HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes the following water treatment for closed-loop hydronic systems:
 - 1. Chemicals.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- B. RO: Reverse osmosis.
- C. TSS: Total suspended solids are solid materials, including organic and inorganic, that are suspended in the water. These solids may include silt, plankton, and industrial wastes.

1.4 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:
 - 1. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment equipment showing tanks, maintenance space required, and piping connections to hydronic systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.
- C. Field quality-control reports.
- D. Other Informational Submittals:
1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.
 2. Water Analysis: Illustrate water quality available at Project site.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sensors, injection pumps, and controllers to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

1.8 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion and scale formation for hydronic piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion and shall include the following:
1. Initial water analysis and HVAC water-treatment recommendations.
 2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
 3. Customer report charts and log sheets.
 4. Laboratory technical analysis.
 5. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. West Chemical
 - 2. Other manufacturer's may be allowed for chemical equipment installation but require owner approval to bid.

2.2 PERFORMANCE REQUIREMENTS

- A. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including:
 - 1. Hot-water heating
 - 2. Glycol Chilled water (MRI Chiller)
- D. Closed hydronic systems, shall have the following water qualities:
 - 1. pH: Maintain a value within the combined recommendations of the various equipment manufacturers.
 - 2. Nitrite: Maintain a value within 800 to 1000 ppm.
 - 3. Microbiological Limits:
 - a. Total Aerobic Plate Count: Maintain a maximum value of zero organisms/mL.

2.3 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.
- B. GLYCOL
 - 1. The glycol provided shall be propylene glycol as manufactured by Dow Chemical or Huntsman Chemical. Trade name shall be DowFrost HD or JeffCool HD. The water quality in the hot/chilled water system shall meet the recommendations of the glycol manufacturer so as to reduce the formation of sludge. If the water quality at the jobsite does not meet manufacturers recommendations then the glycol solution shall be provided

- pre-mixed with deionized water. An analysis of the glycol solution and the water quality shall be included in the O&M manuals. Glycol percentage shall be:
- a. 40 % by volume.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 CONNECTIONS

- A. Where installing piping adjacent to equipment, allow space for service and maintenance.
- B. Make piping connections between HVAC water-treatment equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232116 "Hydronic Piping Specialties."
- C. Install shutoff valves on HVAC water-treatment equipment inlet and outlet. Metal general-duty valves are specified in Section 230523 "General-Duty Valves for HVAC Piping."
- D. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
- E. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 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 with the assistance of a factory-authorized service representative:
 1. Inspect field-assembled components and equipment installation, including piping and electrical connections.

2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.
 3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of hydronic systems' startup procedures.
 4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.
 5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.
 7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.
 8. Repair leaks and defects with new materials and retest piping until no leaks exist.
- C. Equipment will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. At quarterly intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to "Performance Requirements" Article.
- F. Comply with ASTM D 3370 and with the following standards:
1. Silica: ASTM D 859.
 2. Acidity and Alkalinity: ASTM D 1067.
 3. Iron: ASTM D 1068.
 4. Water Hardness: ASTM D 1126.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.
- B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 23 2513

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SECTION 23 3113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Exhaust Air Stacks
5. Guy wires and connectors.
6. Sheet metal materials.
7. Duct liner.
8. Sealants and gaskets.
9. Hangers and supports.
10. Seismic-restraint devices.

- B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
3. Section 230713 "Duct Insulation" for duct insulation and fire wrap.

- C. Stacks from the exhaust systems are to be designed per SMACNA guidelines. Use the "Guide for steel stack design and Construction" the latest edition. The outside of the stacks are to be painted with Pota-Pox. 80 series 141 material. Color is to be selected by the architect. Provide guy wires and angle supports. Construction shall be a minimum of 10 gauge and shall be painted on the inside of the stack and on the exterior where the stack is exterior to the building.

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: 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 and design criteria indicated in "Duct Schedule" Article.

- B. Seismic Performance: Duct hangers and supports shall withstand the effects of earthquake motions determined according to SEI/ASCE 7 and with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. For equipment with a seismic importance factor of 1.0 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."
 - 2. For equipment with a seismic importance factor of 1.5 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."
- C. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- D. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Seismic-restraint devices.
- B. Shop Drawings:
 - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
 - 2. Factory- and shop-fabricated ducts and fittings.
 - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
 - 4. Elevation of top of ducts.
 - 5. Dimensions of main duct runs from building grid lines.
 - 6. Fittings.
 - 7. Reinforcement and spacing.
 - 8. Seam and joint construction.
 - 9. Penetrations through fire-rated and other partitions.
 - 10. Equipment installation based on equipment being used on Project.
 - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.

12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
13. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
14. Duct fabrication shall not begin until shop drawings have been submitted and reviewed by the mechanical engineer.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. 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 in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including, but not limited to the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Perimeter moldings.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
 3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Duct dimensions shown on drawings are inside clear dimensions.
- E. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- B. Duct dimensions shown on drawings are inside clear dimensions.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

- D. 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."
- E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Interstitial Insulation: Flexible elastomeric duct liner complying with ASTM C 534, Type II for sheet materials, and with NFPA 90A or NFPA 90B.
 - 1. Maximum Thermal Conductivity: 0.25 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
- H. Inner Duct: Minimum 0.028-inch solid sheet steel.
- I. Formed-on Transverse Joints (Flanges): 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."
- J. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

- B. Duct dimensions shown on drawings are inside clear dimensions.
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- D. Longitudinal Seams: Not allowed.
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 EXHAUST AIR STACKS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
- C. Longitudinal Seams: Not allowed.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Design Wind Loads: 150 mph.
- F. Design for seismic conditions at Project site.
- G. Accessories: Terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as duct straight sections.

1. Termination: Antibackdraft damper.
- H. Drain: Provide drain section incorporated into base of stack with trap. Seal depth design to prevent seal blowout at highest estimated static pressure.
- I. Guying and Bracing Materials
 1. Cable: Three minimum galvanized or stainless steel, stranded wires of the following thickness:
 - a. Minimum Size: 1/4 inch in diameter.
 - b. For ID Sizes 4 to 15 Inches: 5/16 inch.
 - c. For ID Sizes 18 to 24 Inches: 3/8 inch.
 - d. For ID Sizes 27 to 30 Inches: 7/16 inch.
 - e. For ID Sizes 33 to 36 Inches: 1/2 inch.
 - f. For ID Sizes 39 to 48 Inches: 9/16 inch.
 - g. For ID Sizes 51 to 60 Inches: 5/8 inch.
 2. Cable Hardware: Provide duct angle ring, turnbuckles, cable loop thimbles, cable clamps and all hardware necessary to brace stack.
 3. Pipe: Two galvanized steel, NPS 1-1/4.
 4. Angle Iron: Two galvanized steel, 2 by 2 by 0.25 inch.

2.5 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653.
 1. Galvanized Coating Designation: G90.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008, with oiled, matte finish for exposed ducts.
- D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.
- F. 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.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 DUCT LINER

- A. **Per ASHRAE Standard 170 section 6.9 duct liner shall not be installed in supply ductwork downstream of filter bank #2 for this project.**
- B. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation; Insulation Group.
 - b. Johns Manville.
 - c. Knauf Insulation.
 - d. Owens Corning.
 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive:
 - a. Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
 - b. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - c. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Aeroflex USA Inc.
 - b. Armacell LLC.
 - c. Rubatex International, LLC
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.
 - a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, , length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
 - a. 0.135-inch-diameter shank.
 2. Insulation-Retaining Washers: With beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
 - a. Self-locking washers formed from 0.016-inch-thick aluminum.
- E. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
 3. Butt transverse joints without gaps, and coat joint with adhesive.
 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
 6. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
 7. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

- a. Fan discharges.
 - b. Intervals of lined duct preceding unlined duct.
8. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
 - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
9. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated build-outs (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.7 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
 2. Tape Width: 4 inches.
 3. Sealant: Modified styrene acrylic.
 4. Water resistant.
 5. Mold and mildew resistant.
 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 7. Service: Indoor and outdoor.
 8. Service Temperature: Minus 40 to plus 200 deg F.
 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
 1. Application Method: Brush on.
 2. Solids Content: Minimum 65 percent.
 3. Shore A Hardness: Minimum 20.
 4. Water resistant.

5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.8 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. 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.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. 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.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.

- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 2 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines" .

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
 - 2. Outdoor, Supply-Air Ducts: Seal Class A.
 - 3. Outdoor, Exhaust Ducts: Seal Class A.
 - 4. Outdoor, Return-Air Ducts: Seal Class A.
 - 5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
 - 6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 7. Unconditioned Space, Exhaust Ducts: Seal Class A.
 - 8. Unconditioned Space, Return-Air Ducts: Seal Class A.
 - 9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class A.
 - 10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
 - 11. Conditioned Space, Exhaust Ducts: Seal Class A.
 - 12. Conditioned Space, Return-Air Ducts: Seal Class A.

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
 - 1. Where practical, install concrete inserts before placing concrete.
 - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
 - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
 - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with the requirements specified in Section 230548 "Vibration and Seismic Controls for HVAC."
 - 1. Comply with ASCE/SEI 7.

3.6 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.

- b. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - c. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - d. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
 4. Test for leaks before applying external insulation.
 5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
 6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
 1. Visually inspect duct system to ensure that no visible contaminants are present.
 2. Any liner showing evidence that it has wet at any time shall be removed and replaced with new liner.
 - a. Disinfect affected sheet metal, and pins.
 - b. Install new liner per specifications
 - c. Seal friable edges and seams of repaired liner.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.9 DUCT CLEANING

- A. Clean new duct system before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.10 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel.
- B. Ductwork running in areas where there are no ceilings or when noted on the drawings shall be doubled wall duct and shall meet the requirements indicated below.
- C. MRI Ducts:
 - 1. All ducts Connected to and serving MRI Areas:
 - a. All ductwork shall be aluminum with non-ferrous hardware and accessories.
 - b. Pressure Class: Positive or negative 6-inch wg.
 - c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - d. SMACNA Leakage Class: 2.
- D. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A
 - c. Minimum SMACNA Seal Class: A.
 - d. SMACNA Leakage Class for Rectangular: 16.
 - e. SMACNA Leakage Class for Round: 8.
 - 2. Ducts Connected to Constant-Volume Air-Handling Units:
 - a. Pressure Class: Positive 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round: 4.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 6-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round: 2.
 - 4. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round: 2.
- E. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.

- c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round: 8.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round: 8
 - 3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round: 4.
- F. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 16.
 - d. SMACNA Leakage Class for Round: 4.
 - 2. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 8.
 - d. SMACNA Leakage Class for Round: 4.
 - 3. Ducts Connected to Variable-Air-Volume Air-Handling Units:
 - a. Pressure Class: Positive 6-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4.
 - d. SMACNA Leakage Class for Round: 2.
 - 4. Branch Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:
 - a. Type 304, stainless-steel sheet.
 - 1) 0.05-inch thick.
 - 2) Exposed to View: No. 4 finish.
 - 3) Concealed: No. 2B finish.
 - b. Pressure Class: Positive or negative 6-inch wg.
 - c. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - d. SMACNA Leakage Class: 2.
 - e. Main laboratory exhaust trunks to be galvanized steel with same pressure, seal and leakage class.

5. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive or negative 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 4 .
 - d. SMACNA Leakage Class for Round: 2 .
- G. Intermediate Reinforcement:
 1. Galvanized-Steel Ducts: Galvanized steel.
 2. Stainless-Steel Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
 3. Aluminum Ducts: Aluminum.
- H. Duct Liner Restrictions:
 1. Duct liner shall not be used on supply ductwork downstream of the air handler final filter on this project per ASHRAE Standard 170 section 6.9.
 2. Duct Liner exposed to air movement shall not be used on medium pressure ductwork (2000 to 4000 FPM velocity). See section 230713 "Duct Insulation" for insulation requirements.
 3. Duct Liner exposed to air movement shall not be used on high pressure ductwork (Greater than 4000 FPM velocity). See section 230713 "Duct Insulation" for insulation requirements.
 4. All duct liner shall meet all of the requirements found in 2021 IECC
- I. Liner: (Ductwork located in Unconditioned space)
 1. Return Air Ducts: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0 for ducts in unconditioned spaces.
 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick for ducts in conditioned spaces.
 3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
 4. Supply Fan Plenums: Fibrous glass, Type I, 1-1/2 inch thick with a minimum R value of 6.0.
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1-1/2 inch thick with a minimum R value of 6.0.
 6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- J. Liner: (Ductwork located Interior to building Insulated Envelope)
 1. Return Air Ducts: Fibrous glass, Type I, 1 inch thick with a minimum R value of 4.0 for ducts in unconditioned spaces.
 2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick for ducts in conditioned spaces.

3. Exhaust Air Ducts: Fibrous glass, Type I, 1 inch thick.
 4. Supply Fan Plenums: Fibrous glass, Type I, 1 inch thick with a minimum R value of 4.0.
 5. Return- and Exhaust-Fan Plenums: Fibrous glass, Type II, 1 inch thick with a minimum R value of 4.0.
 6. Transfer Ducts: Fibrous glass, Type I, 1 inch thick.
- K. Double-Wall Duct Interstitial Insulation:
1. Supply Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.
 2. Return Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.
 3. Exhaust Air Ducts: 1-1/2 inch thick with a minimum R value of 6.0.
- L. Exterior Ductwork Liner Insulation:
1. Supply Air Ducts: 2 inch thick with a minimum R value of 8.0.
 2. Return Air Ducts: 2 inch thick with a minimum R value of 8.0.
 3. Exhaust Air Ducts: 2 inch thick with a minimum R value of 8.0.
- M. Elbow Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
 - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
 - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
 - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
 - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm or Lower: 1.0 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.5 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio: 1.5.

- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

N. Branch Configuration:

- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
 - a. Rectangular Main to Rectangular Branch: 45-degree entry high efficiency take-off.
 - b. Rectangular Main to Round Branch: 45-degree entry high efficiency take-off.
- 2. Round:
 - a. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - b. Velocity 1000 to 1500 fpm: 45-degree entry high efficiency tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 3113

SECTION 23 3114 - CRYOGEN VENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section specifies the construction of piping for the listed System.
- B. Provide piping for the following high pressure system:
 - 1. MRI cryogen Vent.
- C. Include all wall and ceiling access panels, flexible couplings, diffusers, roof caps, sealing systems, hangers and supports necessary to complete the indicated and specified system and achieve the desired system operation.

1.2 QUALITY ASSURANCE

- A. All piping and fittings must have a computer generated label affixed to each section detailing all applicable information including the pipe dimensions, gauge, reinforcement type/class, and connector type of systems manufacturer. In addition, country of origin must be clearly stenciled on each pipe section.
- B. The engineer reserves the right to randomly check metal gauges and reinforcing to verify all pipe construction is in compliance. Non-conforming material will be replaced by the Contractor at no cost to the Owner.

1.3 SUBMITTALS

- A. Submit cryogen vent fabrication and layout shop drawings in accordance with Submittal and Shop Drawing requirements contained within Section 230100, "Mechanical Requirements." Coordinate the size and location of piping with structure, piping, lighting, equipment, conduit, bus ducts, ceiling construction and clear height above ceilings and other items which may present a potential conflict.
- B. Layout drawings shall be at ¼ inch = 1 foot scale on reproducible media with enlarged sections, elevations, plan drawings, and mechanical room drawings as necessary to ensure a coordinated installation.
- C. Submit documentation that the minimum air flush-out was completed, including dates when the flush-out was begun and completed.

1.4 CRYOGEN VENT DIMENSIONS

- A. The dimensions indicated on the contract drawings are the net inside clear dimensions available for cryogen flow.
- B. Contractor shall allow for exterior insulation thickness as required and indicate this on the cryogen vent layout shop drawings.

PART 2 - PRODUCTS

2.1 MRI CRYOGENIC VENT PIPE

- A. For cryogenic venting, welded non-magnetic stainless steel pipe shall be used in all MRI rooms where shown on the drawings.
- B. Stainless steel pipe shall be Type 304 non-ferromagnetic. All vent pipe shall be Schedule 5 pipe.
- C. Piping shall be installed with bracing as required to withstand the forces encountered during a cryogenic release event. These forces are indicated by the MRI manufacturer to be 2500 lb. helium flow reaction force and temperature increase from 4.5°K to ambient.
- D. Provide a stainless steel bellows in each cryogen vent system, to be located in the middle of each horizontal piping run exceeding 25 feet. Bellows shall be rated to 50 psi. provide Flexicraft MNLC50WS or equal as manufactured by U.S. Bellows, PHPK Tech, or Microflex.
- E. All expansions in diameter shall be made with a diffuser. All elbows shall be long radius (centerline radius at least 1.5 times pipe diameter).
- F. Provide 12 to 19 inch flexible section of pipe at cryogen valve of MRI.
- G. All connections to be welded. All internal surfaces shall be smooth.
- H. Provide 3/8 inch stainless steel wire mesh at outlet, covering at least 2.5 times the cross sectional area of the cryogenic vent pipe.
- I. The vent system must be insulated with 1.5 inch thick flexible unicellular insulation to prevent magnet ramping. Exposed insulation must be covered with a white PVC jacket.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All piping installation and construction shall comply with all requirements of this specification and meet or exceed MRI manufacturer's standards and recommendations for construction and installation.

- B. Seal all pipe seams, joints, connections, and penetrations.
- C. Keep piping tight to underside of structure. Maintain at least 3 inches clear between pipe and ceiling construction.
- D. Secure all installation and vapor barriers on pipes with a separate draw band.
- E. Coordinate all attachments through roofing penetration with roofing contractor.

3.2 TESTING

- A. Test requirements:
 - 1. Installed piping shall be tested prior to installation of MRI equipment.
 - 2. Leak-test all piping. Leakage in any tested section of cryogen vent shall not be accepted.
- B. Document all duct testing and submit testing results as part of the "As-Built" documents in the O&M manual.
- C. Testing must be performed prior to application of insulation and PVC jacket.

3.3 CRYOGEN VENT CLEAN OUT

- A. Clean and blow out complete cryogen vent system before any connections to equipment are made. Inspect for debris before starting any equipment.
- B. Interior surfaces shall be free of dust and debris prior to initial start up. Protect equipment which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access for cleaning purposes. Any cleaning of cryogen vent systems shall comply with recommendations of NAIMA and NADCA.
- C. When internally cleaning pipe work prior to installation or shipment to the jobsite, cover all pipe ends and openings with a dual polyethylene protective film. Securely affix the film to protect against dirt and debris. Film must be translucent to facilitate inspection of interior surfaces without removing film. Film must have a minimum elongation of 600%, contain no VOC, and leave no residue on pipe after removal.
- D. Clean external surfaces of foreign substances that might cause corrosion, deterioration of the metal, or where cryogen vent is to be painted.

END OF SECTION 23 3114

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

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SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Backdraft dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Remote damper operators.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.
13. High efficiency take-offs.

- B. Related Requirements:

1. Division 23 "Diffusers, Registers and Grilles".
2. Division 28 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
3. Division 28 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.3 ACTION SUBMITTALS

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

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, smoke-damper, combination fire- and smoke-damper, pressure relief-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653.
 - 1. Galvanized Coating Designation: G60.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- C. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- D. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- E. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Warming and Ventilating; a division of Mestek, Inc.
 - 2. Greenheck Fan Corporation.
 - 3. Nailor Industries Inc.
 - 4. Pottorff.
 - 5. Ruskin Company.
 - 6. United Enertech
- B. Function:
 - 1. Designed to allow airflow in one direction and prevent reverse airflow.
 - 2. Keeps outside air out of the space by sensing and closing against mass flow.
- C. Description:
 - 1. Gravity balanced.
- D. Maximum Air Velocity:
 - 1. 1000 fpm
- E. Maximum System Pressure:
 - 1. 3-inch wg.

2. 4-inch wg.
- F. Frame: Hat-shaped, with welded corners or mechanically attached and mounting flange:
 1. 16GA 0.063-inch- thick extruded aluminum.
- G. Blades: Multiple single-piece blades, maximum 6-inch width noncombustible, tear-resistant, neoprene-coated fiberglass with sealed edges:
 1. Center pivoted: 16GA 0.050-inch- thick aluminum sheet.
- H. Blade Action: Parallel.
- I. Blade Seals: Mechanically locked.
 1. Neoprene.
- J. Blade Axles: 0.20 inch diameter:
 1. Material: Nonferrous metal.
- K. Tie Bars and Brackets:
 1. Aluminum .
- L. Return Spring: Adjustable tension.
- M. Bearings:
 1. Synthetic pivot bushings.
- N. Accessories.
 1. Adjustment device to permit setting for varying differential static pressure.
 2. Counterweights and spring-assist kits for vertical airflow installations.
 3. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 4. Screen Mounting: Rear mounted.
 5. Screen Material:
 - a. Aluminum.
 6. Screen Type:
 - a. Bird
 7. 90-degree stops.
 - 8.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a division of Mestek, Inc.
 - b. McGill AirFlow LLC.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.
 - f. United Enertech
 2. Standard leakage rating , with linkage outside airstream .
 3. Suitable for horizontal or vertical applications.
 4. Frames: Hat-shaped, Mitered and welded corners. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - a. 16GA 0.064-inch thick, galvanized sheet steel.
 5. Blades:
 - a. Multiple or single blade. Parallel- or opposed-blade design. Stiffened damper blades for stability.
 - b. Material:
 - 1) Galvanized -steel, 16GA 0.064 inch thick.
 6. Blade Axles:
 - a. Nonferrous metal
 - b. Shall extend full length of damper blades in ducts with pressure classes of 3-inch wg or more.
 7. Bearings:
 - a. Material:
 - 1) Molded synthetic.
 - b. Bearings at both ends of damper operating shafts in ducts with pressure classes of 3-inch wg or more.
 8. Tie Bars and Brackets: Galvanized steel.
- B. Low-Leakage, Steel, Manual Volume Dampers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Warming and Ventilating; a division of Mestek, Inc.
 - b. McGill AirFlow LLC.
 - c. Nailor Industries Inc.
 - d. Pottorff.
 - e. Ruskin Company.
 - f. United Enertech

2. Comply with AMCA 500-D testing for damper rating.
3. Low-leakage rating , with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
4. Suitable for horizontal or vertical applications.
5. Frames:
 - a. Frame: Hat-shaped,
 - 1) 16GA 0.064-inch thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Material:
 - 1) Galvanized, roll-formed steel, 16GA 0.064 inch thick.
7. Blade Axles:
 - a. Nonferrous metal.
8. Bearings:
 - a. Molded synthetic.
 - b. Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades and bearings at both ends of operating shaft.
9. Blade Seals:
 - a. Neoprene.
10. Jamb Seals: Cambered Stainless steel or aluminum.
11. Tie Bars and Brackets: Galvanized steel or aluminum.
12. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.

C. Jackshaft:

1. Size:
 - a. 1-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.

2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Pottorff.
 3. Ruskin Company.
 4. Young Regulator Company.
 5. United Enertech
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Section:
 - a. Hat shaped.
 2. Material:
 - a. 20 GA 0.40-inch- thick galvanized steel .
 3. Corners:
 - a. Mitered-and-welded.
- D. Blades: Multiple.
1. Maximum blade width:
 - a. 6 inches.
 2. Opposed -blade design.
 3. Material:
 - a. Galvanized-steel.
 4. Thickness:
 - a. 20 GA 0.40-inch- thick galvanized steel
 5. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
 - a. Closed-cell neoprene
- E. Blade Axles:
1. Section:
 - a. 3/8-inch-square
 2. Material:
 - a. Galvanized steel.
 3. Blade-linkage hardware:
 - a. Zinc-plated steel and brass.
 - b. Ends sealed against blade bearings:

4. Operating Temperature Range: From minus 40 to plus 200 deg F.

F. Bearings:

1. Type:
 - a. Molded synthetic.
2. Axles: Dampers in ducts with pressure classes of 3-inch wg or more shall have axles full length of damper blades.
3. Bearings: Thrust bearings at each end of every blade. Bearings at both ends of each operating shaft.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Pottorff.
5. Ruskin Company.
6. United Enertech

B. Type:

1. Dynamic.

C. Standard: Rated and labeled according to UL 555 by an NRTL.

D. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

E. Fire Rating:

1. 1-1/2 hours.

F. Frame:

1. Curtain type with blades outside airstream.
2. Material:
 - a. Fabricated with roll-formed galvanized steel; with mitered and interlocking corners.
 - b. Thickness:
 - 1) 20GA-0.040-inch-.

G. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel. Length to suit application.

1. Minimum Thickness:
 - a. 18GA-0.05 inch, as indicated.

2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

H. Mounting Orientation: Vertical or horizontal as indicated.

I. Blades: Roll-formed, interlocking, galvanized sheet steel.

1. Thickness:
 - a. 24GA-0.024-inch-
2. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

J. Horizontal Dampers: Include blade lock and Type 301 constant force stainless-steel closure spring.

K. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.
5. United Enertech

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: See electrical for smoke detector requirements.

D. Frame: Galvanized sheet steel. With or without mounting flange as required.

1. Thickness:
 - a. Hat-shaped, 16GA-0.064-inch.
2. Corners:
 - a. Welded.

E. Blades: Horizontal, galvanized sheet steel.

1. Section;
 - a. Roll-formed.
2. Fit:
 - a. Interlocking.
3. Thickness:
 - a. 14GA-0.079-inch.

F. Leakage:

1. Class II.
- G. Seals:
 1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 deg F .
- H. Rated pressure and velocity to exceed design airflow conditions.
- I. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
 1. Minimum 17-inches long.
 2. Thickness:
 - a. 0.05-inch-.
- J. Damper Motors:
 1. Action:
 - a. Two-position
 2. Mode: Fail close.
 3. Mounting: External.
- K. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 1. Electrical Connection: 115 V, single phase, 60 Hz .
- L. Accessories:
 1. Auxiliary switches for signaling:
 - a. Position indication.
 2. Test Switch type:
 - a. Momentary test switch.
 3. Test Switch Mounting:
 - a. Damper.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Greenheck Fan Corporation.
 2. Nailor Industries Inc.
 3. Pottorff.
 4. Ruskin Company.
 5. United Enertech
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.

- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum velocity of:
 - 1. 4000-fpm
- D. Fire Rating:
 - 1. 1-1/2 hours.
- E. Frame: Hat shaped, galvanized sheet steel. With or without mounting flange as required.
 - 1. Thickness:
 - a. 16GA-0.064-inch
 - 2. Corners:
 - a. Welded.
- F. Heat-Responsive Device: Replaceable, 212 deg F rated, fusible links.
- G. Blades: Horizontal, galvanized sheet steel.
 - 1. Type:
 - a. Air-foil.
 - 2. Fit:
 - a. Interlocking.
 - 3. Thickness:
 - a. 0.063-inch.
- H. Leakage:
 - 1. Class I.
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
 - 1. Thickness:
 - a. 18GA 0.05-inch.
- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: Damper Motors to be Belimo or approved equal. Honeywell motors are not allowed.
 - 1. Locate outside air stream unless otherwise indicated.
 - 2. Action: Two-position.
 - 3. Voltage: to match fire alarm system (coordinate).
 - 4. Listed: UL, as part of damper assembly.
 - 5. Outdoor Motors and Motors in Outside-Air Intakes:
 - a. Gaskets: O-ring gaskets designed to make motors weatherproof.
 - b. Internal Heaters: Equip to permit normal operation at minus 40 deg F.
- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Electrical Connection: 115 V, single phase, 60 Hz.

N. Accessories:

1. Auxiliary switches:
 - a. Signaling.
 - b. Position indication.
2. Test Switch type:
 - a. Momentary test switch.
3. Test Switch Mounting:
 - a. Damper.

2.9 TURNING VANES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. METALAIRE, Inc.
 2. SEMCO Incorporated.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 4. Ductmate Industries, Inc.
 5. Duro Dyne Inc.
 6. Elgen Manufacturing.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Fabricate single blade vanes to comply with SMACNA's "HVAC Duct Construction Standards-Metal and Flexible."
 2. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
- D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- E. Vane Construction:
1. Single wall
- F. Vane Spacing:
1. 1-1/2" spacing between turning vanes
 2. 3-1/4" spacing not allowed.
- G. Vane Construction: Single wall for ducts up to 36 inches wide and additional bracing for larger dimensions.

2.10 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff.
 - 2. Ruskin Company; Tomkins PLC.
 - 3. Young Regulator Company.
- B. Cable Type:
 - 1. Description: Cable system designed for remote manual damper adjustment.
 - 2. Tubing/Sheathing: Galvinsed, Brass, Copper or Aluminum.
 - 3. Cable: Stainless steel or Steel.
 - 4. Wall-Box Mounting: Coordinate with Architect.
 - 5. Wall-Box Cover-Plate Material: Coordinate with Architect.
- C. Activated Electric Type:
 - 1. Description: Electrically activated zone control damper for remote adjustment. When an adjustment is needed the system is powered up.
 - 2. Means: Factory mounted actuator factory wired to damper.
 - 3. Portable 9 volt system. No field power requirement.
 - 4. Mounting: Recessed Wall Box or Diffuser or Hand Held.
 - 5. Wall-Box Cover Finish: Coordinate with Architect.
 - 6. Wall-Box Porting: 1 to 6 ports or more.

2.11 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. McGill AirFlow LLC.
 - 3. Pottorff.
 - 4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 - 5. Ruskin Company
 - 6. American Warming and Ventilating; a division of Mestek, Inc.
 - 7. Cesco Products; a division of Mestek, Inc.
 - 8. Ductmate Industries, Inc.
 - 9. Elgen Manufacturing.
 - 10. Flexmaster U.S.A., Inc.
 - 11. Nailor Industries Inc.
 - 12. Ventfabrics, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:
 - a. Double wall, rectangular.
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
 - c. Vision panel.
 - d. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
 - e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
 - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square:
 - 1) Hinges:
 - a) Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches, provide outside and inside handles:
 - 1) Hinges:
 - a) Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches, provide outside and inside handles:
 - 1) Hinges:
 - a) Continuous and two compression latches with outside and inside handles.

2.12 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Ductmate Industries, Inc.
 2. Ventfabrics, Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
 4. Duro Dyne Inc.
 5. Elgen Manufacturing.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a wide fabric strip attached to two narrower metal strips. Provide strips of metal compatible with connected ducts.
 1. Wide Strip:
 - a. 3-1/2 inches.
 2. Narrow Strips:
 - a. 0.028-inch- thick, galvanized sheet steel.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.13 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Themaflex
4. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Ducts shall conform to the requirements for Class I connectors when tested in accordance with "Standard for Factory Made Air Ducts Materials and Air Duct Connectors" (UL 181).

C. Ducts shall also pass the 15 minute U.L. flame penetration test as specified in the UL 181 Standard.

D. Insulated, Flexible Duct: Two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene or aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

E. Flexible Duct Connectors:

1. Clamps: in sizes 3 through 18 inches, to suit duct size.
 - a. Material: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action.

2.14 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.
- C. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- D. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.

2.17 HIGH EFFICIENCY TAKE-OFFS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - 1. Air-Rite
 - 2. Hercules Industries
 - 3. Sheet Metal Connectors, Inc.
 - 4. Spiral Manufacturing Co. Inc.
 - 5. Ferguson
- B. Materials:
 - 1. 24 gauge galvanized sheet metal meeting ASTM A653 and A924
- C. Take-off shall meet SMACNA third edition Section 4.8 figure 4.6 - 45 degree entry.
- D. Rectangular opening with flanged sides on all sides. Complete with closed cell neoprene gasket to provide a tight seal.

PART 3 - EXECUTION

3.1 INSTALLATION

General

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Use the Remote Damper Operator when they are called out on the drawings or when the damper cannot be easily accessed.
- D. Install high efficiency take-off on all branch duct take-offs. Provide take-off with balancing damper as shown on drawings. Spin-in fittings are not allowed.

Flexible Ducts / Flexible Duct Connectors

- E. Install flexible connectors to connect ducts to equipment.
- F. Flexible duct connections from the main trunk ducts to diffuser boots shall be furnished and installed as shown on the drawings. Flexible ductwork shall only be used as indicated on the drawings.
- G. Where flexible duct is indicated, use insulated flexible duct for supply air return and exhaust air.
- H. Flexible ductwork shall be run in straight lengths.
- I. Provide support in flexible duct every three feet.
- J. Flexible ducts shall have compression fittings on both ends.
- K. Flexible ductwork is not allowed to bend 90 degrees. If a bend is needed use sheet-metal hard elbows. Hard turns, offsets, or kinks will not be allowed.
- L. Flexible ducts shall connect to trunk duct with high efficiency takeoffs.
- M. Connect flexible ducts to metal ducts with draw bands.
- N. Connect terminal units to supply ducts:
 - 1. With maximum 12-inch lengths of flexible duct.
- O. Do not use flexible ducts to change directions.
- P. Connect diffusers or light troffer boots to ducts:
 - 1. With maximum 60-inch lengths of flexible duct clamped or strapped in place.

Backdraft/Control/ Dampers

- Q. Install backdraft dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

Volume Damper

- R. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
1. Install steel volume dampers in steel ducts.
 2. Install aluminum volume dampers in aluminum ducts.
- S. Set dampers to fully open position before testing, adjusting, and balancing. Exception: Pressure relief damper.
- T. A balance damper with locking quadrant will be provided downstream of take-off from trunk duct.

Fans And Test Holes

- U. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- V. 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.
- W. Install duct test holes where required for testing and balancing purposes.
- X. Install test holes at fan inlets and outlets and elsewhere as indicated.

FIRE, SMOKE AND FIRE-SMOKE DAMPERS

- Y. Install fire and smoke dampers according to UL listing.
1. Install fusible links in fire dampers.
- Z. For round ductwork 24-inch and smaller a true round fire damper with the same rating may be used.

Access Doors

- AA. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
1. On upstream side of duct coils.
 2. Upstream from duct filters.
 3. At outdoor-air intakes and mixed-air plenums.
 4. At drain pans and seals.

5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be standard access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

BB. Install access doors with swing against duct static pressure.

CC. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

DD. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed. Coordinate testing requirements with fire alarm system and provide startup reports with O&M manual.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

3.3 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.

- C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

END OF SECTION 23 3300

SECTION 23 3423 - HVAC POWER VENTILATORS

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. Centrifugal roof ventilators.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on:
 - 1. Actual Project site elevations.
- B. Operating Limits: Classify according to AMCA 99.
- C. Fan Schedule: Fan characteristics and performance data are described in an equipment schedule on the drawings including:
 - 1. Fan arrangement with wheel configuration, inlet and discharge configurations, and required accessories.
 - 2. Capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, shipping weights, operating weights, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Certified fan performance curves with system operating conditions indicated.
 - 2. Certified fan sound-power ratings.
 - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
 - 4. Material thickness and finishes, including color charts.
 - 5. Dampers, including housings, linkages, and operators.
 - 6. Roof curbs.
 - 7. Fan speed controllers.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
 - a. Detail all wiring systems and differentiate clearly between manufacturer-installed and field-installed wiring.
- C. Delegated-Design Submittal: For unit hangars and supports 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. 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. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 1. Roof framing and support members relative to duct penetrations.
 2. Ceiling suspension assembly members.
 3. Size and location of initial access modules for acoustical tile.
 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- B. Field quality-control Reports

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.7 MATERIALS MAINTENANCE SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Belts: One set for each belt-driven unit.

1.8 QUALITY ASSURANCE

- 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.
- B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Power ventilator electrical components shall comply with applicable NEMA standards.
- D. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

1.9 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided.
- C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 PRODUCTS FURNISHED BUT NOT INSTALLED

- A. Products furnished, but not installed, under this Section include roof curbs for roof-mounted exhaust fans. Roof curbs to be installed by Division 07, section "Roof Accessories".

2.2 CENTRIFUGAL ROOF VENTILATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Greenheck Fan Corporation.
 - 2. Loren Cook Company.
 - 3. Twin City.
- B. Housing: Removable: Square, one-piece, aluminum base with venture inlet cone.
 - 1. Spun-aluminum, dome top and outlet baffle.
 - 2. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
 - 3. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

- C. Fan Wheels:
 - 1. Aluminum hub and wheel with backward-inclined blades.
- D. Direct-Drive Units: Motor mounted outside of airstream within fan housing.
- E. Belt-Driven Units: Motor mounted on adjustable base, adjustable sheaves and with motor and belts within fan housing.
- F. Accessories:
 - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
 - 2. Disconnect Switch: Nonfusible type:
 - a. Thermal-overload protection; factory wired through an internal aluminum conduit.
 - 1) Mounted inside fan housing.
 - 3. Bird Screens: Removable, 1/2-inch mesh:
 - a. Aluminum wire.
 - 4. Dampers:
 - a. Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
 - b. Motorized parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.
- G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Provide neoprene gasket between fan base and curb to reduce sound transmission.
 - 1. Configuration:
 - a. Self-flashing without a cant strip, with mounting flange.
 - 2. Overall Height:
 - a. 14 inches.

2.3 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - 1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 - 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 26 Sections.
- B. Enclosure Type: Totally enclosed;
 - 1. Fan cooled

2.4 FACTORY FINISH

- A. Metal Parts: All assembly parts shall be protected from rust and corrosion.
 - 1. Stainless steel, aluminum, and other non-corroding materials require no protective finish.
 - 2. Non-galvanized sheet metal parts shall be prime coated or powder coated before final assembly.
 - 3. Prime coated parts shall receive baked enamel finish coat after assembly.

2.5 SOURCE QUALITY CONTROL

- A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements of installation tolerances and other conditions affecting performance of the power ventilators. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements. Verify clearances.
- B. Do not operate fans until ductwork is clean, filters are in place, bearings are lubricated, and fans have been commissioned.

3.3 INSTALLATION

- A. Install power ventilators level and plumb according to manufacturer's written instructions.
- B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077213 "Manufactured Curbs" for installation of roof curbs.

- C. Support Steel: Support suspended units from structure using threaded steel as specified in Division 23 "Vibration and Seismic Controls for HVAC."
- D. Label units according to requirements specified in Division 23 "Identification for HVAC Piping and Equipment."
- E. Install power ventilators with factory recommended and code required clearances for service and maintenance.

3.4 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 "Grounding and Bonding for Electrical Systems."
 - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- D. Connect wiring according to Division 26 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

3.6 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Comply with requirements in Division 23 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.7 CLEANING

- A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.
- B. Clean fan interiors to remove foreign material and construction debris. Vacuum clean fan wheel and cabinet.

3.8 DEMONSTRATION

- A. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
- B. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout."
- C. Schedule training with Owner, through Architect, with at least 7 days' advance notice.
- D. Demonstrate operation of power ventilators. Conduct walking tour of the Project. Briefly identify location and describe function, operation, and maintenance of each power ventilator.

END OF SECTION 23 3423

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SECTION 23 3713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections:
 - 1. Section 233714 "Fixed Louvers" for fixed and louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
 - 3. Section 230593 "Testing, Adjusting and Balancing for HVAC" for balancing diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.

- B. Source quality-control reports.

1.5 QUALITY ASSURANCE

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated.
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Air Factors
 - 2. Carnes.
 - 3. Kruegar.
 - 4. METALAIRE, Inc.
 - 5. Nailor Industries Inc.
 - 6. Price Industries.
 - 7. Titus.
 - 8. Tuttle & Bailey.
 - 9. AJ Manufacturing.

2.2 REGISTERS, GRILLES, & DIFFUSERS

- A. General: The frames for all registers, grilles, and diffusers shall match type of ceiling where they are to be installed. Special frames shall be provided for narrow T-bar ceilings. Refer to reflected ceiling plan and other specification divisions for ceiling type. See drawings AND schedules for additional information.

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, coordination drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

END OF SECTION 23 3713

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 05 33 "Raceways and Boxes for Electrical Systems"
 - 2. Section 26 09 23 "Lighting Control Devices"
 - 3. Section 26 09 36 "Standalone Modular Preset Dimming Controls"
 - 4. Section 26 09 43 "Relay-Based Lighting Controls"
 - 5. Section 27 41 33 "Master Antenna Television System"
 - 6. Section 27 51 17 "Networked Public Address and Paging System"
 - 7. Section 27 51 19 "Sound Masking Systems"
 - 8. Section 28 13 00 "Access Control"
 - 9. Section 28 31 11 "Digital, Addressable Fire-Alarm System"
 - 10. Section 27 00 00 "Intermountain Healthcare Networked Structured Cable & Standards" for cabling used for voice and data circuits.

1.3 DEFINITIONS

- A. Outlet Box: Electrical box used to support utilization equipment such as a receptacle or light fixture.
- B. Pull Box: Electrical box through which branch circuit or feeder conductors are run but are not spliced.
- C. Junction Box: Electrical box used for splicing branch circuit or feeder conductors.
- D. Multiwire Branch Circuit: A branch circuit as defined by the National Electrical Code that shares a grounded conductor between two or more phase conductors.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SINGLE CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Alpha Wire Company.
 - 2. Belden Inc.
 - 3. Cerro Wire LLC.
 - 4. Encore Wire Corporation.
 - 5. General Cable; General Cable Corporation.
 - 6. Southwire Company.
 - 7. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

2.2 MULTI-CONDUCTOR CABLES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Southwire Company.
 - 2. AFC Cable Systems.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.
- D. Multi-conductor Cable, Type AC-HCF:
 - 1. Armor: Galvanized Interlocking Steel Strip (green striped or solid green).
 - 2. Conductors: Solid Copper
 - 3. Conductor Insulation: THHN-2 with individual moisture resistant, fire retardant paper wrap on each individual conductor.
 - 4. Grounding: 16 AWG integral bond wire and insulated green copper grounding conductor.
 - 5. Neutral (Grounded) Conductor: White for 120Y/208 volt systems and Grey 480Y/277 volt systems.
 - 6. Maximum Voltage Rating: 600 volts.
 - 7. References and Ratings:
 - a. UL 4, 83, 1479, 1581, 2556, File Reference E7330
 - b. NEC 250.118(8), 300.22(C), 392, 320, 517.13, 518, 645
 - c. Federal Specification A-A-59544 (formerly J-C-30B)
 - d. UL Classified 1, 2, and 3-hour through (Fire) penetration product, R-14141
 - e. Environmental Air-Handling Space Installation per NEC 300.22(C)

- E. Other Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.

2.3 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. 3M.
 - 2. AFC Cable Systems; a part of Atkore International.
 - 3. Hubbell Power Systems, Inc.
 - 4. Ideal Industries, Inc.
 - 5. ILSCO.
 - 6. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.4 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. APC Group; Kitchen Leash
- B. Case (housing):
 - 1. Dimensions: 9" x 12" x 3'
 - 2. Material: Molded Polypropylene 3.175 mm thickness
 - 3. 94v-2 flammability rating
- C. Power Cord
 - 1. Conductors: 14/3 AWG copper type SJOW
 - 2. Length: 10 feet
 - 3. Rating: 200 degrees F
- D. Receptacle/Plug
 - 1. Rated: 125vac/20 amp
 - 2. Receptacle: NEMA 5-15P
 - 3. Plug: Dual Duplex rated 20 amp
- E. Mounting Bracket: Designed for installation on the ceiling type where the cord reel will be installed.

2.5 SYSTEM DESCRIPTION

- 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.
- B. Comply with NFPA 70.

2.6 FIRE-ALARM WIRE AND CABLE

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
 - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
 - 1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
 - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; for feeders No. 4 AWG and larger provide copper feeders unless aluminum is specifically indicated on the one-line diagrams. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Aluminum conductors may not be installed for circuiting to imaging and mechanical equipment.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Refer to Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway types and applications.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders below Slabs-On-Grade, and Underground: Type THWN-2, single conductors in raceway.
- E. Multiwire Circuits: may not be used for branch circuit wiring. All 120 volt and 277 volt circuits shall be provided with a dedicated grounded conductor (neutral) for each phase conductor. Up to three of these circuits may be installed in a single conduit but not more than one conductor of each phase may be installed in a single conduit.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

1. Armored cable, Type AC-HCF may be installed for normal and equipment system single branch circuits concealed in walls, and partitions in lengths between outlet boxes 30' or less and not as homeruns or wiring between pullboxes or junction boxes.
 2. Armored cable, Type AC-HCF may be installed between the first outlet box concealed in a wall or partition and a junction box above an accessible ceiling immediately above the location where the cable exits the wall or partition framing.
- G. Branch Circuits below Slabs-on-Grade and Underground: Type THHN/THWN-2, single conductors in raceway. Installation of raceways within any concrete slab or composite concrete and steel deck is prohibited. NEC 517.13 (A) requires that all branch circuits serving patient care areas are provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly that qualifies as an equipment grounding conductor. Metallic raceways are not a specified raceway for branch circuits installed below slabs-on-grade. To assure compliance with the NEC requirement, both initially and when remodels occur in the future, the installation of branch circuit wiring under slabs-on-grade is limited to circuits supplying only the following rooms and area types without extension beyond the room or area to a room or area not listed here:
1. Mechanical Spaces.
 2. Electrical Rooms.
 3. Food Service.
- H. Branch circuit wiring may also be installed under slabs-on-grade to supply power for the following:
1. Systems Furniture.
 2. Floor Boxes.
 3. Direct wired equipment that is not located against a wall.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain-relief device at terminations to suit application.
- J. Isolated Power System Conductors: #10 AWG, Type XHHW-2 stranded with cross-linked PE insulation and a dielectric constant of 3.5 or less, installed in EMT conduit. To limit leakage-current the branch circuit conductors must be reduced to the shortest overall length possible. Install conduits for Isolated Power System branch circuits in the most direct path between the panel and the outlet box, which is not necessarily parallel and perpendicular to the structure and framing, to reduce conductor length. Install only one circuit in per conduit. Do not use pulling compounds when installing the branch circuit conductors of Isolated Power Systems.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Do not use pulling compounds or lubricant for installation of branch circuit conductors for Isolated Power Systems.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CORD REELS

- A. Coordinate location of cord reels to align with kitchen equipment supplied by the cord reel.
- B. Fasten brackets to structure using minimum 3/8" threaded rod and to rigidly support the cord reel. Minimum of 2 rods per bracket with addition if required to provide a rigid support.
- C. Adjust cord stopper as coordinated with owner.

3.5 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with panel and circuit number and identify as spare conductor.

3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.8 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
 - a. Imaging Equipment
 - 2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
 - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
 - 1. Installation and Bonding of Grounding Electrodes including:
 - a. Metal Underground Water Pipe
 - b. Metal Frame of the Structure
 - c. Concrete-Encased Electrodes including UFER Grounds
 - d. Ground Ring
 - e. Rod Electrodes
 - 2. Ground bonding common with lightning protection system.
 - 3. Foundation steel electrodes.
 - 4. Electrical Room Ground Bus.

1.3 ACTION SUBMITTALS

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

1.4 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Grounding Electrodes
 - 3. Bonding Jumpers
 - 4. Electrical Room Grounding Bus.
 - 5. TEC and TDR Grounding Bus.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
 - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - 2) Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- 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.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Stranded Conductors: ASTM B 8.
 2. Tinned Conductors: ASTM B 33.
 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- C. Electrical Room Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 20 inches.
- D. TEC and TDR Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 12 inches.

2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install stranded conductors unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.
 - 1. Bury at least 18 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in Normal Power Electrical Room, Essential Power Electrical Room, TEC and all TDR. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 96 inches (2400 mm) above finished floor unless otherwise indicated.
- E. Conductor Terminations and Connections:
 - 1. Pipe Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.

- B. Pad-Mounted Transformers and Switches: Install tinned-copper conductor not less than No. 4/0 AWG from equipment grounding terminals to ground ring. Bury ground ring not less 18 inches below finished grade.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.
 - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Metallic Fences: Comply with requirements of IEEE C2.
 - 1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
 - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are shall be at least 12 inches (300 mm) deep, with cover.
 - 1. Test Wells: Install one test well at the ground rod location indicated on the drawings.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through concrete footings.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Use exothermic-welded connectors; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate interior and exterior columns at distances not more than 60 feet (18 m) apart.
 - 1.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod.
 - 1. Install tinned-copper conductor not less than No. 4/0 AWG for bond to ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches (600 mm) from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4/0 AWG.
 - 1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
 - 2. Bond grounding conductor to reinforcing steel in at least four locations in mat footing and at four spread footing locations evenly distributed throughout building. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding

- conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- J. Panelboard Bonding: To comply with NEC 517.14 panelboard bonding requirements install a minimum #10 AWG copper conductor between all branch-circuit panelboard grounding terminal buses in each electrical room. The conductor may be installed in ½" EMT conduit or may be exposed where securely fastened to the walls.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
- 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding conductor, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed 3 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
1. Hangers and supports for electrical equipment and systems.
 2. Construction requirements for concrete bases.
- B. Related Requirements:
1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Hangers.
 - b. Steel slotted support systems.
 - c. Nonmetallic support systems.
 - d. Trapeze hangers.
 - e. Clamps.
 - f. Turnbuckles.
 - g. Sockets.
 - h. Eye nuts.
 - i. Saddles.
 - j. Brackets.
 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
1. Trapeze hangers. Include product data for components.
 2. Steel slotted-channel systems.
 - 3.
 4. Nonmetallic slotted-channel systems.
 5. Equipment supports.
 6. 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.

- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
 - 1. Include design calculations and details of trapeze hangers.
 - 2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which hangers and supports will be attached.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Items penetrating finished ceiling, including the following:
 - a. Lighting fixtures and lighting control.
 - b. Electrical power devices
 - c. Communications devices.
 - d. Air outlets and inlets.
 - e. Speakers.
 - f. Fire sprinklers.
 - g. Access panels.
 - h. Projectors.
 - i. Fire alarm system devices.
 - j. Nurse call system devices.
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
 2. Component Importance Factor: 1.5.
- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
 2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
1. Material: Galvanized steel.
 2. Channel Width: Use 1-1/4 inches (31.75 mm) where possible and minimum 13/16 inches (20.64 mm) where necessary due to space restrictions.
 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 4. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for electrical conductors in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include and are limited to the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
 6. Hanger Rods: Threaded steel.

2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

- B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be **3/8 inch (9 mm)** in diameter.
- D. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70. Only prefabricated openings in structure members may be used. Do not create openings in structure members unless directed to do so by the structural engineer of record.
- C. Cable Support Methods: Cables used for Circuits and Equipment Operating at Less Than 50 Volts and Class 1, 2 or 3 Remote-Control, Signaling and Power-Limited Circuits shall be installed in J-hooks. Where cables extend from J-hooks to equipment cables shall be supported from the structure by straps, hangers, cable ties or similar fittings designed and installed so as not to damage the cable. Do not fasten or secure cables to the raceways of the power system.
- D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb (90 kg)**.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 7. To Light Steel: Sheet metal screws.
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on 13/16 inches (20.64 mm) slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete" or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting", Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Metal wireways and auxiliary gutters.
 - 4. Surface raceways.
 - 5. Boxes, enclosures, and cabinets.
 - 6. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
 - 1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. ARC: Aluminum Rigid Conduit.
- B. EMT: Electrical Metallic Tubing.
- C. GRC: Galvanized rigid steel conduit.
- D. IMC: Intermediate metal conduit.
- E. RTRC: Reinforced Thermosetting Resin Conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For color coded EMT conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797. Factory applied color finish available in black, orange, green, purple, red, yellow, blue, and white. Refer to Specification Section 26 05 53 "Identification for Electrical Systems" for color coding of raceways.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Set screw or compression.
 - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. RTRC: Comply with UL 1684A and NEMA TC 14.
- E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.4 RECEPTACLE RACEWAYS

- A. Listing and Labeling: Receptacle raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Aluminum with snap-on covers complying with UL. Clear anodized finish.
 - 1. Raceways for receptacles only: Wiremold AL3300 series.
 - 2. Raceways for applications where both receptacles and data devices are installed in the raceway and at all laboratory locations: Wiremold ALA4800 series two-channel and dual-cover. Satin anodized finish.
 - 3. Provide duplex receptacles at 12 inches on center in all receptacle raceways. Provide GFCI receptacles as noted on drawings.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Floor Boxes and Poke-Through Devices: Refer to Specification Section 26 27 26 "Wiring Devices" for floor boxes and poke-through devices
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions:
 - 1. **Wiring Devices other than data or communications devices: Minimum 4 inches square by 2-1/8 inches deep** with switch ring as required for the device configuration and wall or ceiling surface. Where light switches are indicated at a common location provide multi-gang boxes to accommodate the quantity and type of switches indicated. Where deeper boxes are required provide masonry type boxes which do not require a separate switch ring.
 - 2. Data and communications devices: Minimum 4-11/16 inches square by 3 inches deep with single-gang 5/8 inch deep (or deeper if wall or ceiling finish is deeper) ring.
- K. Pull boxes behind monitors: Minimum 6 inches square by 3-1/2 inches deep with two-gang ring.

- L. Gangable boxes are prohibited.
- M. Partitions: Provide partitions to separate emergency system conductors from conductors or other systems, where voltage between adjacent switches exceeds 300 volts and where switches controlling Low Voltage Controllers for interface to Nurse Call systems are installed in common boxes with line voltage switches.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250.
 - 1. Indoor: Type 1 with continuous-hinge cover with flush latch unless otherwise indicated. Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Outdoor: Type 4X with continuous-hinge cover with flush latch unless otherwise indicated. 304 stainless steel with smooth brushed finish.
 - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel. Provide interior panels when there are control devices or power blocks located inside the enclosure.
- O. Handholes and Boxes for Exterior Underground Wiring: Refer to Specification Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".

2.6 PUTTY PADS

- A. Moldable intumescent wall opening-protective pads designed for application to the back of electrical outlet boxes prior to installation of the wall finish to provide up to 2-hour fire barrier ratings and minimum Sound Transmission Class (STC) of 52 when tested in an STC-53 rated wall assembly or 59 according to ASTM E90-97.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. 3M Company.
 - 2. Hilti

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC or IMC.
 - 2. Concealed Conduit, Aboveground: EMT.
 - 3. Underground Conduit for branch circuits: RNC, Type EPC-40-PVC, direct buried.
 - 4. Underground Conduit for feeders: Refer to Specification Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".
 - 5. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 7. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X, 304 stainless steel.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 - 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:

- a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms below 8 feet.
 - d. Gymnasiums.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 5. Feeder Raceways under Slabs: RNC, Type EPC-40-PVC encased in not less than 2 inches of 3000 psi concrete. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
 6. Branch Circuit Raceways under Slabs: Refer to Specifications Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for allowable application of under slab raceways. RNC, Type EPC-40-PVC direct buried. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
 7. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
 8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 9. Damp or Wet Locations: GRC or IMC.
 10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, 304 stainless steel in kitchens and damp or wet locations.
 - 11.
- C. Minimum Raceway Size: **3/4-inch (21-mm)** trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Separation of Life Safety and Critical Branch Wiring: Comply with NFPA 70 Article 517.
- C. Keep raceways at least **6 inches (150 mm)** away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- D. Complete raceway installation before starting conductor installation.

- E. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab except where concealed in chases.
- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- J. Raceways Embedded in Slabs are prohibited.
- K. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
 - 1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.

2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- X. Expansion(Seismic)-Joint Fittings:
 1. Install flexible metal conduit at all locations where conduits cross building or structure expansion joints. Allow for minimum 4 inches deflection in all directions or greater if expansion joint exceeds 4 inches. Provide droop in flexible conduit to accommodate movement. Do not loop the flexible conduit. When calculating total bend degrees in conduit runs with expansion fittings use minimum 60 degrees for each expansion-joint fitting
 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 1. Use LFMC in damp or wet locations.
- Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- CC. Locate boxes so that cover or plate will not span different building finishes.
- DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

FF. Set metal floor boxes level and flush with finished floor surface.

GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING AND SOUND TRANSMISSION MITIGATION

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Install putty pads with acoustical and firestopping capabilities on all boxes that are installed in wall or partition cavities and in gypsum board ceilings.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 48
SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Restraint channel bracings.
 - 2. Restraint cables.
 - 3. Seismic-restraint accessories.
 - 4. Mechanical anchor bolts.
 - 5. Adhesive anchor bolts.
- B. Related Requirements:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
 - 1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional or structural engineer responsible for their preparation.
 - 2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
 - 3. Seismic-Restraint Details:
 - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

- b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
- c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
- d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional or structural engineer.
- C. Welding certificates.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Observation Report signed by the professional or structural engineer responsible for the design calculations and details for the seismic restraint devices indicating that all restraints have been installed and tested per the approved action submittal documents.

1.6 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading: Refer to Structural criteria for the project.

2.2 RESTRAINT CHANNEL BRACINGS

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.3 RESTRAINT CABLES

- A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.4 SEISMIC-RESTRAINT ACCESSORIES

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.6 ADHESIVE ANCHOR BOLTS

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide

anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete" and Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- B. Equipment and Hanger Restraints:
 - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

- F. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 - 5. Test to 90 percent of rated proof load of device.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels, including arc-flash warning labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.

- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Use the following color code for all electrical equipment and junction boxes that are specified to be labeled:
 - 1. Standby Power Circuits: Black letters on red field.
 - 2. Life Safety Branch Circuits: White letters on orange Field
 - 3. Critical Branch Circuits: White letters on red Field
 - 4. Equipment System Circuits: White letters on green field.
 - 5. Normal Power Circuits: White letters on black field.
 - 6. Uninterruptible Power Supply (UPS):
 - a. UPS-A: Blue letters on a grey field.
 - b. UPS-B: Red letters on a grey field.
 - 7. Fire Alarm: Red letters on white field.
 - 8. Communications: White letters on blue field.
- B. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR XX INCHES" where XX is replaced by the clearance requirements of NFPA 70.
- C. Use the following color code for all electrical raceways that are specified to be labeled:
 - 1. Color Coding for Raceways:
 - a. Standby Power: Black
 - b. Life Safety Branch: Yellow
 - c. Critical Branch: Orange
 - d. Equipment Branch: Green
 - e. UPS: White
 - f. Fire alarm: Red
 - g. Communications: Blue
 - h. Access Control: Purple
 - 2. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: where voltage, system type, or other written information is required, black lettering on orange background.

2.3 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: printed, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Indoor Equipment Labels: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high. Color coded as indicated in Color and Legend Requirements.
- C. Outdoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high. Color coded as indicated in Color and Legend Requirements.

2.4 BANDS AND TUBES:

- A. Snap-Around, Color-Coding Bands for Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, **2 inches (50 mm)** long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

2.5 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.6 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Engraved legend.
 - 2. Thickness:
 - a. For signs up to **20 sq. inches (129 sq. cm)**, minimum **1/16-inch- (1.6-mm-)**.
 - b. For signs larger than **20 sq. inches (129 sq. cm)**, **1/8 inch (3.2 mm)** thick.
 - c. Engraved legend with white letters on a dark grey background.
 - d. Punched or drilled for mechanical fasteners.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. System Identification for Feeder Raceways: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands 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.
- I. Fire Alarm: Provide raceway with factory applied finish or paint conduit in field.
- J. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.

3.3 IDENTIFICATION SCHEDULE

- A. Switchboards and Panelboards: Include Identification per the One-Line Diagrams and the Source Location, including the circuit number.

- B. Disconnect Switches, Enclosed Circuits Breakers and Motor Controllers. Identify the equipment that is controlled and the Source, including the circuit number.
- C. Accessible Raceways, including above accessible ceilings, for all Feeder Circuits and for Branch Circuit rated more than 30A: Identify with self-adhesive tape or vinyl label. Install labels at **30-foot (10-m)** maximum intervals.
- D. Accessible Raceways and Cables, including above accessible ceilings, within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels indicating the wiring system and system voltage. Conform to system color legend/schedule.
 - 1. Standby Power
 - 2. Life Safety Branch
 - 3. Critical Branch
 - 4. Equipment System
 - 5. Normal Power
 - 6. UPS
 - 7. Fire Alarm
 - 8. Communications
 - 9. Access Control
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Grounded Systems: Color-Coding for Phase-, Neutral- and Voltage-Level Identification: Use colors listed below for feeder and branch-circuit conductors.
 - a. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Feeder Neutral: White
 - 5) Branch Circuit Neutral: White with colored stripe matching the color of the phase circuit that is paired with the neutral.
 - b. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Feeder Neutral: Grey
 - 5) Branch Circuit Neutral: Grey with colored stripe matching the color of the phase circuit that is paired with the neutral.
 - 2. Isolated Power Systems: Color-Coding for Circuit Identification: Use colors listed below for Isolated Power conductors.
 - a. Isolated Conductor No.1: Orange with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
 - b. Isolated Conductor No. 2: Brown with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
 - 3. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
 - a. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum 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. Locate bands to avoid obscuring factory cable markings.
 - 4. Provide a sign at each panelboard identifying the color coding scheme.

- F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- I. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters on an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
 - 1. Comply with NFPA 70E and ANSI Z535.4.
 - 2. Comply with Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- P. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum **3/8-inch- (10-mm-)** high letters for emergency instructions at equipment used for power transfer or load shedding.

- Q. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - b. Fasten mechanically fastened labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment To Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer.
 - b. Enclosures and electrical cabinets.
 - c. Lighting control relay cabinets.
 - d. Access doors and panels for concealed electrical items.
 - e. Switchgear.
 - f. Switchboards.
 - g. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - h. Emergency system boxes and enclosures.
 - i. Motor-control centers.
 - j. Enclosed switches.
 - k. Enclosed circuit breakers.
 - l. Enclosed controllers.
 - m. Variable-speed controllers.
 - n. Push-button stations.
 - o. Power-transfer equipment.
 - p. Contactors.
 - q. Remote-controlled switches, dimmer modules, and control devices.
 - r. Battery-inverter units.
 - s. Battery racks.
 - t. Power-generating units.
 - u. Monitoring and control equipment.
 - v. UPS equipment.
 - w. Communications Equipment Racks.
 - x. Fire Alarm System.
 - y. Access Control System.
 - z. Overhead Paging System.
 - aa. Nurse Call System.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Twist-locking receptacles.
 - 3. USB charger devices.
 - 4. Isolated-ground receptacles.
 - 5. Hospital-grade receptacles.
 - 6. Tamper-resistant receptacles.
 - 7. Weather-resistant receptacles.
 - 8. Snap switches and wall-box dimmers.
 - 9. Floor service outlets (floor boxes) and poke-through assemblies.
 - 10. Pendant Cord Connector Devices (Drop Cords).
 - 11. Cord Reels

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

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

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton (Arrow Hart).
 - 2. Hubbell Incorporated; Wiring Device-Kellems.
 - 3. Leviton Manufacturing Co., Inc.
 - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. All devices must be manufactured for use with modular plug-in connectors, shall comply with UL 2459 and shall be made with stranded building wire. Devices shall comply with the requirements in this Section.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Hospital-Grade, Tamper Resistant, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
 - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Mechanical shutter system to help prevent insertion of foreign objects. Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from

mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
 - 1. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
 - 3. Include indicator light that illuminates only when the GFCI has malfunctioned or tripped and no longer provides proper GFCI protection.
- B. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:
- C. Hospital-Grade, Tamper Resistant, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

2.5 TWIST-LOCKING RECEPTACLES

- A. Provide NEMA configurations as indicated on drawings.

2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
 - 1. Matching, locking-type plug and receptacle body connector.
 - 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
 - 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
 - 4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Kitchen Leash by APC Group
- B. Description:
 - 1. Molded Polypropylene Housing.
 - 2. Retracting cord with adjustable stop.
 - 3. SJOW Power cord, 10 foot; rated 200 degrees.
 - 4. Receptacles Dual Duplex NEMA 5-20R unless noted otherwise.

5. Impact: UL746C
6. Hose Down: CSA 6.8.2
7. Strain Relief: CSA 6.4
8. Flame Retardant: UL 94-94V-2
9. Mounting Bracket for ceiling mount.

2.8 CORD AND PLUG SETS

- A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
 2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
 3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
1. Single Pole and Three Way:
 - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - 1) [Eaton \(Arrow Hart\)](#).
 - 2) [Hubbell Incorporated; Wiring Device-Kellems](#).
 - 3) [Leviton Manufacturing Co., Inc.](#)
 - 4) [Pass & Seymour/Legrand \(Pass & Seymour\)](#).
- C. Key-Operated Switches, 120/277 V, 20 A:
1. Description: Single pole, with factory-supplied key in lieu of switch handle.
 - a. Public Restrooms and Other Spaces: Keyed switch, heavy duty specification grade (Pass & Seymour PS20AC1-WL or equivalent).
 - b. Behavioral Health Patient Accessible Spaces: Keyed locking switch, extra heavy duty specification grade security switch (Pass & Seymour PS20AC1-KL or equivalent). Coordinate common or differentiated keying of multiple switches with owner.
- D. Momentary Contact Switches: 2-Button, Single Pole, Low-voltage switch, mounts in standard single gang ring.
- E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
- F. Decora style rocker switches are not permitted.

2.10 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable full width slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module for off.
 - 1. These shall be used to control power modules driving large quantity of LED drivers using 0-10VDC control signals. This interface shall operate either 120 or 277 volt circuits, 200 ma rating.
- D. Decora style rocker switches are not permitted.
- E. LED and Low Voltage Dimmer Switches:
 - 1. Modular; compatible with LED drivers; trim potentiometer to adjust low-end dimming used where "LR" is shown, otherwise full range of 1% to 100% of lumen output or as noted.
 - 2. Maximum of four (4) buttons per gang.
 - 3. Dimmer shall operate either 120 or 277 volt circuits, 28 ma minimum rating.
 - 4. Touch dimming switches shall cover the full range of dimming with a single press-and-hold function in not more than three (3) seconds.
 - 5. Switches, with LED indicators to indicate both ON and OFF status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.
 - 6. Switches and switch hardware shall mount to standard wall boxes.
 - 7. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable unless specifically noted otherwise.
- F. Slide Dimmer Locations:
 - 1. Exam Rooms, Imaging Rooms, Operating Rooms, Procedure Rooms, Recovery Bays, and Imaging Control Rooms: Provide slide dimmer switches; do not provide touch dimming switches in these spaces except when an integrated component of an antimicrobial or integrated operating room ceiling system.

2.11 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws (behavioral health spaces): Metal tamper resistant TORX screws with head color to match plate finish.
 - 2. Plate-Securing Screws (other than behavioral health spaces): Metal with head color to match plate finish.
 - 3. Material for Finished Spaces, except Operating Rooms, Food Service Kitchens, and Behavioral Health Spaces: Smooth, high-impact thermoplastic.
 - 4. Material for Operating Rooms and Food Service Kitchen: ~~0.035-inch-~~ (1-mm-) thick, satin-finished, Type 302 stainless steel.
 - 5. Material for Behavioral Health Spaces: Smooth, nylon, unbreakable, with a minimum of two (2) screws per gang; provide Torx head tamper resistant screws.
 - 6. Material for Unfinished Spaces: Galvanized steel.

7. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable, weatherproof-in-use cover.

2.12 FLOOR SERVICE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Wiremold / Legrand.
- B. Type: Modular, flush-type, dual- or multi- service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Round, die-cast aluminum with satin finish.
- E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in owner's Section 27 00 00 requirements.
- G. Description by Device Type:

FB1	Flush, Dual Service, Furniture Feed. One .75" conduit for power and One 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFBFF Hubbell CFB2G30/2GCFFCVR
FB4	Flush, Dual Service, one piece finish flange. Four gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFG45S Hubbell CFB2G30/24GCCVR
FB6	Flush, Dual Service, one piece finish flange. Six gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB6S Evolution Hubbell CFB6G30/610GCCVR
FB8	Flush, Dual Service, one piece finish flange. Eight gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB8S Evolution
FB10	Flush, Dual Service, one piece finish flange. Ten gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB10S Evolution Hubbell CFB10G30/610GCCVR
FB11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers. Housing material shall be stamped steel above grade and cast iron at grade. Provide appropriate carpet and tile flanges.	Legrand 880MS(CS)/817/828 Hubbell B2431/S3825

2.13 POKE-THROUGH ASSEMBLIES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Wiremold / Legrand.
- B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Size: Selected to fit cored holes in floor and matched to floor thickness.
4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

C. Description by Device Type:

PT1	Flush, Dual Service, 4" Diameter Furniture Feed Poke-Thru. One piece finish flange. One .75" conduit for power, One 1.5" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand 4FFATC Hubbell PT73FFS/FRF3
PT2	Flush, Dual Service Capable, 4"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Two Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 4AT Evolution Hubbell S1R4PT
PT3	Flush, Dual Service Capable, 6"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Three Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 6AT Evolution Hubbell S1R6PT
PT8	Flush, Dual Service Capable, 8"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Five Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 8AT Evolution Hubbell S1R8PT
PT10	Flush, Dual Service Capable, 10"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Eight Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 10AT Evolution Hubbell S1R10PT
PT11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers.	Legrand RC7CTC Hubbell PT7FS/FRF

2.14 FINISHES

A. Device Color:

1. Wiring Devices Connected to Normal Power System: Gray in Food Service Kitchen. As selected by Architect in other finished spaces unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Power System: Red.
3. Isolated-Ground Receptacles: Orange.

B. Wall Plate Color:

1. Plastic covers: Match device color.
2. Cover plates for receptacles mounted above data racks in TEC and TDR rooms: Provide blue cover plates for receptacles served by UPS-A and red cover plates for receptacles served by UPS-B.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
 - 1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
 1. Install dimmers within terms of their listing.
 2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
 3. Install 0-10VDC control wiring in conduit with power wiring. Use conductors with insulation equivalent to insulation of power wiring.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor boxes and pokethroughs to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
 2. Test Instruments: Use instruments that comply with UL 1436.
 3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
 1. Line Voltage: Acceptable range is 105 to 132 V.
 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar

problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

- C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g). Submit test report indicting each receptacle and test result.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 13

FUSES

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. Cartridge fuses rated 600-V ac and less for use in enclosed switches, panelboards and enclosed controllers.,
 - 2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
 - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
 - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
 - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 3. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Ambient temperature adjustment information.
 - 2. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

- E. Comply with UL 248-11 for plug fuses.
- 1.7 PROJECT CONDITIONS
 - A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.
- 1.8 COORDINATION
 - A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.
- 2.2 CARTRIDGE FUSES
 - A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
- 2.3 PLUG FUSES
 - A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.
- 2.4 PLUG-FUSE ADAPTERS
 - A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.
- 2.5 SPARE-FUSE CABINET
 - A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
 - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
 - 2. Finish: Gray, baked enamel.
 - 3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
 - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

- 3.1 EXAMINATION
 - A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
 - B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
 - C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
 - E. Proceed with installation only after unsatisfactory conditions have been corrected.
- 3.2 FUSE APPLICATIONS
- A. Cartridge Fuses:
 - 1. Feeders: Class J, time delay.
- 3.3 INSTALLATION
- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
 - B. Install spare-fuse cabinet(s).
- 3.4 IDENTIFICATION
- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 26 28 16

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Receptacle switches.
 - 4. Shunt trip switches.
 - 5. Molded-case circuit breakers (MCCBs).
 - 6. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
 1. Test procedures used.
 2. Test results that comply with requirements.
 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. 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.
- E. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
 - 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than 2 weeks days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Siemens Industry, Inc.
 - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 6. Service-Rated Switches: Labeled for use as service equipment.
 - 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Siemens Industry, Inc.
 - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
 - 4. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. General Electric Company.
 - 3. Siemens Industry, Inc.
 - 4. Square D; by Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I^2t response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
 - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
 - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Kitchen Locations (other than Wash Down Areas): NEMA 250, Type 4X, stainless steel.
 - 4. Kitchen Wash Down Areas: NEMA 250, Type 4X, stainless steel.
 - 5. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
 - 6. Imaging Rooms: Flush Mount.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Perform the following infrared scan tests and inspections and prepare reports:

- a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 26 51 19

LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior solid-state luminaires that use LED technology.
 - 2. Lighting fixture supports.
 - 3. Standby Emergency Power supplies for individual luminaires
- B. Related Requirements:
 - 1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 26 09 36 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
 - 3. Section 26 09 43 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Arrange in order of luminaire designation.

2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaires.
 4. Include emergency lighting units, including batteries and chargers.
 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project. Report data compliant with IES LM-79 and IES LM-80. Only Absolute Photometry is acceptable.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products (NVLAP).
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.
- C. LEED Submittals:
1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
 2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products 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. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- E. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
1. Include Samples of luminaires and accessories involving color and finish selection.
- F. Samples for Verification: For each type of luminaire.
1. Include Samples of luminaires and accessories to verify finish selection.
- G. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting luminaires.
 2. Suspended ceiling components.
 3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
 4. Structural members to which equipment and or luminaires will be attached.
 5. Initial access modules for acoustical tile, including size and locations.
 6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.

- c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.
 - g.
- 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer or a qualified testing agency holding NVLAP accreditation.
- G. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
 - 1. Provide a list of all lamp types LED Modules and LED Drivers used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents citing lighting fixture types.
 - 1. Lamps: 2 for every 100 of each type and rating installed. Furnish at least one of each type.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
 - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
 - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 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.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- 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.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. Bulb shape complying with ANSI C79.1.
- F. Lamp base complying with ANSI C81.61 or IEC 60061-1, where employing universal base or mount.
- G. CRI of minimum 80. CCT of 3500 K.
- H. L70 rated lamp life of 50,000 hours.
- I. Lamps dimmable as indicated or 0.5 to 100 percent of maximum light output, via 0-10 VDC control signal or, where indicated, Digital Dimming Control Signal.
- J. Field Replaceable driver.
- K. Nominal Operating Voltage: Universal voltage 120 V ac or 277 V ac unless scheduled differently.
 - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- L. Housings:
 - 1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
 - 2. Anodized or powder-coat finish.

2.3 LED LAMPS AND DRIVERS:

- A. Minimum CRI Ra- 82 or as specified.
- B. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. LED Rated life L70 of 50,000 hours per (IES LM-80). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.
- E. Flicker: No visible or detectable flicker, operating on all dimmed intensities.

- F. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level as scheduled.
- G. Inrush current shall be reported and the lighting controls adjusted for inrush of LED product supplied.
- H. THD: THD shall not exceed 80%.
- I. Minimum driver efficiency shall be 83%.
- J. LED module shall be replaceable in the field using modules with digitally traceable matching modules.
- K. Luminaire shall be NRTL Listed at intended operating temperature.
- L. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.
- M. Approved Manufacturers- Drivers
 - 1. General Electric.
 - 2. Philips.
 - 3. Osram / Sylvania.
 - 4. Lutron
 - 5. EldoLED
 - 6. Thomas Research
- N. Approved Manufacturers- LEDs
 - 1. General Electric
 - 2. Philips
 - 3. Osram
 - 4. Cree
 - 5. Xicato
 - 6. Nichia
- O. Approved Manufacturers for Luminaires shall be as scheduled.

2.4 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
 - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

2. Glass: Annealed crystal glass unless otherwise indicated.
 3. Lens Thickness: At least **0.125 inch (3.175 mm)** minimum unless otherwise indicated.
- D. Housings:
1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
 2. Anodized or powder-coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and line wattage. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI for all luminaires.

2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: **1/2-inch (13-mm)** steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, **12 gauge (2.68 mm)**.
- D. Rod Hangers: **3/16-inch (5-mm)** minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

2.7 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.

- E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with LED light source and driver, including dimming driver.
 - 1. Emergency Connection: Operate luminaire continuously at an output of 5 watts upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
 - 2. Operation: Relay automatically turns driver/led module on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F with an average value exceeding 95 deg over a 24-hour period.
 - b. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F
 - c. Humidity: More than 95 percent (condensing).
 - d. Altitude: Exceeding 3300 feet
 - 4. Battery: Sealed, maintenance-free, lead-acid type.
 - 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 - 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.

- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and repair.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- D. Flush-Mounted Luminaire Support:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- E. Wall-Mounted Luminaire Support:
 - 1. Attached to structural members or approved backer plate in walls
 - 2. Do not attach luminaires directly to gypsum board.
- F. Ceiling-Mounted Luminaire Support:
 - 1. Ceiling mount with four ~~5/32-inch~~ (4-mm) diameter steel wire or aircraft cable supports.
 - 2. Ceiling mount with hook mount.
- G. Suspended Luminaire Support:
 - 1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
 - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Comply with requirements for startup specified in Section 26 09 43 "Relay-Based Lighting Controls."

3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
 - 1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
 - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 27000

**GENERAL COMMON CONDITIONS FOR ALL
COMMUNICATION SECTIONS**

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, and other documents as designated, apply to this Document.
- B. See Division 7 and section 27 01 00 Part 3 for additional requirements.

1.2 RELATED SECTIONS

- A. Specifications throughout all Divisions of the Project Manual are directly applicable to this section, and this section is directly applicable to them.
 - 1. All Division 27 Sections
 - 2. Requirements of the following Division 26 sections apply to this section.
 - a. Basic electrical requirements
 - b. Basic electrical materials and methods
 - c. Grounding, earthing, and bonding.
 - 3. Division 21 Fire Suppression
 - 4. Division 22 Plumbing
 - 5. Division 23 HVAC
 - 6. Division 28 Electronic Safety and Security

1.3 SUMMARY

- A. The work on many processes in this section is not part of Division 27. The respective trades shall include their portions, and administration topics that are applicable to all Division 27 Sections in their proposals.
- B. This document is based upon the 2018 Construction Specification Institute (CSI) Master Format numbers and titles for sections within Division 27: Communications.
- C. Where IT or Owner representation is stipulated in this Division, it shall be provided by the Data Center Operations.

1.4 SUBMITTALS

- A. Product data shall be supplied for any parts/equipment that do not match the specified part number.
- B. Shop drawings
 - 1. Labeling schedules and layouts in owner designed electronic format.
 - 2. Cabling administrative drawings

1.5 CONDITIONS

Drawings and General provisions of the contract, including communications section and, Supplementary General Conditions, architectural plans and specifications, requirements of Division 1, electrical, mechanical, plumbing, audio visual, security, and telecommunications specifications and plans apply to the communications section, and shall be considered a part of

this section. The contractor shall read all sections in their entirety and apply them as appropriate for work in this section.

- A. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div. 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- B. Conflicts:
 - 1. Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the drawings determine the nature and quality of the installation, materials, and tests. The quantities are derived from the drawings, details, listings, and manufacturer's directions.
 - a. Final order counts and distances are the contractor's responsibility.
 - 2. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quality or quantity shall be submitted, estimated, and installed.
 - 3. Clarification with the Owner and/or Owner's Representative about these items shall be made prior to the ordering and installation.
- C. Owner / Contractor
 - 1. The Architect/Project Manager will submit appropriate scope of work information that will allow the contractor to appropriately plan and bid the project.
- D. Contractor
 - 1. Furnish all labor, materials, tools, equipment, and services for the installation described herein. Provide add/deduct unit pricing for all components as part of the bid response. Base fixed price add/deduct units on an average cable length of 175 linear feet.
 - 2. The Contractor shall procure and maintain for the duration of this agreement insurance against claims.
 - 3. Use of Subcontractors: Successful bidder shall inform the Owner's contact and/or General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired. The Owner or Owner's designated contact must approve the chosen Subcontractors in writing prior to the Subcontractor's hiring and start of any work. The low voltage Subcontractor must be approved and certified. Refer to the listing in appendix 7.
 - 4. Use of Subcontractors: The Contractor's designated project manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which include all specifications and drawings) to ensure a quality installation.

1.6 SCOPE OF WORK

- A. This establishes a communications infrastructure to be used as signal pathways for voice, high-speed data transmission, and other low voltage services. Contractor shall:
 - 1. Comply with all Master Specifications documents and the following requirements for a complete project installation.
 - 2. Provide a structured cabling system as described hereafter that includes, but is not limited to, supplying, installing, labeling and testing of fiber backbone, fiber and voice riser cable; data copper, fiber, and voice copper horizontal cabling, cable connectors, communications outlets and terminations, patch cables, and equipment racks/cabinets for networking hardware and patch panels.

3. All requirements and specifications will be enforced. Cable pathways and runs to individual outlets are not shown in their entirety but should be provided as if shown in their entirety.
4. Coordinating with electrical tradespersons to verify conduit routing does not cause cabling to exceed allowable 295' link length.
5. Follow industry standard installation procedures, including BICSI Installation Standard and guidelines as well as specified manufacturers standard recommended procedures and installation practices for communications cable to ensure that the mechanical and electrical transmission characteristics of this cable plant and equipment are maintained.
6. Division 27 work shall be performed by an approved, certified installer.
7. The low voltage communications Subcontractor shall complete non-concealed work.

1.7 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of the Contract shall be applicable to this Project.
- C. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.
- D. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.
- E. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed in **Appendix 04**.

1.8 DEFINITIONS

- A. Definitions and Abbreviations are listed in **Appendix 05**:

PART 2 - PRODUCTS

2.1 PRODUCTS AND WORK NOT included BY DIVISION 27

- A. Others shall separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the installation process. Such items may not be indicated in the documents. Contractor shall coordinate with the Owner and his suppliers when considering:
 1. Provision and installation of phone systems, computer hardware, and related networking software and equipment.
 2. Provision and installation of multi-port routers, hubs in communications rooms.
 - a. TEC/TDR UPSs are owner provided, and contractor installed.
 3. Communications grounding bus bars and grounding wires connecting to the main building electrode system by Division 26.
 4. Dedicated power panels, ground bus bars, circuits, and utility outlets.
 5. Installation and finishing of fire-rated plywood backboards.
 6. Building mechanical ductwork, cooling/heating system, and environmental control sensors.

7. Communication pathway devices such as conduits, conduit sleeves, back boxes, and penetrations in walls and floors. Including, but not limited to concealed work, office spaces and open areas.
8. Provision and installation of modular furniture and millwork.

PART 3 – PENETRATIONS

3.1 THE WORK IN THIS SECTION IS IN DIVISION 7 CONTRACT; AND VERIFIED COMPLETE AT PROJECT TURNOVER.

- B. Wall Penetrations - Fire - Smoke – Sound
 1. All fire, smoke, and sound wall penetrations must be correctly done to protect the safety of patients and employees. A facility is designed/architected and built with fire integrity that must not be lost as the building is modified over its lifetime.
 2. The items listed often penetrate 1 – and 2 – hour fire-resistance-rated (FRR) assemblies. General requirements for filling the space between the item in question and the wall are found in NFPC 101® Section 8.2.3.2.4.2. There is the option to either fill the space with appropriately rated fire-stop material or protect the space with an approved device designed to maintain the fire resistance of the wall. (Preferred method)
 3. If a sleeve is used around the item that transverses the wall, the sleeve must be installed into the wall without any opening between the sleeve and the wall. The open space within the sleeve must then be filled with appropriately rated fire stop material.
- C. All items listed in 1 through 2 must have penetrations in fire-resistance-rated assemblies filled to maintain the integrity of the fire barrier.
 1. Conduits
 - a. When conduit passes through a wall that is either rated or must be fire-stopped due to lack of sprinklers in the compartment, it is essential to fill any gap around the conduit as described above.
 2. Cables/Wires
 - a. Sometimes cables or wires are passed through a penetration contained in a fire wall as a single installation. This often happens in a health care organization with communication cables. Even in these cases, the penetration must be patched appropriately.
 3. NOTE: Fire, smoke, and sound wall penetration are also governed by local and state building codes.
 4. NOTE: This requirement applies to all departments, organizations, employees, and/or vendors who perform structured cable work in the facilities for:
 - a. Telephony and Computer networks, fire, smoke, and sound wall penetrations, alarm systems, security systems, HVAC Control or sensors, patient entertainment systems, announcing systems, nurse call, telemetry, RFID, etc.
 5. NOTE: While this document is written specifically for low voltage wiring, the JCAHO standards apply for any fire or smoke wall penetration. As you perform work in the facility, if you note any existing penetrations that are not up to standard, please notify the construction Project Manager immediately.
 6. While Facility Engineering has the overall responsibility, each department, organization, employee, and/or vendor has the responsibility to follow the process in obtaining a permit from facility engineering before work is started and to follow the guidelines to maintain the fire/smoke wall integrity.
- D. Process:
 1. NOTE: This process applies to any person, group, and/or vendor who performs low voltage cable installations at any Intermountain facility or clinic.
 - a. Fire/Smoke Walls

- 1) Any Vendor, department, and/or person needing to do any cable work that involves wall penetrations, adding to existing or new, are required to obtain a "Above Ceiling Permit" from Facility Engineer.
 - b. Above Ceiling Work
 - 1) Any vendor, department, and/or person needing to do any cable work above ceiling tiles, adding to existing or new, are required to obtain an "Above Ceiling Permit, ICRA Permit and any other required permits.
 - c. Above Ceiling Permit to be obtained from Facilities Management
 - 1) The permit requires detailed information as to what work is being done, and where the work will be done. The permit will also state the current approved sealing compound for the facility and specific requirements for conduits etc.
 - 2) There may also be specific rules regarding how work may be conducted in certain areas of the hospital. NOTE: Different manufacturers' sealing products can NOT be used in the same penetration. Therefore, if an additional cable is added to an existing penetration, and you don't have the same brand of caulk, you must remove all the caulk and re-do the seal completely.
 - d. ICRA Permit to be obtained from Infectious Preventionist
 - e. Hot Work Permit to be obtained from Facilities Engineer
2. Quality of Work
 - a. Facility Engineering Orientation

2.2 MEASUREMENT PROCEDURES

- A. The Contractor shall
 1. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
 2. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements and scale on shop drawings.
 3. Coordinate fabrication schedule with construction progress to avoid delaying the work.
 4. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.
 5. When approved, proceed with fabricating units without field measurements.

2.3 CHANGES

- A. ALTERNATES:
 1. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers' specifications in writing for Owner approval prior to purchase and installation.
 2. Substitutions of material by the Contractor shall be in writing complete with written manufacturers' specifications. The material substituted shall not void, alter or change manufacturers' structured cabling system warranty.
 3. Contractor shall:
 - a. Provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing.

- b. Promptly respond to these changes with a complete material list, including pricing, and labor in writing, presented to the Owner for approval. Also include unit pricing.
 - c. Do not proceed with any additional scope of work without a signed approval by the Owner.
 - 4. Owner will not pay for additional work performed by the Contractor without signed approval of these changes. The contractor will submit a copy of the signed change order upon billing.
 - 5. The Owner's Infrastructure Cable team will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect. No substitute shall be ordered, installed, or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.
- B. SUBSTITUTION PROCEDURES
 - 1. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
 - 2. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Include in each request for substitution:
 - a. Product identification, manufacturer's name and address.
 - b. Product Data: Description, performance and test data, reference standards, finishes and colors.
 - c. Samples: Finishes
 - d. Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
 - e. Data relating to changes required in construction schedule.
 - f. Cost comparison between specified and proposed substitution.
 - 3. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
 - 4. The Owner will be the final judge of acceptability, with review by the Owner's Representative and the distribution of the acceptance by the Architect.
 - 5. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Contractors shall supply all city, county, and state telecommunication cabling permits required by appropriate governing agency.
 - 2. Prior to commencing work, the Contractor and staff shall secure all required Intermountain Health permits including, but not limited to; facility sign in, ceiling work permits, hot work permits, and confined space permits.
 - 3. Contractors shall be city, county, and state-licensed and/or bonded as required for communications/low voltage cabling systems work.
- B. Certifications:
 - 1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
 - 2. The contractor shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice and video network systems.

3. The contracting firm shall have installed similar-sized systems in at least ten (10) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Certification shall include, but not be limited to, items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
 4. Contractors shall provide certificates for the appropriate insurance coverage as defined in contract documents.
 5. All installation personnel that will be assigned to this project shall be listed in a qualification document. 50% of the personnel working on the job site shall have a minimum of 3 years' experience in the installation of the types of systems, equipment, and cables specified in this document. Any personnel substitutions shall be noted in writing to Owner's Data Center Operations Infrastructure Cabling representative prior to commencement of work.
 7. BICSI ITS Cabling Installation Program Installer Level 1 or 2 or Technician certifications may be substituted in lieu of the 3-year requirement. All cabling installers shall be trained and certified by the cable manufacturer for communication cabling installations and maintenance of said materials.
 8. Refer also to General Conditions.
- C. Administrative Requirements and Coordination:
1. The Contractor shall:
 - a. Ensure that all technicians performing work have obtained badge access 48 hours prior to scheduled start.
 - b. Provide a specified contact person (name and contact number) for coordination to attend project meetings with the communication consultant, the Owner, and others.
 - c. Coordinate work of this section with Owner's system specifications, workstations, equipment suppliers, and installers.
 - d. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) under the direction of the General Contractor to resolve procedures and installation placement for cable trays and cable bundle pathways. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components. Damage by Contractor to the craftwork of others will be remediated at the Contractor's expense in a timely manner.
 - e. Exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in meetings and distributed records to other participants, Owner and communication consultant.
 - f. Arrangement, layout, and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment as directed by Data Center Operations. Tasks shall be coordinated with the Owner's Data Center Operations team, and other trades' installation representatives.
 - g. Where installed, confirm exact locations and method of mounting outlets in modular furniture. Follow furniture manufacturers' written instructions for installing cable and devices in modular partitions. Obtain modular furniture and power pole locations from the General Contractor. Wiring locations noted in plans along walls for modular furniture are approximate and will have to be determined by Contractor at time of installation. Field condition

adjustments for installation may have to be made and coordination efforts with the mechanical and electrical contractor for pathway must take place early in the project to comply with maximum 40% conduit fill factor requirements.

- h. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents. Unit pricing shall apply.

D. Contract Administration:

- 1. Change orders shall be submitted to the Owner/Project Manager complete with price breakdown and description for approval before any work is done.
- 2. Owner's Data Center Operations Representative will provide job field reports upon inspection of Contractor's installation, materials, supporting hardware, coordination with other trades and progress to schedule to the Owner's project manager.
- 3. Job Field Report outline:
 - a. General installation progress in relation to scheduled work made by the Contractor up to that date.
 - b. All deficiencies noted in the cable installation need to be corrected by the Contractor.

E. Pre-Installation Meetings - Contractor shall:

- 1. Attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section.
 - a. Agenda: This venue is to ask and clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/and Data Center Operations Infrastructure Cabling representative.
 - b. Attendance: Communications project manager/supervisor shall attend meetings arranged by General Contractor, Owner's Data Center Operations Infrastructure Cabling representatives, and other parties affected by the work of this document.
 - c. All individuals who will be installers of communication cables and equipment in an on-site supervisory capacity shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation of, or install, terminate, or test communications cables on the project. This includes supervisors, project managers, and lead installers of this project.

F. Request for Change (RFC)

- 1. A Request for Change shall be opened and approved by the Change Approval Board prior to any modifications, attachments, or other activities that may affect production systems.
 - a. Policy and details available through the Data Center Operations Infrastructure Cable Representative.

G. Post-Installation Meetings:

- 1. Schedule Div. 27 Final Inspection
- 2. At the time of substantial completion, or shortly thereafter, the low voltage Sub-Contractor shall call and arrange for a post-installation meeting to present and review all submittal documents to include, but not limited to as-built drawings, test reports, warranty documentation, etc. Attendees shall be Owner staff, Owner's Representative, General Contractor, and others that the General Contractor deems appropriate.
- 3. At this meeting the Contractor shall present and explain all documentation, including test results, and ask for feedback on its completeness. Any discrepancies or

deviations noted by and agreed to by participants shall be remedied by the Contractor and resubmitted within one week of the meeting.

3.2 DELIVERY, STORAGE, AND HANDLING

- A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.
- B. Contractor Shall:
 - 1. Be responsible for prompt material deliveries to meet the contracted completion date.
 - 2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
 - 3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
 - 4. Equipment shall be delivered in original packages with intact labels and clearly marked identification.
 - 5. Materials shall not be damaged in any way and shall comply with the manufacturer's operating specifications.
 - 6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
 - 7. Material Contractor shall be responsible for all handling and control of equipment. Material Contractor is liable for any material loss due to delivery and storage problems.
- C. The owner/General Contractor shall supply a list of security requirements for the Contractor to follow.

3.3 PROJECT/SITE CONDITIONS

- A. For all environmental recommendations, refer to the master Architectural section.
- B. For all security recommendations, refer to related Division 01.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractors will remove burrs, dirt, and construction debris. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.
- D. The contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- E. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.
- F. The contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

3.4 CLEANING

- A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.
- B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been performed daily, unless designated for storage.
- C. The Contractor will damp clean all surfaces prior to final acceptance by the Owner.

END OF SECTION

SECTION 270100

OPERATION AND MAINTENANCE OF COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 INTRODUCTION

- A. To make the approval of such a large topic possible, the structured cable topic has been broken into its subcomponents and each subcomponent was completed, reviewed, and approved in turn. The result is this comprehensive guideline that should provide adequate guidance on this topic.

PART 2 - PRODUCT

2.1 KEY POINTS

- A. Category 6A shielded foil over unshielded twisted pair (F/UTP) is the only approved standard for cabling.
 - 1. Specifically, Siemon category CAT6A F/UTP (foil over unshielded twisted pair) cable and associated patch panels, wall plates and jacks; for all Intermountain health properties.
 - 2. Only Siemon certified contractors or certified Intermountain Health cable technicians will install structured cable at Intermountain Health facilities.

2.2 IMPLEMENTATION

- A. This guide is to be used for New Construction and Remodels. These standards will be implemented over time in existing cabling environments as rework is performed.
- B. If there is a current need to connect servers at 10GBaseT and the only option is copper, CAT6A F/UTP is required. New Server connections shall be a minimum OS1 Single Mode Fiber.
- C. Installations already in place do not require removing or replacing existing cabling CAT5e or newer. All new cabling shall follow the recommendation to use CAT6A F/UTP cabling.

2.3 STANDARD PRODUCT

- A. The Approved cable type for horizontal cabling is CAT 6A F/UTP.
 - 1. The Approved Standard Manufacturer for Intermountain Health's horizontal cabling is:
 - a. **Siemon Company USA**
101 Siemon Company Drive
Watertown, CT 06795
 - 2. Approved Suppliers of Siemon cable, patch panels, jacks, and parts are listed in Appendix 06:

PART 3 - EXECUTION

3.1 HORIZONTAL CABLING

- A. Horizontal Subsystem is the portion of the cabling system that extends from (and includes) the work area telecommunications outlet/connector to the Floor Distributor (FD)/Horizontal Cross-connect (HC) in the telecommunications room (TDR). It consists of

the communications outlet/connector, the horizontal cable, optional consolidation point,

and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Floor Distributor/Horizontal (FD/HC) Subsystem located in the Telecommunications Room (TDR).

1. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
 2. Current Siemon Approved/Certified Cable Installers for Siemon Network are listed in Appendix 07.
- B. Reliability of the horizontal cabling system is critical to the operation of IS equipment throughout a facility. Installing the cable is extremely labor intensive and there are several learned skills used to correctly install the cable. Cable installers are certified, and installers must demonstrate the ability to install the cable correctly to be certified. If the cable is installed by a certified installer and is installed in accordance with the manufacturer's guidelines, the manufacturer will warranty the cable installation.
- C. The manufacturer also requires the cables to be individually labeled and 100% tested and certified. Cable testing and certification equipment is usually expensive and is not commonly available at the facility or by many telecom installers. Certified Installer companies are required by the manufacturer to be knowledgeable in the use of "Qualified" Field Testing equipment and provide test results for warranty registration.
1. The contractor is to verify with the manufacturer the current "Qualified" tester manufacturers and the current operating software.
 2. Contractors will provide test results in the operating software format (not PDF, text or Word) to Intermountain Health upon completion.
- D. Much of the cable is installed in walls and in the ceiling and usually lasts the lifespan of the building. As with most technology, the lifespan of cable is its usability and applicability to its use on future computing technology.

END OF SECTION

SECTION 270113

WARRANTY, PRODUCT AND SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

PART 2 - PRODUCTS

2.1 STANDARD WARRANTY

- A. Contractor shall provide a minimum one (1) year warranty on installation and workmanship PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system and shall commit to make available local support for the product and system during the Warranty period.
- B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a Manufacture Warranty certificate.
- C. Either a permanent link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

2.2 EXTENDED WARRANTY

- A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its products. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.
 - 1. Special Project Warranty: A full end-to-end written warranty mutually executed by manufacturer and the principal Installer, agreeing to replace and install voice/data distribution system components that fail in materials or workmanship, or do not meet manufacturer's official published specifications and performance criteria within the special Project warranty period specified below. This shall cover applications assurance, cable, and connecting hardware including both labor and materials. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against the Contractor under the Contract Documents.
- B. A twenty-five (25) year warranty available for the Category 6A Z-MAX copper structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. The fiber warranty will be an XGLO twenty (25) year warranty, which is based on using laser optimized single mode fiber as minimum.
 - 1. Performance claims based on worst case testing and channel configurations.

2. Special Project Warranty Period: 25 years minimum, beginning on the date of Substantial Completion.
3. Siemon Certified Warranty Requirements:
 - a. Upon Completion of the project, Intermountain Health must receive the Full Warranty Documentation from The Siemon Company before final retention funds are released to the general contractor, electrical contractor and structured cabling subcontractor if applicable.

2.3 MAINTENANCE

- A. Support Availability: The Contractor shall commit to making available local support for the product and system during the Warranty or Extended Warranty period.

END OF SECTION

SECTION 270119

FIELD TESTING AND REPORTING

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. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

1.2 SYSTEM DESCRIPTION

- A. The owner reserves the right to be present during any or all testing.
- B. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to fiber backbone, riser system, horizontal data and voice cabling with associated terminations, mounting equipment, cable pathway and management systems, testing and other items/materials, as specified in drawings, these specifications, and contract documents.
- C. The Contractor's BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all documents prior to submitting. The Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.
- D. Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.
- E. The contractor shall submit the required Field Test Reports in the format and media specified, upon completion of testing the installed system.
- F. Contractor shall deliver manufacturer's signed long-term Warranty of installed cabling system to include all components that comprise the complete cabling system. Delivery to be affected within two weeks of the time of final punch list review. Failure of any component to pass system component tests shall be promptly corrected, repaired or replaced to meet standards compliance.

1.3 PREFERRED OWNER INSPECTION & TEST CHECKPOINTS

- A. DCO & ICT Inspection Milestones & Responsibilities need to be coordinated into master project plan to allow the GC to make timely arrangements. All are per floor and/or phase.
 - 1. ICT & DCO = Framing, during and/or after boxes & conduits are in place, prior to sheetrock.
 - 2. ICT = When cable basket is starting to be installed.
 - 3. ICT = When cable basket is ready, but prior to starting to pull cable.
 - 4. ICT & DCO = When TDRs are ready for racks and ladders.
 - 5. DCO = When anchoring racks and laying out equipment.
 - 6. ICT & DCO = When TDR environmental requirements are ready, the room is dust free, and securable. See attached TDR checklist.
 - a. The TEC and TDRs must be high on the build timeline and be completed early in the construction to accommodate the building systems to be tested and commissioned, such as BAS, Security, and Wireless Network.
 - 7. ICT = When trim and testing are in progress.
 - 8. OTHERS

- a. Depending on the project, the manufacturer will inspect 1 or 2 times.
- b. DCO or ICT = When problems or questions arise.

PART 2 - PRODUCTS

2.1 SITE TESTS & INSPECTIONS

- A. Prior to pulling the cable, the cabling contractor shall schedule an inspection of the pathways with a member of the Data Center Operations Infrastructure cabling team.
- B. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
 - 1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
 - 2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
 - 3. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
 - 4. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
 - 5. Manipulation of tester parameters on a failing test to achieve a passing test is unacceptable.
- C. These specifications will be strictly enforced. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing the cable type in use), and documentation as specified below. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at the final walk-through in soft copy.
- D. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable. Without the contractor's prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor's expense (including respective connectors).
- E. Testing is still required for non-compliant cabling. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground. The test results must be within acceptable tolerances and shall be submitted with the Owner's acceptance document.

2.2 CABLE TESTING PLAN

- A. The Contractor shall:
 - 1. Provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber optic components and accessories prior to beginning cable testing. The following minimal items shall be submitted for review:
 - a. All testing methods that clearly describe procedures and methods.
 - b. Product data for test equipment
 - c. Certifications and qualifications of all persons conducting the testing.
 - d. Calibration certificates indicate that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
 - 2. Include validation, and testing. Owner will require that the telecommunications cabling system installed by the Contractor be fully certified to meet all necessary requirements to be compliant with referenced IEEE and TIA specifications and vendor's warranty.
 - 3. Will determine the source/cause of test failure readings and correct malfunctioning component and/or workmanship within each channel or permanent link and retest to demonstrate compliance until corrected failure produces a passing result.

2.3 CABLE TESTING REPORTS

- A. The Contractor shall submit cable test reports as follows:
 - 1. Submit certified test reports of Contractor-performed tests.
 - a. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
 - b. (1) set of electronic test reports shall be submitted and clearly identified with cable identification.

PART 3 - EXECUTION

3.1 TEST EQUIPMENT

- A. All transmission testing of balanced twisted-pair cables shall be performed with an approved Level III balance twisted pair tester found on the Siemon Ally Website. The latest version of software shall be installed prior to performing testing. Refer to the Siemon Warranty Documents for proper testing requirements of associated cable and components.
- B. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
- C. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
- D. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

3.2 TEST METHOD / CRITERIA

- A. Copper Testing
 - 1. Testing of all newly installed cable channels shall be performed prior to system cutover.
 - a. Visually inspect F/UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-C.1.
 - b. Visually confirm Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
 - c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
 - d. Test F/UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - e. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C, and those required by manufacturer to validate and start warranty.
 - 2. Copper Testing all 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device, that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex (Level IIe or IIIe balanced twisted pair field test device). Use only test cords and adapters that are qualified by test equipment manufacturers for channel or link test configuration.
 - 3. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified below:
 - a. Category 3 balanced twisted-pair backbone cables, for the channel shall be

- 100 percent tested according to ANSI/TIA/EIA-568-C.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
- b. 500 MHZ Category 6A balanced twisted-pair horizontal and backbone cables, shall be 100 percent tested.
- 4. F/UTP Performance Tests
 - a. Wire map.
 - b. Length (physical vs. electrical, and length requirements)
 - c. Insertion loss
 - d. Near-end crosstalk (NEXT) loss
 - e. Power sum near-end crosstalk (PSNEXT) loss
 - f. Equal-level far-end crosstalk (ELFEXT)
 - g. Power sum equal-level far-end crosstalk (PSELFEXT)
 - h. Return loss
 - i. Propagation delay
 - j. Delay skew
 - k. F/UTP Shield continuity
 - 5. Final Verification Tests: Perform verification tests for F/UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
 - 6. Document data for each measurement. Data for submittals shall be printed in a summary report.
 - 7. End-to-end cabling will be considered defective if it does not pass tests and inspections.
 - 8. Prepare and submit test and inspection reports.
- B. Horizontal Fiber Testing
 - 1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
 - 2. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125 μ m and 62.5/125 μ m multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
 - 3. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
 - 4. The horizontal link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.
 - C. Backbone Fiber Testing
 - 1. Fiber backbone cables shall be 100% tested for insertion loss.
 - 2. Insertion loss shall be tested at both 850 nm and 1300 nm for 50/125 μ m and 62.5/125 μ m multimode cabling and both 1310 nm and 1550 nm for 8.5/125 μ m single mode cabling and in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
 - 3. Insertion loss shall be tested at 1310 and 1550 for single-mode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
 - 4. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
 - 5. The backbone link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations for any fiber cable greater than 90m (295 ft.) shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.

3.3 DEMONSTRATION

- A. Include training for appropriate IT staff in numbering system and documentation system

methods and record keeping. Proper fiber terminations and fiber jumper installations.

END OF SECTION

SECTION 270133

**SHOP DRAWINGS, PRODUCT DATA, SAMPLES
DESIGN RECORDS & EXISTING CONDITIONS**

PART 1 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

1.1 SUBMITTALS

- A. The Contractor:
 - 1. Shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until Owner has approved the respective submittal. Such work shall be in accordance with approved submittals.
 - a. Shop drawings as required by the owner or as a minimum to include a minimum of two sets of a plan view and elevations of all work to be installed. The Contractor shall make any corrections required by the owner or the owner's representative or consultant team, file with him two corrected copies and furnish such other copies as may be needed. The consultant's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing and called to the Architect's attention such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.
- B. The Contractor shall provide a copy of the Certified Test Data Sheet, available from the delivering distribution warehouse for either a full run or cut piece from the Master Reel of the fiber cable to be installed
 - 1. The Certified Test Data Sheet shall include the Master Reel number, cable description, a passing test result with details, test equipment description, date certified, and a certificate of compliance stamp, and shall be included in the O&M Manual as a component of the final deliverables submittal package.

1.2 DRAWINGS

- A. Shop Drawings
 - 1. The Contractor shall:
 - a. Submit catalogue cut sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten, marked with an arrow or underlined to indicate exact selection.
 - b. Identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.
- B. Record Drawings
 - 1. Drawings for the cabling system infrastructure elements shall be maintained and kept on file by the Siemon Certified Installer (Company) for the entire term of the warranty. Drawings shall include:
 - a. Horizontal cable routing and terminations
 - b. Telecommunications outlets/connectors
 - c. Backbone cable routing and terminations
 - d. Telecommunication Spaces (TS)
- C. Samples

1. For workstation outlet connectors, jack assemblies, housing and faceplates for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color before purchasing materials. Face plates shall match the electrical face plates in Color and material type.
 2. Upon request, provide samples for workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration
 3. Sample mock-up rooms may be required in some areas to ensure proper equipment placement and fit.
- D. Qualifications:
1. The Contractor shall provide the appropriate documentation to comply with the requirements set forth in Section 01 43 23 Qualifications, included with, and at the time of, bid submittal.

PART 2 - SUSTAINABLE DESIGN RECORDS AND REPORTS

2.1 DRAWINGS

- A. Closeout Submittals (As-built Drawings):
1. Communications Design drawings are to be supplied to the Architect to prepare the master "As-Built" drawings.
 2. As-Built drawings shall be in a format that is compatible with the format used by the Architect and consultant. Dimensions and scale of the drawing sheets submitted shall match the size of the drawing used for the contract documents and shall include the cable numbers labeled in accordance with this document.
 3. Utilize normal recognized drafting procedures that match standards, Architect and consultant guidelines and methodology.
 4. The As-Built drawings shall incorporate all changes made to the building identified in, but not limited to, addendum, change notices, site instructions or deviations resulting from site conditions.
- B. Contractor shall:
1. Clearly identify any resubmitted drawing sheets, documents or cut sheets either by using a color to highlight or cloud around resubmitted information.
 2. Maintain drawing numbering or page/sheet scheme consistency as per previously issued drawings/documents.
 3. Provide dimensioned plan and elevation views of networking components, showing:
 - a. All communications data/voice outlet locations complete with outlet/cable labeling.
 - b. Cable routing paths of communications cables to identified infrastructure pathways.
 - c. All rack and cabinet locations and labeling thereof.
 - d. One-line diagram of equipment/device interconnecting data/voice cabling of the data and voice systems.
 - e. Standard or typical installation details of installations unique to Owner's requirements.
 - f. Graphic symbols and component identification on detail drawing shall conform to the latest ANSI/TIA 568-C, ANSI/TIA 569-B, ANSI/TIA 606-A and ANSI/NECA/BICSI 607-A conventions.
 4. Submit one soft (compatible with Microsoft software) and hard copy with project deliverables within three weeks after substantial completion.
 5. Hard copy of floor plans for record shall be plotted to a standard, saleable, identified drawing scale.

2.2 RECORDS AND REPORTS

- A. All records shall be created by the installation contractor and turned over at the completion of work.
 - 1. The format shall be computer based
 - a. Soft copies and hard copies shall be part of the As-built package.
 - b. The minimum requirements include:
 - 1) Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
 - 2) Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
 - 2. Test documentation on all cable types shall be included as part of the As-built package.
- B. All Siemon Warranty Registration documents shall be included.
- C. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
 - 1. Cable Reports
 - 2. Cross-connect Reports
 - 3. Connecting Hardware Reports

PART 3 - EXISTING CONDITIONS SITE SURVEY

3.1 SITE SURVEY

- A. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

END OF SECTION

SECTION 270143

**QUALIFICATIONS AND REQUIRED TRAINING
FOR CONTRACTORS AND INSTALLERS**

PART 1 - GENERAL INSTALLER QUALIFICATIONS

1.1 ENTITIES

- A. Communications contractors
 - 1. The Communications Contractor shall at a minimum possess the following qualifications:
 - a. The contractor shall be a Siemon Certified Contractor with valid up to date contract certification and in good standing with the Siemon Company.
 - b. Be in business for a minimum of five (5) years.
 - c. The contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.
 - d. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 - e. Use personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
 - 2. Contractors must possess current liability and workers compensation insurance certificates.
 - 3. Contractors must be registered with BICSI and have at least one RCDD on staff or ITS Cabling Installer Program Technician certification and Installer Level 1 & 2 for a minimum of 75 percent of staff.

1.2 TRAINING

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
 - 1. Personnel trained and certified in the design of the Siemon Cabling System®.
 - 2. Personnel trained and certified to install the Siemon Cabling System®.
 - 3. The Designer and Installer shall show proof of the current certification of the Siemon Cabling System® via an updated certificate given after attending the Certified Installer training course or an on-line re-certification class given every two years.
 - 4. Provide references for the type of installation provided in this specification.
 - 5. Personnel trained and certified in the installation of copper cable and in the use of Level IIIe Copper Transmission Performance testers, fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus an OTDR.
 - 6. Personnel trained in the installation of pathways and supports for housing horizontal and backbone cabling.
- B. Facilities Orientation
 - 1. Personnel must complete the onsite Facilities Orientation

END OF SECTION

SECTION 270171

**RESPONSIBILITY AND WORKMANSHIP
OF CONTRACTOR**

PART 1 - GENERAL

1.1 CONTRACTOR RESPONSIBILITY

- A. The contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in a request for proposal. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
- B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed in accordance with standards recommendation for a specific type of media (i.e. UTP vs. F/UTP @ 10 Gigabit)
- C. Workers must clean any debris and trash at the close of each job and workday.
- D. Contractor acknowledges that Intermountain Health will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest standard of care in performing contractual obligation as defined in the Scope of Work.
- E. Contractor must submit The Siemon warranty, Cable Records, As Built Drawings and Test Results at the completion of work. Note: Intermountain Health reserves the right to withhold final payments until all registration documents are approved by the Siemon Company and received by Intermountain Health.

1.2 CONTRACTOR AND EMPLOYEE RESPONSIBILITY

- A. Contractors, their employees, and installers will attend annually Intermountain Health required Infection Control training.
- B. Contractors, their employees, and installers will complete Symplr registration.
- C. Contractors, their employees, and installers will attend Intermountain Health required site and job specific orientation.
- D. Contractors, their employees, and installers will maintain Intermountain Health required immunizations.
- E. Contractors, their employees, and installers will keep their Intermountain Health required confidentiality agreements current.
- F. Contractors, their employees, and installers always agree to follow all Intermountain Health Policies and procedures and wear the appropriate ID while on any Intermountain properties.
- G. The contractor will determine with the Owner the appropriate level of Environmental Containment precautions to utilize for each work location. Infection Control Risk Assessments and permits will be performed as required.
- H. Upon request, provide qualification data for all qualified layout technicians, installation supervisors, and field inspectors.
 - 1. Siemon issued qualification badges shall be readily available for this purpose.

1.3 EXAMINATION

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field measurements measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

1.4 PREPARATION

- A. Pre-installation inspection
 - 1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

1.5 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

- A. Contractors will maintain unobstructed egress in work areas.
- B. The contractor will keep access for all Emergency Services.
- C. Contractor will maintain training for Personnel in alternate exits if needed.
- D. Contractor will maintain Temporary construction partitions, as required, that are smoke tight and built of non-combustible materials.
- E. Additional Fire Extinguishers may be required and will be properly maintained and inspected.
- F. The construction site will be maintained clean and orderly.
- G. The contractor will observe Intermountain Health's Tobacco Use Policy. (All forms of tobacco use are strictly prohibited)
- H. All Electrical Extension cords will be grounded, and in good condition and plugged into approved GFI Receptacles.
- I. Construction sites will be restricted. (Approved personnel Only)
- J. Personal Protective Equipment (PPE) will be worn as required. (i.e. hard hats, safety glasses, safety shoes, fluorescent vest, in accordance with the general contractor's safety policy)
- K. Tools will be unplugged, and power secured at the end of each working day.
- L. All employees and contractors will understand how to obtain MSDS sheets.
- M. The contractor will notify proper personnel of any fire system shut down. A 48-hour notification is required.
- N. The contractor will address all vibration concerns to Intermountain Health and the general contractor's staff.
- O. The contractor will address all Noise Issues with Intermountain Health and the general contractor's staff.
- P. The contractor will fill out a Hot Work permit and keep it on site daily as needed.
- Q. The contractor will fill out an Above Ceiling Work Permit and keep it on site daily as needed.
- R. The contractor will complete an Infection Prevention permit and will not begin work until it is approved.
- S. Contractors will obtain a Confined Space Permit, when required, and keep it on site.
- T. The contractor shall notify Information Systems 72 hours in advance of any shutdown or known interruption of required environmental services. Follow up by notifying the Service Desk.
- U. Demolition of low voltage cabling shall be performed by the Low Voltage installation contractor.
 - 1. To prevent accidental removal of in-use circuits.
 - 2. To allow for re-use of circuits where practical.
- V. Prior to removal of unused low voltage cabling, you must verify that both ends of the cable are no longer attached to any device. (Both ends of the cable are un-terminated).

END OF SECTION

SECTION 270500

**COMMON WORK RESULTS
FOR COMMUNICATONS**

PART 1 - PRODUCT

1.1 SUMMARY

- A. This section covers general work results for all Communications Division detail subsections.
- B. Work of the following sections cover a complete installation of both permanent and channel links for a data and voice communications network utilizing copper and fiber transmission media.

PART 2 - EXECUTION

2.1 SCOPE OF WORK

- A. Includes, but is not limited to the following.
 - 1. The Contractor shall:
 - a. Provide and install fabric and/or either plenum, PE or PVC Innerduct, rated appropriately for the installation environment; in accordance with all applicable codes and ordinances.
 - b. Provide, install, terminate, test, label and document all fiber backbone, fiber and copper riser cable.
 - c. Provide, install, terminate, test, and document all fiber, copper voice, and data horizontal cable.
 - 1) CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
 - d. Provide and place all termination devices such as, but not limited to, modular patch panels, blank panels, termination blocks, information outlets (jacks and plates), phone jacks, fiber distribution panels, bulkheads, connectors, and fiber fan out kits.
 - e. Provide in quantities specified interconnect components such as, but not limited to, copper patch cords, fiber patch cables.
 - f. Provide and place horizontal and vertical cable support devices such as, but not limited to, rack and wall-mounted horizontal and vertical cable management, cable runway, communications cable runway, and all required mounting hardware, unless otherwise noted.
 - g. Provide and install all equipment mounting racks, cabinets and/or brackets.
 - h. Provide and install UL-approved fire stopping systems in all communication pass-thru, conduits, cable trays and ceiling, wall and floor penetrations in coordination with General Contractor.
 - i. Provide all appropriate consumable items required to complete the installation.
 - j. Grounding and bonding in TEC and TR rooms to grounding bus provided by Division 26.
 - k. Provide complete documentation and demonstration of work.
 - l. Completion of all punch list deficiencies within 10 working days.
 - m. Provide indexed and organized complete Test Results of all copper and fiber cable and their components.

- n. Provide Submittals.
- o. Conduct a final document handover meeting with client, consultant, and PM to review, discuss and educate the Owner on the test results and As-Built Drawings.
- p. Provide a Manufacturer's Extended Product Warranty and System Assurance Warranty for this wiring system.

END OF SECTION

SECTION 270526

**GROUNDING AND BONDING FOR
COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This work shall be provided by Division 26.
 - 1. Division 26 shall provide and install the communications system grounding bus bar.
 - 2. Systems other than the voice/data system shall be bonded by their respective installers or Division 26.
- B. Exception: Division 27 shall bond racks, ladders, and other conductive IT equipment and enclosures as required.
- C. Requirements of the following Division 26 Sections apply to this section:
 - 1. Basic Electrical Requirements
 - 2. Basic Electrical Materials and Methods
 - 3. Grounding and Bonding for Electrical Systems

1.2 SUMMARY

- A. This Section includes methods and materials for grounding and bonding Communications systems.
- B. All grounding / earthing and bonding shall be done to applicable codes and regulations. It is recommended that the requirements of IEC/TR 61000-5-2: 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
 - 1. Stranded conductors No. 6 AWG.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Compression fitting – 2-hole strap.

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

3.2 APPLICATIONS

- A. Conductors: Install stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

3.3 **INSTALLATION**

- A. Grounding Conductors
 - 1. Route along shortest and straightest paths possible, unless otherwise indicated or required by Code.
 - 2. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
 - a. Jumper across all tray junctions use two-hole crimp lugs with a bolt, lock washer and nut to prevent loosening of ground connections over time.
 - b. Contractor to remove small area of powder coat or paint to create a metal-to-metal bonding connection.
 - c. Per current BICSI TDMM "Grounding, Bonding and Electrical Protection":
 - 1) Grounding and bonding connectors should be one of the following:
Tin plated copper, copper or copper alloy
 - 2) Connections should be made using crimp connectors, or exothermic welding.
 - d. Per TIA/EIA 607-A the TBB (Telecommunications Bonding Backbone) connections "shall be made using irreversible compression-type connectors, exothermic welding or equivalent."

END OF SECTION

SECTION 270528

PATHWAYS FOR COMMUNICATONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Main pathways for communications systems shall be the responsibility of the Division 27 low voltage contract.
 - 1. Includes, but is not limited to, hangars, supports, J-hooks and cable tray.
 - 2. Sections 270536 and 270543_46 are supplemental clarifications that are additions to this section. The appropriate section(s) shall be added for the material used.
- B. Conduits, pathways, and boxes which are embedded within building finishes for communications systems shall be the responsibility of the Division 26 electrical contractor.
- C. Requirements of the following Division 26 sections apply to this section.
 - 1. Basic electrical requirements
 - 2. Basic electrical materials and methods
 - 3. Grounding, earthing, and bonding for electrical systems.

1.2 SUMMARY

- A. Contractors shall install work following specifications, drawings, manufacturer's instructions, and approved submittal data.

PART 2 - PRODUCTS

2.1 CABLE PATHWAYS

- A. Comply with TIA/EIA-569-B.
- B. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
 - 1. All materials shall be UL- and/or CSA and/or ETL-approved and labeled in accordance with NEC for all products where labeling service normally applies.
 - 2. NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 3. Materials and equipment requiring UL 94, 149 or 1863 listing shall be so labeled. Modification of products that nullify UL labels is not permitted.
 - 4. The installed systems shall not generate, nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.
- C. Pathways consist of fire rated sleeves, conduit, basket tray/ladder rack, J-hooks, surface mounted raceway and power poles.
 - 1. Basket trays shall be utilized for distribution pathways.
 - a. Provides proper support and load distribution along pathways.
 - b. All wall penetration for the basket tray shall be framed.
 - c. Flexibility, scalability, and accessibility.
 - d. Ladder rack shall be used in all TEC and TDR's.
 - 2. Conduits may be utilized where basket tray is not viable, providing the cross-sectional area of the conduit is greater than the cross-sectional area of the basket tray.
 - 3. Fire Rated Sleeves must be used in place of conduit when penetrating a fire rated wall.
 - a. 2" x 2" for room penetrations, 4" x 4" for j-hook pathways

- b. Approved Manufacturers
 - 1) STI EZ Path
 - 2) Hilti Modular Sleeve
 - 4. J-hooks are the minimum pathway device required for all low voltage contractors for use in ceiling distribution.
 - a. Refer to section 270529.

Note: Surface mounted raceway and power poles should be installed only when other pathway choices are not feasible.
 - D. Outdoor Microduct
 - 1. Manufactures
 - a. Duraline
 - b. Pre-Approved Equal
 - 2. Description: 7 Way MicroDuct
 - a. All Microduct shall be composed of all dielectric materials (except for armored version). All Microduct shall be manufactured to include enhanced jetting design, such as internal ribbing to minimize surface contact and permanent slick interior to eliminate the need for jetting lubricant.
 - b. 12.7mm OD1MM ID
 - c. Microduct rating FP (OSP)
 - d. 7-Way
 - e. Color: Orange

2.2 EQUIPMENT

- A. Compatibility
 - 1. All material and equipment as provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products. All shall be typical commercial designs that comply with the requirements specified. All material and equipment shall be readily available through manufacturers and/or distributors.
 - a. All equipment shall be standard catalogued items of the manufacturer and shall be supplied completely with any optional items required for proper installation.
 - b. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility
- B. Horizontal cables shall be installed in "clean, dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
 - 1. Cable pathways shall be installed to provide protection from the elements (i.e., moisture) and other hazards.
 - 2. Cables and cable pathways shall be protected from detritus elements such as paints, adhesives, water, and cleaners.
 - a. In case of contamination, the cables shall be replaced at General Contractors' expense. Cleaning is not acceptable.
 - 3. Pathways shall not have exposed sharp edges that may meet telecommunications cables.
- C. Pathways shall not be in elevator shafts.
- D. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-B, or both be observed throughout the entire cabling system.

2.3 SURFACE MOUNTING

- A. Surface Mount Cable Runs and Faceplate Boxes
 - 1. Surface mounting of cable pathway runs and/or boxes for outlets/faceplates are only authorized as a last resort and exception to running cables through the wall and above the ceiling.
 - 2. If surface mount cable runs are used:
 - a. Burs will be removed from the inside of the plastic or metal surface mount pathway to prevent damage to cables pulled through the run.
 - b. Raceway manufacturer plastic bushings shall be installed at all outlet openings in raceway to prevent damage to cable.
 - c. "T", Splice, and corner pieces will be used to join runs. Runs will not be butted together without the appropriate joining pieces.

PART 3 - EXECUTION

3.1 HORIZONTAL PARAMETERS

- A. Allowable Cable Bend Radius and Pull Tension:
 - 1. In general, communications cables cannot tolerate sharp bends or excessive pull tension during installation.
 - a. Bend radius for 4 pair UTP and F/UTP under no load (no pulling tension) shall not exceed four (4) times the outside diameter of the cable and eight (8) times the outside diameter of the cable under load (110N/25lbf). Note: Cable bend radius and pulling tensions for cables other than 4 pair cable increase with the diameter and type of cable refer to the manufacturer's recommendations for specific requirements.
 - 2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.
- B. Pull Strings:
 - 1. Horizontal and Vertical Pathways
 - a. The pathway installer shall:
 - 1) Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
 - 2) Provide pull strings in all new cable trays.
 - 3) Pull string shall have a rated average breaking strength of 200 pounds.
 - 4) During pulling sessions, pull strings must move freely to prevent cable jacket/cable damage.
 - 5) Free moving pull strings shall be provided in all locations where they are utilized as part of this contract.
- C. Conduit Fill:
 - 1. Reference manufacturer's Design Installation Guidelines manual.
 - 2. Comply with requirements of NFPA 70 (NEC)
 - 3. The number of cables placed in a pathway shall not exceed manufacture specifications, nor will the geometric shape of a cable be affected.
 - a. Conduit pathways shall have a maximum fill ratio of 40% to allow for proper pulling tension and laying of the CAT6A F/UTP cable. A minimum of a 1" diameter conduit is required for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.

3.2 INTRA-BUILDING CABLE ROUTING

- A. Pathways

1. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between Telecommunications rooms and the main or intermediate cross-connect in a long single-story building.
2. Adequate riser sleeve/slot space shall be available with the ability to ingress the area later in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary. Proper fire stopping is required for all sleeves/slots per national and local codes. Install fire stop material designed specifically for the building construction conditions and to meet the existing fire stop material as directed by the building engineer.
3. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.
4. Where redundant paths are required, they shall be separated by a minimum of 24".
 - a. Separate innerducts and/or armored fiber are required for each leg of the redundant path.
 - b. Separate physical routes for each path shall be utilized where possible.
5. Building backbone cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
6. "Slab-on-Grade" building designs wherein pathways are installed underground on/in the poured concrete slabs that are in direct contact with the soil are considered wet locations and hence are not permitted.

END OF SECTION

SECTION 270529

**HANGERS AND SUPPORTS FOR
COMMUNICATION SYSTEMS**

PART 1 - PRODUCTS

1.1 APPROVED PRODUCT

- A. The J-hooks shall meet or exceed the below characteristics of construction and features
 1. Provide broad based support for cabling to aid in maintaining overall system performance.
 2. Be available in 50.8mm (2") and 101.6mm (4") options
 3. Come equipped with a cable retention clip
 4. Offers a full line of mounting accessories.

1.2 APPROVED MANUFACTURERS

- A. Ericson / Caddy
- B. B-Line
- C. Stiffy

PART 2 - EXECUTION

2.1 J-HOOKS AND OTHER SUPPORTS SHALL BE INSTALLED SUCH THAT THEY

- A. Shall be supported with devices designed for this purpose and shall be installed independently of any other structural component. J-Hooks shall not use the suspended ceiling support wires or lighting fixture support wires.
- B. The number of cables placed into the J-hooks shall be limited to a number that will not cause a change to the geometric shape of the cables.
 1. Limit to a 40% fill in new construction.
- C. J-hooks shall not be spaced farther than 1.5 meters (5 ft.) apart, with a recommendation that they be space at 1 meter (3 ft.) apart. Note: Construction may require distances to exceed the maximum and are considered an exception requiring approval of project manager or building engineer.
- D. J-hooks or better must be installed without exception.
- E. All J-hooks that pass through a fire rated wall must have an EZ-Path Sleeve or Hilti Modular Sleeve installed to go through the fire wall. Size is to be based on J-hook size. To be installed by the Low Voltage Contractor installing the J-hooks.

2.2 UNACCEPTABLE INSTALLATIONS

- A. Free flight of cables
- B. Resting or attaching of cables on pipes, conduits, HVAC duct work, fire sprinkler systems, basket tray, basket tray supports or on the ceiling tiles/grid.

END OF SECTION

SECTION 270533

**CONDUITS AND BACK BOXES FOR
COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Division 26 – Electrical work

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. Conduits and Back boxes shall meet the construction requirements of the NEC for the type of structure and space in which they are installed and will be of the diameter and size to provide adequate fill, bend radius and connector space. Refer to section 270528.

PART 3 - EXECUTION

3.1 CONDUIT SIZING

- A. Conduit size shall be based on the type of cable installed and the required fill ratio and bend radius associated with the type of cable specified.
1. Minimum conduit size to back box for CAT6A F/UTP shall be 1-inch EMT.

Conduit Trade Size (metric designator)	Max number of cables based upon allowable fill		
	Cable O.D.		
	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
1 (27)	4	3	2
1-1/4 (35)	6	5	4
1-1/2 (41)	9	7	6
2 (53)	14	11	10
2-1/2 (63)	20	16	14
3 (78)	31	24	22
3-1/2 (91)	42	32	29
4 (100)	54	42	37

- B. Conduit and installation shall be provided by Division 26.
- C. All conduit stubs shall be installed with plastic bushings appropriate for the size of conduit used.
- D. Conduits that stub to accessible ceiling shall be installed in the direction to provide the shortest path to the TDR, complete with pull string.

- E. Conduit pathway must be provided to the nearest basket tray when area has hard lid or decorative ceiling.

3.2 BACK BOX SIZING

- A. New work back boxes for CAT6A F/UTP shall be a minimum of trade size 4-11/16" x 4-11/16" x 3" (depth) plus a 5/8" plaster ring to allow for proper bend radius and connector termination/installation. Side knockouts shall be avoided.
- B. Back boxes for rework shall meet the same specification as for new work.
 - 1. If existing back boxes or back boxes that are smaller due to construction restrictions, then devices such as extension rings, bezels or faceplates shall be used to modify the back box to insure proper bend radius and connector termination/installation.
 - a. Verification and approval of the size change must have DCO Infrastructure Cabling and engineering approval.

3.3 BACK BOX COMPOSITION

- A. All back boxes for IT systems shall be UL/CSA listed and approved for the purpose.
 - 1. Non-metal back boxes shall not be used for any interior IT related device.

3.4 SPECIAL CONDITIONS – LEAD LINED WALLS FOR RADIATION CONTROL

- A. Refer to the complete IT Lead Lined Wall Procedure – Attachment Appendix 8

END OF SECTION

SECTION 270536

**CABLE TRAY FOR
COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. This section shall be coordinated with Sections 270528, and 270543 46

1.2 COORDINATION

- A. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable.
- B. The wire basket tray routing shall be approved and installed by the low voltage CI cable contractor (Div. 27 sub-contractor), and Data Center Operation Team.
- C. Where adequate space is available a 4", Triple tier J-Hook pathway shall parallel the basket trays for other services
1. The triple tier J-Hooks shall be installed by the cable tray installer.
- D. Single J-Hooks as needed to extend beyond the triple tier, shall be installed by the trade that will be utilizing them.
- E. The cable tray shall be a high priority installation to allow adequate time for proper and complete cable installation prior to ceiling grid.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. The Cable Ladder Tray shall meet or exceed the characteristics of construction and features below:
1. It shall be fully welded and available in a galvanized silver or powder coat black finish
2. Have an optional construction using "elongated" shaped wires offering a more broad-based support for installed cables.
3. The Cable ladder tray shall be used in data rooms for horizontal management above the racks.
4. Ladder shall match the manufacturer of the data racks or exact equal.
5. Ladder shall be assembled with manufacturer approved parts and methods.
6. Ladder Rack must be installed using waterfalls.

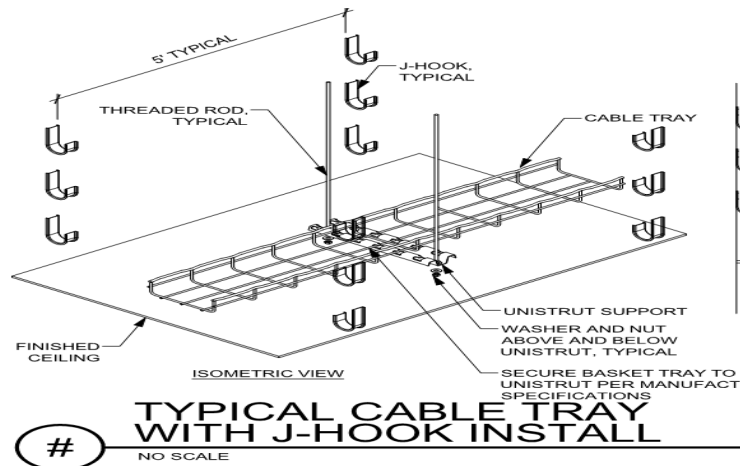
2.2 PART NUMBERS (SUBMITTAL REQUIRED)

- A. Cable Ladder Tray
1. Refer to Appendix 3 or the plans for part numbers.
- B. APPROVED BASKET TRAY MANUFACTURES
1. WBT – Wire Basket Ray (preferred).
2. Siemon RouteIT™ Wire Mesh Cable Tray, or equal basket type tray.
3. Cabolfil per owner's approval.

PART 3 - EXECUTION

3.1 PATHWAY INSTALLATION

- A. Supports
 - 1. Installed per Manufacturer's Specifications and utilize components specific to the maintenance of proper access in and out of the basket tray using bend delimiters.
 - 2. Distance between supports shall not exceed 5 feet
 - a. Less distance between supports required if per manufacturer's instructions.
 - b. Minimum of one support required within 24" on each side of any junction point.
 - 3. Supports shall be of the trapeze design to provide maximum stability.
 - a. Each support shall attach to structure via its own hangers.
 - 1) All hanger supports shall be constructed of rigid material such as all-thread.
 - 2) All hangers and supports shall be installed perpendicular and plumb to the tray. No angle supports shall be permitted unless augmented perpendicularly.
 - 3) Vibration and sway (seismic) damping is required.
 - 4) Provide support across the width of tray underneath, not via basket side wires.
 - 5) Building walls do not qualify as support and shall not be used as support.
 - 6) All basket tray penetrations through a wall are to be framed by the General Contractor.
 - 4. Support shall be of sufficient strength to support at least 200% of the expected load
 - 5. Wall mounted angle brackets shall not be used as a load bearing support for basket tray.
 - 6. Basket Tray should not be installed directly below any pressurized water pipes.
- B. Complete system access
 - 1. Basket trays shall have a dedicated free clearance zone surrounding it.
 - a. 12" clear space shall be provided on the side where natural feed will occur.
 - b. 6" clear space shall be provided on the side opposite the feed access.
 - c. 8" clear space above the top of tray minimum - recommended 12".
 - d. 3" clear space below the tray.
 - 2. Exception: other services may pass through the free clearance zone provided it is perpendicular to the tray direction and providing they do not exceed 6' in width or interfere with the access to pull wire in the tray.
 - 3. When basket tray is installed in Hard Lid or decorative locations, access panel locations must be installed at corners or at T intersections. Consult DCO personnel on placement.
 - 4. NOTHING shall be attached to the basket tray or basket tray supports without prior written approval from DCO.



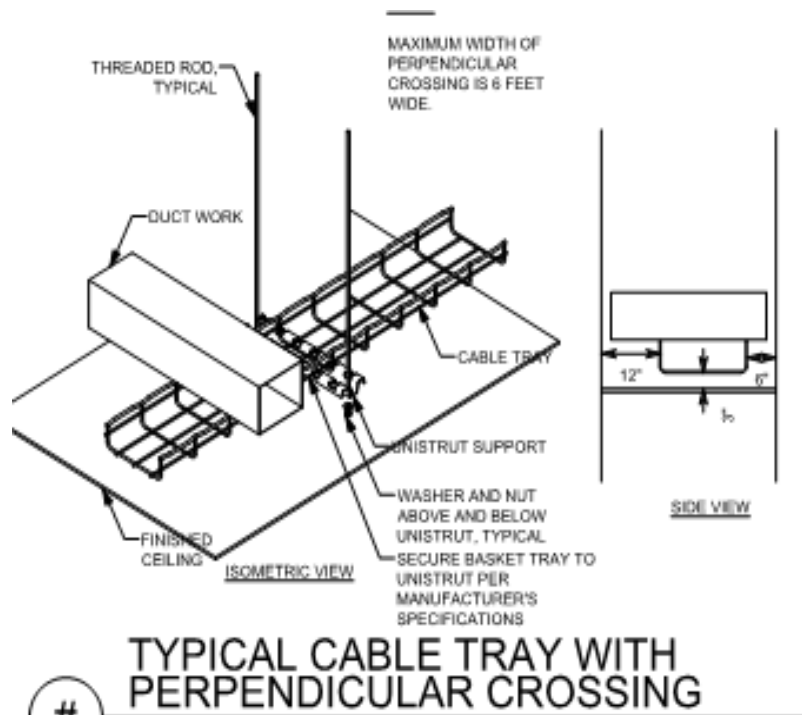
3.2 ROUTING OF BASKET TRAY

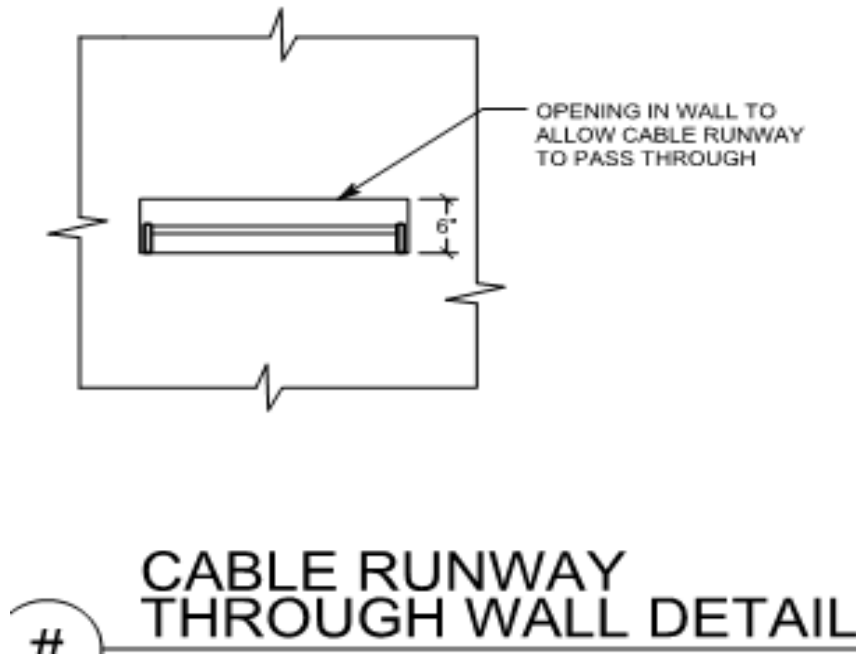
- A. The exact basket tray location shall be coordinated with other trades to ensure proper clearances and access. Prior to installation, final cable tray routes must be approved by the Owner's DCO/Infrastructure cabling team.
- B. Basket tray shall be installed in straight lines, either parallel or perpendicular to building lines
- C. Wire basket trays are assumed to include joiner kits, stabilizer kits, rack mount kits, splices, clamps, hangers, supports, waterfalls, and thus no accessories are called out below except the tray divider.
- D. Cut basket tray structural components/rods will not be left with any edges that can cause injury to the skin and eyes by a person who is in the ceiling working. Cut ends are to be covered with a coating or cap.
- E. All changes in cable elevation(s) transitioning between basket tray, or cable rack will be protected using a waterfall device.
 - 1. This may also be mitigated by creating a rack 'ramp' which lowers the upper rack to the lower rack by cutting and bending the upper rack to slope downward to the lower rack.
 - 2. This method requires DCO pre-approval and proper ceiling support for the ramp.
- F. Basket tray shall follow corridor paths
 - 1. Routing above rooms and other partitions shall be avoided
 - 2. The cable tray shall not block access to VAV's valves or other like equipment.
- G. Basket tray and flush penetrations shall be utilized over hard-lid areas as specified.
- H. Access panels shall be provided where needed to provide access to the basket tray on both sides of the wall in hard lid areas within 3' or less of the basket tray.

3.3 TRAY INTEGRITY

- A. Tray shall be installed as a complete, continuous system with no open spaces, cut outs, or missing segments. Bonding between sections shall be accomplished by the manufacturer's approved clamp or designated method.
- B. Trays shall be free from obstructions, other systems, trash or debris. Access to the tray shall be provided as outlined.
- C. No other trades infrastructure or equipment may be connected to or rely on the basket tray or its support system.

- D. Tray must not be notched or cut-out to accommodate other trades. Repairs will not be accepted. Section replacement will be required at no cost to the owner.
- E. As much tray material as possible shall be left uncut at turns, junctions, elevation changes, width changes, etc. Overlap shall be clamped to maximize strength and prevent pinch points.





3.4 WALL OR OTHER PENETRATIONS (SUBMITTAL REQUIRED)

- A. Fire and smoke rated assemblies
 - 1. Penetrations shall comply with all fire and smoke prevention methods per code and as outlined elsewhere in this document, including Section 270528 and Division 7 (Thermal and Moisture Protection).
- B. Approved penetration methods
 - 1. The preferred barrier penetration method shall be to run the tray continuous through the barrier, with closure provided by Firestop pillows.
 - a. Framing shall be boxed around openings to permit proper pillow insertion. Coordinate with framing contractor.
 - 2. Sleeves or conduits
 - a. Fire assemblies or alternate penetrations must provide 150% of the designed cross-sectional area of the basket.
 - b. Conduit permitted only with written pre-bid permission or engineering notation on the drawings.
 - c. Each penetration sleeve or conduit shall be bonded on both sides of the penetrated barrier using UL and AHJ approved methods.
 - 3. All penetrations shall be positioned in-line with the basket tray to facilitate ease of pulling conductors and provide a straight-line path.
 - a. The bottom of the penetration device shall be flush with the bottom of the basket tray
 - b. Side-to-side penetrations must be completely within the cable tray space or directly above whenever possible.
 - 4. Approved penetration devices shall be a minimum size of 4"
 - a. Total penetration space at each location shall be sized for 20% growth and be equal to or greater than the cross-sectional area of the basket tray.
 - b. Approved devices where smaller penetrations are permitted shall be a minimum size of 1".

5. Approved devices shall be approved by the local facility manager:
 - a. Fire rated assemblies
 - b. Tray with enclosed walls, properly sized and installed pillows
 - c. Conduit sleeves
 - 1) Conduit sleeves should only be used as a last resort upon approval from owner's DCO representative.

3.5 UTILIZATION

- A. Capacity
 1. Trays and penetration devices shall be properly sized
 - a. Provide a maximum calculated fill ratio of 40% to an inside depth not to exceed 3 inches (75 mm)
 - b. Provide capacity to allow for at least 20% future growth
- B. Systems served
 1. Basket trays, J-hooks, and penetrations shall be dedicated to a single system. Mixing of other systems with voice and data shall not be permitted in tray or J-hook paths.
- C. Restricted content in trays
 1. The wire basket tray shall only contain cables for the voice and data communications systems.
 - a. If there is sufficient space in the tray, and with approval from both the data network sub-contractor and DCO, certain other IP services may share tray space. (i.e. camera, telemetry, similar).
 - b. Service loops must not reduce tray capacity.
 - c. Nurse call cabling shall be run in the J-Hook path. All nurse call installations must provide their own path or utilize the triple J-Hook system.
- D. Triple J-Hook
 1. Triple Tree J-Hooks – Caddy CAT64HPS WM3
 2. Path Assignments
 - a. The Lower tier of the triple J-Hook path is designated for Card Access and building automation and controls
 - b. The Middle tier of the triple J-Hook path is designated for Nurse Call.
 - c. The Top tier of the triple J-Hook path is designated for satellite, DAS, or similar systems.
 3. When a triple J-hook pathway is not installed or available each system provider shall install their own j-hook pathway and wall penetrations.
 4. Service loop and slack shall not interfere with other pathways.
 5. Triple J-Hooks must be a minimum of 4" hooks each.

END OF SECTION

SECTION 270543-46

**UNDERGROUND DUCTS, UTILITY POLES,
AND RACEWAYS FOR INTER-
BUILDING/CAMPUS CABLE ROUTING**

PART 1 - PRODUCTS

1.1 INTER-BUILDING/CAMPUS CABLE ROUTING

- A. The backbone subsystem shall include cable installed between buildings via approved underground, tunnel, direct -buried, aerial or any combination of these from the Campus Distributor/Main Cross-connect (CD/MC/TEC) to Building Distributor/Intermediate Cross-connect (BD/IC/TDR) in a multi-building campus.
 - 1. 4" Conduit is required
 - 2. (3) 1 1/4" inner ducts shall be installed in (1 out of 2 or 2 out of 4) 4" conduits going building to building.
 - 3. (2) 12.7/10 microduct and (1) 1 1/4" inner ducts shall be installed in (1 out of 2 or 2 out of 4) 4" conduits going building to building.
 - 4. Armored Fiber is required.
 - 5. Microduct/microfiber is optional.
 - 6. All outdoor conduits must be capped.
- B. Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.
- C. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill ratio of 40%.
 - 1. All underground systems shall be designed to prevent water runoff from entering the building. All underground systems must be cleared of moisture prior to installation of any cable type. These systems must be sealed at both ends when not in use and after cable installation to prevent moisture and rodent infiltration.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. The backbone cables shall be installed in a hierarchical star topology, emanating from the Campus Distributor/Main Cross-connect to each satellite building, Building Distributor/Intermediate Cross-connect or Floor Distributor/Horizontal Cross-connect located in a telecommunication room. All Inter-building/Campus cables shall be installed to the applicable codes and regulations.
- B. Where redundant paths are required, they shall be separated by a minimum of 24".
 - 1. Separate innerducts are required for each leg of the redundant path.
 - 2. Separate physical routes for each path shall be utilized where possible.
- C. Optical fiber shall be run for all Inter-building/Campus backbone segments, and as a recommendation, at least one balanced twisted-pair cable should be run for each Inter-building backbone segment.
 - 1. Fibers will be Fusion Spliced in the telecommunications rooms using LC Pigtailed in wall mounted interconnect centers or rack mounted panels equipped with enough ports, slack storage space and splice trays if required to terminate and secure all fibers.
- D. ST connectors are no longer recommended in the TIA 568-C.3 standard but may be used in legacy installations.

- E. Over-voltage Circuit Protection shall be utilized for cabling which enters or exits a building shall comply with applicable codes and regulations.
- F. OSP (outside plant) cables shall transition to an ISP (inside plant) within 50 feet of changing environment, per national and local codes and regulations.

END OF SECTION

SECTION 270553

**IDENTIFICATION FOR LOW-VOLTAGE
CABLES AND LABELING**

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 LABELING

- A. Structured cabling shall be labeled in accordance with ANSI/TIA 606-B standards.
- B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- C. Each port in the faceplate shall be labeled with its identifier.
- D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- E. Each port on the connecting hardware shall be labeled with its identifier.
- F. Cable Labeling
 - 1. Label System
 - a. Labels Identification (Labeling) System:
 - 1) Brady
 - 2) Dymo
 - 3) Hellerman-Tyton
 - 4) Panduit
 - 5) Acceptable alternate
 - a) Approval from Data Center Operations Infrastructure Cabling team member required prior to bid.
 - 2. Cable Labels
 - a. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations. Plastic, self-adhesive labels are not acceptable.
 - b. Each end of the Horizontal cables shall be labeled with a mechanically generated label within 300mm (12 in) of the end of the cable jacket with the link identifier which shall be a unique configuration determined by owner. This also applies to Backbone Cables.
 - 3. Flat-surface labels
 - a. Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations.
 - 4. Contractor shall:
 - a. Provide transparent plastic label holders, and 4 pair marked colored labels.
 - b. Install colored labels according to the type of field as per ANSI/TIA 606-B.1 color code designations.
- G. Palette
 - 1. Use the owners color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Otherwise, use the ANSI/TIA 606-B designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Color designations for F/UTP cable:
 - a. Intermountain Health Standard Wiring Palettes for Horizontal Cabling
 - b. Use
 - 1) Data & IP PhonesColor
Blue

	2)	Analog Phone	Blue
	3)	Security Card Readers	Grey/Yellow
	4)	IP Security Cameras	Blue
	5)	Fire Systems	Red
	6)	TV Coax	Black
	7)	Public Address/Telecom Patching in TEC only	White
	8)	Clinical Engineering –	Orange
		a) Monitoring, Bed Systems	Orange
		b) Nurse Call (5e)	Orange
		c) Real time patient data	Orange
	9)	Wireless	Yellow
	10)	Foreseer (Belden 1422)	Red
H.	Outlet/Jack/Faceplate Icons/labeling will match the color of the cable attached to the back side of the outlet/jack.		

PART 3 - EXECUTION

3.1 GENERAL IDENTIFICATION

- A. The installer shall label all cables, regardless of length.
- B. Identify system components, wiring, and cabling complying with TIA/EIA-606-B.1. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- D. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of comprehensive final schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-B.1. Furnish electronic record of all drawings, in software and format selected by Owner.

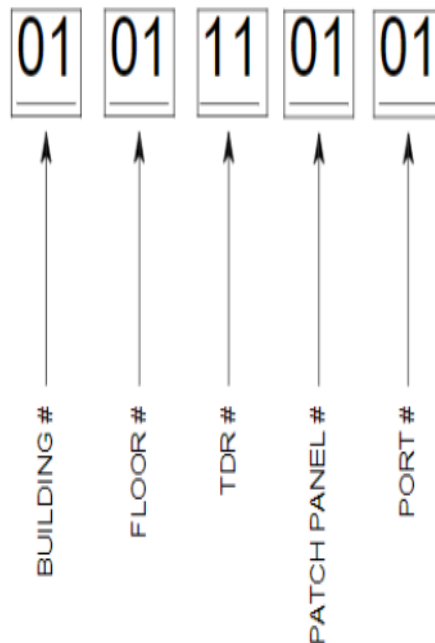
3.2 CONCEALED ENDS

- A. Jacks, connectors, terminations, and similar that are in concealed locations such as above grid ceilings, shall have additional labeling. The additional label shall be on the face of the grid in a visible location, immediately adjacent to the termination location.

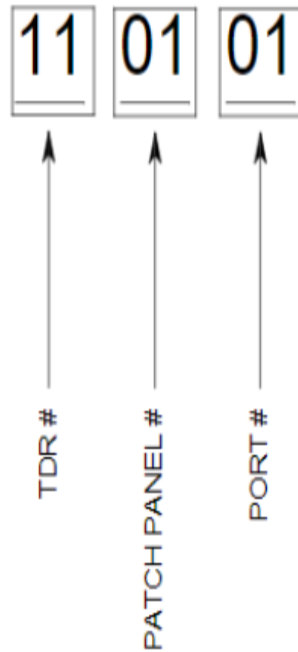
3.3 CABLE AND WIRE IDENTIFICATION

- A. Label each cable visibly within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

- B. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - 1. Individual number wiring conductors connected to terminal strips and identified each cable or wiring group being extended from a panel or cabinet to a building. The mounted device shall be identified with the name and number of devices as shown.
 - 2. Label each unit and field within distribution racks and frames.
 - 3. Cable ID Example



- 4. Building # - The building number is assigned to the building if there are multiple buildings.
Floor # - Will be incorporated into the TDR #
TDR # - Begin with 1A through 1Z for 1st Floor – 2A and so on per the floor the cabling in on.
Patch Panel # - 1 through however many patch panels there are.
Port # - 1 -48 for each patch panel.
- 5. Cable ID Example for Small Clinics.



- D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.1.

END OF SECTION

SECTION 271100

EQUIPMENT ROOM FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section.
 - 1. Basic electrical requirements
 - 2. Basic electrical materials and methods
 - 3. Grounding, earthing, and bonding.
- B. Standards
 - 1. Minimum equipment room specifications shall comply with the 2010 AIA Guidelines for Design and Construction of Health Facilities.
 - 2. Minimum recommended room sizes are requirements, not suggestions.
 - 3. Enterprise IS Architecture (EISA) maintains several documents around standards. The primary standards list is the EISA Standards 2010 – Master List. Occasionally, there is a need to break-out specific standards for an area.

1.2 SUMMARY

- A. This Section specifically details the facilities design and operations standards to be utilized for Intermountain Health Care's Data Rooms (TEC) and data closets (TDR).

1.3 COMMON REQUIREMENTS

- A. Rack layout and mounting
 - 1. Standard room layouts are located on the plans.
- B. Rack and wall mounting locations.
 - 1. Rack and wall space use is pre-designated at the design stage. Before mounting any equipment on a wall or in a rack, the location must be verified by the Div 27 sub-contractor and Data Center Operations.
- C. All Data Centers, TEC's, TSER's, TDR's, Cabinets and Clam Shells must be secured with either a Card Reader, Electronic Key or a secure device that is recordable and auditable.

1.4 DEFINITIONS

- A. **Data Center** – Major computer/technology/network facilities providing a significant percentage of the data and application services for the enterprise.
- B. **Data Rooms – ((TEC) Technology Equipment Center)** – Purpose built buildings or rooms that provide communications point-of-presence along with some data and applications services for a local facility or region.
- C. **TSER (Telecommunications Service Entrance Room)** – Houses the point at which data and voice circuits and services enter the facility and outdoor cabling interfaces with the building infrastructure. Typically, the TSER will be in the TEC.
- D. **Data Closets – (TDR) Technology Distribution Room)** – Specific location within a facility that provides communication services for a specific area (floor, wing, office area) of that facility only. A secure, flexible, and easily managed location for structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.
- E. **Wall Mountable Cabinets** – Specific location within a facility that provides communication services for a specific area when there is not available space for a

TDR within that space only. A secure, flexible, and easily managed location for structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

PART 2 - TECHNOLOGY ROOM SPECIFIC REQUIREMENTS

2.1 TECHNOLOGY EQUIPMENT CENTER (TEC)

- A. Each Hospital will have a dedicated TEC which will serve as the main communications point-of-presence along with data and application services for the local facility or region. Houses the core networking equipment, application servers and data storage devices that serve the buildings on the campus. The Telecommunications Service Entrance Room (TSER) will be in the same room.

2.2 TEC IN HOSPITALS

- A. Physical Construction
1. The TEC should be in an area easily accessed for delivery of equipment and high traffic without disturbing patient care.
 2. The size of the TEC will be based on the number of cabinets required to support the campus, plus 30% growth.
 3. TEC should at a minimum be sized to house the following:
 - a. 13 – Data Cabinets
 - b. 3 – in-row colling units ex. Liebert CRV
 - c. 2 – in-row UPS units
 - d. 2 post patching field for inter TEC cabinets connections for both copper and fiber.
 - e. Wall space for inter TEC electrical distribution panels, transformers and MBP's.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 - a. All usable wall space will be covered by ¾"x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in ¾" fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.
 - c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF
 5. The TEC should not have a ceiling other than exposed structure.
 6. Static Dissipative Tile is required in the TEC.
 7. The door to the TEC shall be 8'-0" x 4'-0" to accommodate the cabinet height.
 8. The walls of the TEC should not have any windows installed.
 9. The TEC will not have infrastructure that serves other trades pass through the TEC other than that infrastructure that serves the TEC
 10. All pressurized supply piping and drain piping will have drip pans or other means installed to contain any failure of these systems.
- B. Layout
1. Cabinets will be laid out in a cold isle configuration.
 2. All isles, inside and outside will be a minimum of 4' wide
 3. Containment will be installed, including removable ceiling panels and isle doors.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE) – B (RED) design.
 2. Each system A (BLUE) and B (RED) will be backed up by a dedicated UPS.

3. Source A shall be supplied by a dedicated emergency circuit backed up by a dedicated UPS.
 - a. Maintenance Bypass Wraparound or equivalent shall be installed.
 4. Source B shall be supplied by a dedicated emergency circuit from a different ATS system from Source A and backed by a dedicated UPS.
 - a. Maintenance Bypass Wraparound or equivalent shall be installed.
 5. Cabinet Outlet type is L21-30
 6. Provide convenience outlets around the room.
 7. All power is to be run in conduit.
 8. Lighting will be installed above each isle and be supplied by an emergency circuit.
- D. Mechanical
1. The mechanical system will be a precision cooling solution installed in an in row, N+1 configuration designed to maintain 72 degrees F at mid cabinet.
 2. The mechanical system will be redundant and concurrently maintainable, including on the electrical supply.
 3. The system shall meet engineering specifications for the room at 110 degrees outside air at 4500 feet above sea level.
 4. Chilled water, DX (Air Cooled) and Glycol (30% polyethylene glycol to water) are all acceptable cooling strategies.
 5. The GC, Mechanical Engineer and Mechanical Contractor are responsible for the complete installation of the cooling equipment and auxiliary devices included with the equipment. Auxiliary equipment includes but not limited to in-row temperature sensors, leak detection and local or remote monitoring hardware.
- E. Security
1. Doors will be fitted with an auditable card reader.
 2. Doors will have an electronic key cylinder installed.
- F. Fire System
1. A pre-action dry pipe fire system will be installed.
 2. Sprinkler fuses will be rated at 200 degrees F or higher, whatever is allowed.
 3. Sprinklers should be protected from accidental activation.
 4. The primary fire detection system will be provided by the facility system.
 5. The secondary detection system is a VESDA system monitored by the Lake Park Data Center.
- G. Monitoring
1. The Eaton Foreseer system will be used to monitor all critical systems.
 2. Foreseer cables will be run to all UPSs, cooling units and TDRs.
 3. One Cat 6a F/UTP cable to each UPS.

2.3 TEC in Clinics and Office Buildings

- A. Clinics and Offices will have a room which will serve as a TEC and TDR. This room will be sized to accommodate the multifunction of the space.
- B. TEC size will be 12' x 16'

2.4 TEC/TDR in Clinics

- A. Physical Construction
1. TDRs should be in a central location off the main corridor away from patient areas.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 12' x 16'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 - a. All usable wall space will be covered by 3/4"x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in 3/4" fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.

- c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF
 - 5. The TDR should not have a ceiling other than an exposed structure.
 - 6. Flooring can be Static Dissipative Tile or Epoxy Paint.
 - 7. A 3'-0" x 7'0" door is required.
 - 8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 - 1. Racks in a single row with the front being the cold isle.
 - 2. The front of the racks should face the door.
- C. Electrical
 - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 - 2. System A(BLUE) will be backed up by a dedicated UPS.
 - 3. System B(RED) will be from a dedicated Emergency or Utility circuit.
 - 4. The outlet type is L6-30 and L5-20.
 - 5. Provide convenience outlets around the room.
 - 6. All power is to be run in conduit.
 - 7. Lighting will be installed above each isle.
- D. Mechanical
 - 1. TDRs will have redundant cooling.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The Mechanical system will be designed to maintain 72 degrees F at mid rack.
 - e. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 - 1. Doors will be fitted with an auditable card reader.
 - 2. Doors will have an electronic key cylinder installed.
- F. Fire System
 - 1. TDRs will utilize the facility fire detection and suppression systems.
 - 2. Sprinkler heads should have a 200-degree fuse.
 - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 - 1. TDRs will be monitored using Eaton/Foreseer.
 - 2. Run 3 foreseeer cables to each TDR.
 - 3. One Cat6a F/UTP cable to each UPS.

2.5 TEC/TDR in Offices

- A. Physical Construction
 - 1. TDRs should be in a central location off the main corridor.
 - 2. TDRs should be stacked from floor to floor.
 - 3. TDR size will be at least 12' x 16'.
 - 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 - a. All usable wall space will be covered by ¾"x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in ¾" fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.
 - c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF

5. The TDR should not have a ceiling other than an exposed structure.
6. Flooring can be Static Dissipative Tile or Epoxy Paint.
7. A 3'0" x 7'0" door is required.
8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. The outlet type is L6-30 and L5-20.
 5. Provide convenience outlets around the room.
 6. All power is to be run in conduit.
 7. Lighting will be installed above each row.
- D. Mechanical
 1. TDRs will have a redundant cooling system designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - 1) The secondary system will be fed from the facility generator equipment electrical source if available.
 - c. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 1. Doors will be fitted with an auditable card reader.
 2. Doors will have an electronic key cylinder installed.
- F. Fire System
 1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.6 TECHNOLOGY DISTRIBUTION ROOM (TDR)

- A. There shall be a minimum of one TDR on each floor of the facility. TDRs shall be provided throughout the facility as necessary to meet the 292' (90-meter) maximum cables distance. The TDR is located on each floor within a facility to house equipment and cabling, providing communication and technology services for a specific area of that facility. Based on the different needs of different facilities, the TDR's will be broken down into three categories. Hospital, Clinic and Office spaces.

2.7 TDR IN HOSPITALS

- A. Physical Construction
 1. TDRs should be in a central location off a main corridor and away from patient areas.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 14' x 16'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.

- a. All usable wall space will be covered by $\frac{3}{4}$ "x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in $\frac{3}{4}$ " fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.
 - c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF
 5. The TDR should not have a ceiling other than an exposed structure.
 6. Flooring can be Static Dissipative Tile or Epoxy Paint.
 7. A 3'0" x 7'0" door is required.
 8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 1. Racks will be in a cold aisle configuration.
 2. Two rows with the cold aisle in the middle.
- C. Electrical
 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. Each system A(BLUE) and B(RED) will be backed up by a dedicated UPS.
 3. The outlet type is L6-30 and L5-20.
 4. Provide convenience outlets around the room.
 5. All power is to be run in conduit.
 6. Lighting will be installed above each aisle.
- D. Mechanical
 1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 1. Doors will be fitted with an auditable card reader.
 2. Doors will have an electronic key cylinder installed.
- F. Fire System
 1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.8 TDR in Clinics

- A. Physical Construction
 1. TDRs should be in a central location off a main corridor and away from patient areas.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 10' x 12'.
 4. The TDR size in Clinics is 6000 sq. ft. or less will be at least 8' x 8' or as approved by Intermountain IS/IT team based on functional layout of TDR equipment.
 5. TDR size in Clinics for Tenants Demarc will be at least 5' x 5'.
 6. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.

- a. All usable wall space will be covered by $\frac{3}{4}$ "x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in $\frac{3}{4}$ " fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.
 - c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF
 7. The TDR should not have a ceiling other than an exposed structure.
 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
 9. A 3'-0" x 7'-0" wide door is required.
 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 1. Racks in a single row with the front being the cold isle.
 2. The front of the racks should face the door.
- C. Electrical
 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 2. System A(BLUE) will be backed up by a dedicated UPS.
 3. System B(RED) will be from a dedicated utility circuit.
 4. The outlet type is L6-30 and L5-20.
 5. Provide convenience outlets around the room.
 6. All power is to be run in conduit.
 7. Lighting will be installed above each isle.
- D. Mechanical
 1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 1. Doors will be fitted with an auditable card reader.
 2. Doors will have an electronic key cylinder installed.
- F. Fire System
 1. TDRs will utilize the facility fire detection and suppression systems.
 2. Sprinkler heads should have a 200-degree fuse.
 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 1. TDRs will be monitored using Eaton/Foreseer.
 2. Run 3 foreseeer cables to each TDR.
 3. One Cat 6a F/UTP cable to each UPS.

2.9 TDR in Offices

- A. Physical Construction
 1. TDRs should be in a central location off the main corridor.
 2. TDRs should be stacked from floor to floor.
 3. TDR size will be at least 10' x 12'.
 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
 - a. All usable wall space will be covered by $\frac{3}{4}$ "x4'x8' Grade AC fire rated plywood with a minimum of 50% of wall space covered in $\frac{3}{4}$ " fire rated plywood.
 - b. Fire rated plywood shall be painted with bright white fire-resistant paint.

- c. Paint must not cover the fire rating stamp on the plywood. 1 stamp per piece of plywood must be taped off to not be painted.
 - d. Mount 6" AFF
 - 5. The TDR should not have a ceiling other than an exposed structure.
 - 6. Flooring can be Static Dissipative Tile or Epoxy Paint.
 - 7. A 3'0" x 7'0" door is required.
 - 8. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
 - 1. Racks in a single row with the front being the cold isle.
 - 2. The front of the racks should face the door.
- C. Electrical
 - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
 - 2. System A(BLUE) will be backed up by a dedicated UPS.
 - 3. System B(RED) will be from a dedicated utility circuit.
 - 4. The outlet type is L6-30 and L5-20.
 - 5. Provide convenience outlets around the room.
 - 6. All power is to be run in conduit.
 - 7. Lighting will be installed above each isle.
- D. Mechanical
 - 1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
 - a. Primary cooling is from the facility cooling system via a dedicated source.
 - b. Secondary cooling is from a standalone split or ceiling mount source.
 - c. The secondary system will be fed from the facility generator equipment electrical source if available.
 - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
 - 1. Doors will be fitted with an auditable card reader.
 - 2. Doors will have an electronic key cylinder installed.
- F. Fire System
 - 1. TDRs will utilize the facility fire detection and suppression systems.
 - 2. Sprinkler heads should have a 200-degree fuse.
 - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
 - 1. TDRs will be monitored using Eaton/Foreseer.
 - 2. Run 3 foreseeer cables to each TDR.
 - 3. One Cat 6a F/UTP cable to each UPS.

2.10 WALL MOUNT CABINET

- A. Physical Condition
 - 1. Wall mount cabinet should only be used when there is not space for a TDR.
- B. Electrical
 - 1. Power should be run into the back of the cabinet.
- C. Mechanical
 - 1. The cabinet should have a factory fan installed.
- D. Security
 - 1. The door will have an electronic key cylinder installed.

PART 3 - EXECUTION

3.1 COMMON REQUIRED CHARACTERISTICS FOR TDR, TEC, & TSER

A. SECURITY - COMMON

1. Any visitor, vendor, or contractor requiring access to a Technology Room, who does not have appropriate approvals or clearances, must be escorted by a properly credentialed tech from the appropriate system.
2. The main technology equipment shall be secured in a dedicated, locked Technology Room.
3. Unused access jacks should be disconnected from the patch panels, and unused switch ports disabled.
4. Technology Rooms shall be dedicated to the data and telecommunications functions.
5. Access to the Technology Room shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the main networking interfaces, the networking equipment, the application servers, data storage devices, and telecommunications equipment systems.
6. Technology Rooms shall not be used for building maintenance services, custodial services, or be used for general storage.
7. Security cameras may be installed in each Technology Room upon the owner's preference.
 - a. At the back wall facing the door but directed to not see the equipment in the racks, end of each row of equipment racks.
 - b. In electrical and mechanical rooms serving the Technology Room
 - c. Approved camera manufacturers: Axis and Bosch
8. Access to a Technology Room shall be restricted and controlled by an auditable access control system. The access control system shall comply with the requirements of this document.
9. All secure data areas must be secured by an auditable badge reader system.
 - a. Refer to plans or quotes for detailed information.
 - b. Approved supplier: Intermountain Lock and Security Supply /
3106 S Main St / Salt Lake City, UT 84115 / 801-486-0079
 - c. Owner of security locks and badge readers:
Intermountain Healthcare Data Center
 - d. For programming on the Medeco XT Electronic Keys contact:
Intermountain Healthcare Data Center

B. PHYSICAL ENVIRONMENT

1. The Technology Room shall be in a dry area not subject to flooding and should be as close as possible to the electrical service room to reduce the length of the bonding conductor to an electrical grounding system.
2. The Technology Room shall be in an accessible, non-sterile area.
3. Access to the Technology Room shall be directly off a corridor and not through another space.
4. The Technology Room shall be located to avoid large ducts, beams, and other building elements that may interfere with proper cable routing and may limit future access.
5. Mechanical and electrical equipment or fixtures not directly and exclusively related to the support of the Technology Room shall not be installed in, pass through, or enter the Technology Room.
6. Technology rooms shall not be located on exterior walls.
7. Technology rooms shall not have windows or other exterior openings.

3.2 TECHNOLOGY DISTRIBUTION ROOM (TDR) / DATA CLOSET

A. ELECTRICAL ENVIRONMENT

1. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-C and local codes.
 2. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-C, or both, be observed throughout the entire cabling system.
 - a. All racks, equipment frames, furniture, flooring, and ductwork within the IT space shall be bonded to the Central Ground bar provided and installed by Division 26.
 - 1) No AC electrical equipment bonding will be done at the Central Ground Bar. AC electrical grounding and bonding will be done according to the NEC.
 3. Some TDRs will require redundant power and data feeds. See plans and drawings.
 4. Lighting in the TDRs should be a minimum of 500 lx (50-foot candles) at the lowest point of termination.
 - a. Light switch should be easily accessible when entering the room.
 - b. Lighting will be fed from the generator system or have fixtures with battery backup.
 5. A minimum of two dedicated duplex or two dedicated simplex electrical outlets, each on a separate 120V 20A circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.
 - a. Only twist lock receptacles will be used for rack power points. Type L-6-30R for 208 volts and type Nema L-5-20R for 120 volts.
 6. All power originates from the facilities generator backup system with one system (A-B) originating from the critical system.
 7. All circuits serving the TDR and the equipment within it shall be dedicated to serving the TDR.
 8. TDRs shall be connected by a backbone of insulated, 6 (minimum) to 3/0 AWG stranded copper cable between all technology rooms. This cable shall be provided and installed by Division 26.
- B. MECHANICAL ENVIRONMENT
1. Reliable cooling shall be provided.
 - a. Based on criticality tiering structure individual rooms may require redundant, concurrently maintainable cooling systems.
 - b. Tier structure level shall be determined from the design guide.
 2. Heat load shall be calculated at 4KW per equipment rack
 3. Temperature and humidity in the TDR shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
- C. EQUIPMENT
1. Each TDR shall be connected to the TEC (Technology Equipment Center) to provide a building-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunication Grounding Bus Bar

3.3 TECHNOLOGY EQUIPMENT CENTER (TEC) / DATA ROOM

- A. ELECTRICAL ENVIRONMENT
1. The TDR and TEC electrical environments shall match the following exceptions:
 2. All circuits serving the TEC and the equipment within it shall be dedicated to serving the TEC.
- B. MECHANICAL ENVIRONMENT
1. TEC and TSER have the same mechanical environment.
 2. Reliable cooling shall be provided.

3. Heat load shall be calculated at 4KW per equipment rack.
 4. Temperature and humidity in the TEC shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
- C. EQUIPMENT
1. Each TEC shall be connected to the TSER (Telecommunications Service Entrance Room) to provide an enterprise-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunications Main Grounding Bus Bar.

3.4 TELECOMMUNICATION SERVICE ENTRANCE ROOM (TSER) / D-MARC

- A. PURPOSE
1. The TSER (Telecommunications Service Entrance Room) equipment subsystem shall consist of shared (common) electronic communications equipment in the
 2. TEC or the TSER required to interface this equipment and distribution hardware to the transmission media of enterprise-Wide Area Network (WAN) infrastructure.
 3. The TSER shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
 - a. Note that the AIA/State guidelines specify that the minimum size for a TSER is 12' by 14'.
 - b. Doors shall swing out of the room to provide maximum available space and rapid egress.
 - 1) Exception: where prohibited by fire or safety code.
 4. The TSER shall be dedicated to the telecommunications function.
- B. MECHANICAL ENVIRONMENT
1. Reliable cooling and heating shall be provided.
 2. Temperature and humidity in the TSER shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
- C. EQUIPMENT
1. The TSER (Telecommunications Service Entrance Room) shall be connected to the specified WAN equipment to provide connectivity to the enterprise-wide network and communications system.
 2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded to a Telecommunications Main Grounding Bus Bar.

END OF SECTION

SECTION 271116

**CABINETS, RACKS, FRAMES,
AND ENCLOSURES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Cabinets and racks specifications are in TIA569-C and in the ET pages of the plans.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

A. OPEN RACKS

1. For rack-mounted installations in a telecommunications room the installer shall use a 19-inch by 3-inch-deep equipment rack.
 - a. Equipment Rack 19" X 8', 52 RU, Black – Chatsworth 55053-715
 - b. Equipment Rack 19" X 7', 45 RU, Black – Chatsworth 55053-703
 - c. Exception: Where other size cabinets are specified by design team at owner's direction
 - d. All equipment racks must be bolted to the floor for seismic support.

B. WALL MOUNTED RACK

1. Wall Mounted Rack 53.6" H x 17" D, 26RU, Black – Chatsworth 11807-718
2. Heavy Duty Swing Gate – Chatsworth 12795-701

C. WIRE MANAGERS

1. Part Numbers
 - a. Vertical Wire Manager, Double Sided, Black 10" wide x 8' tall – Chatsworth 40096-715
 - b. Vertical Wire Manager, Double Sided, Black 10" wide x 7' tall – Chatsworth 40096-703
 - c. Horizontal Wire Manager, 4U – Panduit PR2HF4
2. Typical Standard Layout
 - a. The layout is 10" vertical manager, then 19" rack, then 10" vertical manager, then 19" rack, then 10" vertical manager.
 - b. Where more than 2 racks are called for, maintain the pattern of 10" vertical wire management on the ends, and 10" vertical management between racks.

D. CABINETS

1. Standard Cabinet
 - a. DCE 1-Sided Cabinet – 600mm x 1200mm - Vertiv E4562121120001S
 - b. DCE 2-Sided Cabinet – 600mm x 1200mm - Vertiv E4562122120001S
 - c. DCE 1-Sided Cabinet – 700mm x 1200mm - Vertiv E4572112120001S
 - d. DCE 2-Sided Cabinet – 700mm x 1200mm - Vertiv E4572122120001S
 - e. Baying Gasket – Baying Gasket Kit – Vertiv E4013
 - f. Baying Kit – Baying Hardware Kit – Vertiv E9013
 - g. Blanking Panel – Upsite Hotlok 10031 1U
 - h. Blanking Panel – Upsite Hotlok – 10033 2U
 - i. All cabinets must be bolted to the floor for seismic support.
2. Wall Mount Cabinet
 - a. **Cube-It** – CPI 11996-736 (36" H x 30" D). Or specified size.

- b. Stand Fan and Filter Kit for Cube-It – CPI 40972-001
- c. Power strip for Cube-It – CPI 12820-705 (20 Amp – NEMA 5-20P)
- d. Vertical Wall Mount Cabinet – Legrand VWMSD-4RU-42-B
- e. Vertical Wall Mount Cabinet – Legrand VWMSD-8RU-42-B
- f. Fixed Mounting Rail Kit – Legrand VWM-RR-4RU
- g. Fixed Mounting Rail Kit – Legrand VWM-RR-8RU
- h. Pivoting Mounting Rail Kit – Legrand VWM-PIV-4RU
- i. Fan Kits with 115 VAC fans – Legrand VWMFK-115
- j. Top Brush Grommet Kit – Legrand VWMBGK
- k. Circular Knockout Grommet Kit – Legrand VWMGR-30
- l. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 24” – Hubbell IR221APG.
- m. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 36” – Hubbell IR321APG.
- n. Vertical Wall-Mount Cabinets - Refrigerated Cabinet 48” – Hubbell IR421APG.
- o. Air Conditioners – Aire conditioner for Hubbell refrigerated cabinets - Hubbell IRAC1

END OF SECTION

SECTION 271119

**TERMINATION BLOCKS AND
PATCH PANELS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section.
 - 1. Basic electrical requirements
 - 2. Basic electrical materials and methods
 - 3. Grounding, Earthing, and Bonding

PART 2 - PRODUCTS

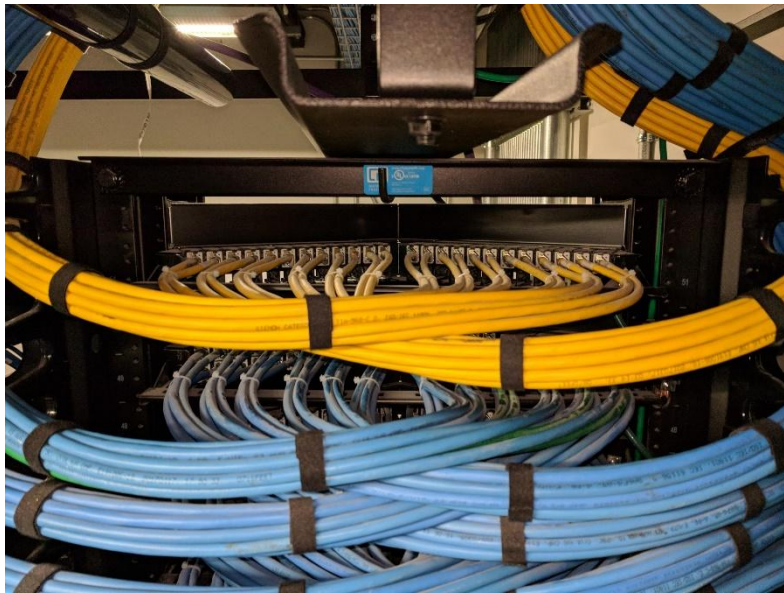
2.1 APPROVED PRODUCT

- A. PATCH PANELS – COPPER
 - 1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets – Siemon Z6AS-PA-48A
 - 2. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U48K
 - 3. 24 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U24K
 - 4. 48 Port CAT 6, 2RU Angled Patch Panel, 110 Style – Siemon UP6-A2-48L-RS
 - 5. 48 Port CAT 6, 2RU Flat Patch Panel, 110 Style – Siemon UP6-F2-48L-RS
 - 6. 24 Port CAT 6, 1RU Angled Patch Panel, 110 Style – Siemon UP6-A1-24L-RS
 - 7. 24 Port CAT 6, 1RU Flat Patch Panel, 110 Style – Siemon UP6-F1-24L-RS
 - 8. 19" Angled Blank Filler Panel, 1U, Black – Siemon PNL-BLNKA-1
 - a. Provide blank fillers where appropriate.
 - 9. 19" Flat Blank Filler Panel, 1U, Black – Siemon PNL-BLNK-1
 - a. Provide blank fillers where appropriate.
- B. PATCH PANELS – FIBER
 - 1. LightVerse Rack Mount Fiber Enclosure – Siemon LVE-4U-MD-P01A
 - 2. Lightverse Blank Adapter Plate, Black – Siemon LVA-BLANK-01A
 - 3. LightVerse LC Splice Cassette - Siemon LVS12-LSUARAB1A
 - 4. LightVerse Splice Tray – Siemon TRAYHD—1-A
 - 5. OM4 Splice Cassette – Siemon LVS12-LS-PVRAB1A
 - 6. Wall Mount Fiber Enclosure – Siemon LVW-M1-01
 - 7. Lightstack Surface Mount Module Enclosure – Siemon – LSE-01
 - 8. Lightstack Surface Mount Splice Enclosure – Siemon – LSS-01
 - 9. Lightstack LC Adapter Plate – Siemon LS-LS12-01C-AQ

PART 3 - EXECUTION

3.1 INSTALLATION

- A. For angled patch panels, the terminations shall cross in the back to the opposite path of the patch panel to maximize available cable bend radius.
- B. See illustration below in this section:



END OF SECTION

SECTION 271300

BACKBONE CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 – Pathways for Communications Systems.

1.2 DEFINITIONS

- A. INTRA-BUILDING CABLING
 - 1. Cable that runs between telecommunications rooms (TRs) inside a building. Can be vertical or horizontal in physical orientation. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.
- B. INTER-BUILDING / CAMPUS CABLING
 - 1. Cable that runs between buildings in a campus environment. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building. Campus Backbones require an optical fiber cable to be installed to support high speed data applications.
 - 2. Customer owned outside plant (OSP) cabling.

PART 2 - PRODUCTS

2.1 PERMITTED BACKBONE MEDIA

- A. Cables allowed for use in the backbone include:
 - 1. CAT 6A F/UTP Riser, Blue, Data – Siemon 9A6R4-A5-06-R1A
 - 2. CAT 6A F/UTP Plenum, Blue, Data – Siemon 9A6P4-A5-06-R1A
 - 3. 50 Pair Category 3 Riser Cable Gray – General Cable 2133161 or equal
 - 4. 50 Pair Category 3, OSP Rated PE-89, Black, 22 AWG – General Cable 7525637 or equal.
 - 5. Building Entrance Terminal, 50-Pair, 110 Style Termination – Circa 1880ECA1-50
 - 6. Fiber Optic Cable, Single-mode, 24 Strand, Armored Indoor/Outdoor Cable, Black – Siemon 9BG8P024L-E201A
 - 7. Fiber Optic Cable, Single-mode, 24 Strand, Armored, Plenum Cable, Yellow – Siemon 9BC8P024L-E205A
 - 8. Fiber optic Cable, Single-mode, 48 Strand, Armored Outdoor Cable, Black – Siemon 9PF8C048G-E201A
 - 9. Fiber Optic Cable, Single-mode, 144 Strand, Armored Outdoor Cable, Black – Siemon 9PF8C144G-E201A
 - 10. Fiber Optic cable, multi-mode, OM4, 12 Strand, Armored, Riser Cable, Aqua – Siemon 9BC5R012G-T512A (Data Centers must be OM4 or better)
 - 11. Microfiber

- B. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.
- C. Multi-pair twisted pair cable is intended to support analog voice applications and shall be tested for continuity only.
- D. In addition to meeting the applicable performance specifications, all copper and optical fiber cables shall be appropriate for the environment in which it is installed.

2.2 MEDIA PRODUCTS

- A. COPPER
 - 1. The total channel length between the Campus Distributor/Main Cross-connect and to any floor Distributor/Horizontal Cross-connect shall not exceed the following length limits for copper cabling:
 - a. 2,000 m (6,560 ft) for balanced twisted pair for PBX/Class A (100 kHz) applications.
 - b. 200 m (656 ft) for balanced twisted pair for Class B (≤ 1 MHz) applications.
 - c. 100 m (328 ft) for balanced twisted-pair categories 6, 6A & 7 (per Backbone segment when providing a two-level Backbone).
- B. MULTIMODE OPTICAL FIBER
 - 1. See Siemon website for supportable fiber distances
 - a. Laser qualified 50/125 μ m multimode fiber optical fiber cables shall be following the following standards ISO/IEC 11801:2002 OM3, ANSI/TIA-568-C.3, ANSI/TIA-568-C.1 and Telcordia GR-409-CORE as well as the guaranteed application distances, attenuation, bandwidth, and group index requirements of refraction.
 - b. Specifications:
 - 1) Shall support 10GBASE-SX for all horizontal workstations, risers and short length backbone (<300 m) locations.
 - 2) Constructed for overfilled launch (OFL) and restricted mode launch (RML) bandwidth to ensure compatibility with both LED and laser light sources.
 - 3) Have an Aqua Outer Jacket and be available in cable ratings including OFNR and OFNP.
- C. SINGLE MODE OPTICAL FIBER
 - 1. See Siemon website for supportable fiber distances
 - 2. Single-mode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.
 - 3. All fiber is to fusion spliced terminations.

PART 3 - EXECUTION

3.1 TOPOLOGY

- A. The Backbone cabling shall use a conventional hierarchal star topology.
 - 1. There shall be no more than two (2) levels of cross-connects between the campus distributor/main cross-connect (CD/MC) and any given floor distributor/horizontal cross-connect (FD/HC).
 - 2. From the FD/HC no more than one cross-connect shall be passed through to reach the CD/MC.
- B. Splicing of UTP, F/UTP and S/FTP copper cables is not permitted.

3.2 TYPICAL TDR BACKBONE

- A. A typical TDR backbone for a hospital campus shall consist of:
 - 1. Redundant (2 ea.) 24 strand single-mode fiber each routed in a separate path.
 - 2. One 50 pair copper feed line.

END OF SECTION

SECTION 271500

HORIZONTAL CABLING

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. Section 27 05 28 - Pathways for Communications Systems

1.2 SUMMARY

- A. This section includes requirements and guidelines for the installation of F/UTP, ScTP, and Fiber horizontal cabling.
 - 1. Horizontal cable and its connecting hardware provide the means of transporting signal between the telecommunications outlet/connector and the horizontal cross-connect located in the communications termination room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

PART 2 - EXECUTION

2.1 HORIZONTAL CABLE

- A. Quantity
 - 1. Two horizontal cables shall be routed to each work area. Cable connected to information outlets shall be CAT6A F/UTP, 4-pair, 100Ω balanced twisted-pair.
 - a. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
 - b. Two (2) standard cables shall be run to each wireless access point location per current best practice.
 - c. One (1) standard horizontal cable may be run to the following locations:
 - 1) Each building control system enclosure as directed by the building controls vendor.
 - 2) Each IP Video Surveillance Camera at each of the designated locations.
 - 3) Each wall phone.
 - 4) Each wall monitor/display.
 - 2. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
 - 3. Installation interfaces shall be T568B wiring standards.
- B. Maximum Length
 - 1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft.) from the telecommunications outlets in the work area to the Floor Telecommunications Room.
 - 2. Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication

- Room.
- 3. The combined length of jumpers, patch cords inclusive of equipment cables in the Floor Distributor/Horizontal Cross-connect shall not exceed 5m (16 ft.).
- 4. The maximum length of Work Area equipment cables shall be 5m (16 ft.) If a MuTOA (Multiple User Telecommunication Outlet) environment exists, then the maximum equipment cable shall not exceed 22m (72 ft.) (Lake Park Facility)
- 5. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
- C. Minimum Length
 - 1. It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
 - 2. For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and consolidation point, and 5m (16 ft.) between the consolidation point and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
- D. Splice Free
 - 1. Each run of balanced twisted-pair cable between Floor Distributor/Horizontal Cross-connect in the telecommunication room and the information outlet at the Work Area shall not contain splices.
 - 2. Bridged taps and splices shall not be installed in the horizontal cabling.
- E. Protection
 - 1. Horizontal distribution cables shall not be run in under slab raceways that are damp or wet locations unless suitably rated for the environment.
 - a. Under slab conduits that are outside of the building are considered wet locations.
- F. Slack -Service Loop – Routing
 - 1. In the work area, a minimum of 1m (3 ft) should be left for balanced twisted-pair cables and fiber cables.
 - 2. In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types.

2.2 SEPARATION

- A. Separation from EMI sources
 - 1. Installation shall comply with BICSI TDM and TIA/EIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and EMI Source shall be as follows:
 - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 5 inches.
 - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 12 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 24 inches.
 - 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or EMI Source shall be as follows:
 - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2-1/2 inches.
 - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 6 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 12 inches.
 - 4. Separation between communications cables in grounded metallic raceways and power lines and EMI Source located in grounded metallic conduits or enclosures shall be as follows:
 - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2 inches.

- b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 3 inches.
 - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 6 inches.
 - 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 1 HP and Larger: A minimum clearance of 48 inches.
 - 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum clearance of 5 inches
- B. Other Clearances
 - 1. Horizontal pathways used for telecommunications cabling shall be dedicated for telecommunications use and not shared by other building services.
 - 2. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.

2.3 PATHWAY

- A. Cable Tie Wraps
 - 1. Cable Tie Wraps are not permitted as a pathway device or support.
 - 2. Tie Wraps shall only be used to provide strain relief at termination points.
 - 3. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- B. Constraints
 - 1. Horizontal cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
 - a. If cabling is intentionally or unintentionally exposed to water or otherwise coated with or exposed to direct contact with solvents, paints, adhesives, sealants or other third-party materials, Siemon will not warranty the cabling product or if after the warranty has been issued, it would become void. Therefore, any cabling that has been exposed as listed above, must be removed and replaced.
 - 2. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
 - 3. A minimum of a 1" diameter conduit is required for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.
 - a. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
 - 1) 4-Pair UTP, F/UTP, S/FTP bend radius = 4 times outside diameter of cable under no-load conditions. 8 times the outside diameter under load (pulling 110 N/25 lbf.) conditions.
 - 2) Multi-pair or Hybrid cable bend radius = 10 times the outside diameter under all conditions.
 - 3) 2-Fiber and 4 Fiber cables bend radius = 25mm (1 in.) under no-load conditions. 50mm (2 in.) under load (pulling 222 N 50 lbf)
 - 4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
 - 5. Cable that passes through non-Intermountain Health spaces must be installed in conduit.
 - 6. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

7. Do not install bruised, kinked, scored, deformed, abraded cable or otherwise damaged cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
 8. During Cold-Weather Installation, bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- C. Capacity
1. The number of horizontal cables placed in a cable support or pathway shall be limited to the number of cables that will not alter the geometric shape of the cables.
 2. Maximum pathway (cable tray/basket tray/wireway) capacity shall not exceed a calculated fill ratio of 50% to a maximum of 75 mm (3 in) inside depth.
 3. Maximum conduit pathway capacity shall not exceed 40% fill. However, perimeter and furniture fill are limited to 60% fill for moves and changes. A 40% fill ratio is the maximum fill for CAT6A F/UTP cables.

Cable Tray Size [W x D] mm (in.)	Cable O.D. - CAT 6A Shielded (.29 in.)		
	7.4mm (0.29 in.)	8.4mm (0.33 in.)	8.9mm (0.35 in.)
304x101 (12 x 4)	363	280	249
457x101 (18 x 4)	545	20	374
610x101 (24 x 4)	726	561	498
304x152 (12 x 6)	545	420	374
457x152 (18 x 6)	817	631	561
610 x 152 (24 x 6)	1099	841	748

4. All unused cables shall be removed
 - a. Or labeled at both ends designating future purpose and locations of each end.

END OF SECTION

SECTION 271513

COPPER CABLE

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 PALLETTE

- A. Color palette shall be in accordance with Section 27 05 53

1.3 SUMMARY

- A. This Section covers approved F/UTP / UTP cable types
- B. All systems except for Nurse Call shall be CAT6A F/UTP unless a written deviation has been approved.
- C. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
- D. This cable shall be used for both voice and data applications and shall be plenum rated where required by code
- E. All Nurse Call cables shall be CAT6 UTP.

PART 2 - PRODUCT

2.1 APPROVED PRODUCT

- A. TYPE 6A F/UTP (foil over unshielded twisted pair) - Siemon
 - 1. CAT 6A F/UTP Riser, (CMR) – Siemon 9A6R4-A5-(XX)-R1A
 - 2. CAT 6A F/UTP Plenum, (CMP) – Siemon 9A6P4-A5-(XX)-R1A
 - a. (XX) = Color – 06, Blue – 05, Yellow – 09, Orange
- B. TYPE 6 UTP (unshielded twisted pair) – Siemon – Nurse Call only
 - 1. CAT 6 UTP Riser, (CMR) – Siemon 9C6R4-E3-09-RXB
 - 2. CAT 6 UTP Plenum, (CMP) – Siemon 9C6P4-E3-09-RXA

END OF SECTION

SECTION 271543

FACEPLATES AND CONNECTORS

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 DEFINITION

- A. Work-Area Cabling
 - 1. The work area is comprised of work area outlet/connectors, faceplates, outlet boxes and equipment cords. It acts as the interface to the horizontal cabling from the horizontal cross-connect (HC) to telephone, network equipment, wireless access points (WAP) and OIP devices.

PART 2 - PRODUCT

2.1 OUTLETS

- A. Category 6A Shielded Jack – Siemon Z6A-S(XX)
 - 1. Use (XX) to specify color.
 - 2. Universal design allows the same outlet to be mounted in a flat or angled orientation.
- B. UltraMAX Category 6 Jack – Orange – Nurse Call – Siemon U6-H09NS
- C. Category 6A Z-Plug WO Latch Protector – Siemon ZP1-6AS-(00)s
- D. Voice Outlet, Single Gang Faceplate, White W/Wall Hung Phone W/6A Insert – Siemon MX-WP-Z6AS-SS

2.2 FACEPLATES/BOXES

- A. 10G Single Gang Faceplate, White, 4 Position – Siemon 10GMX-FP-04-02
- B. MAX Single Gang Faceplate, White – Siemon MX-FP-S-(XX)-02
 - 1. USE (XX) to specify the number of ports.
- C. MAX Single Gang Faceplate, Stainless Steel, 4 Position, with Label Holder – Siemon MX-FP-S-04-SS-L
 - 1. To be used in the Operation Rooms
- D. Surface Mount Box, White, 2 Position – Siemon MX-SMZ2-02
- E. Furniture Faceplate, Black – Siemon MX-UMA-01
- F. Blank Insert, White – Siemon MX-BL-02
- G. Blank Insert, Black – Siemon MX-BL-01
- H. Conference Room Table Inserts shall include an HDMI port.

PART 3 - EXECUTION

3.1 WORK AREA TERMINATION

- A. All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
- B. Outlet/connector back boxes shall be a minimum 4-11/16 square box (4-11/16" x 4-11/16" x 3") with a minimum single gang 5/8" mud ring for new construction to accommodate the CAT6A connectors.
- C. All outlets need to be installed in the angled position.

END OF SECTION

SECTION 271619

PATCH CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This section is issued as a guide for patch cable installations in the Data Center, wiring closets (TDR) and user areas where patch cables are required for connectivity to IP and TDM phones, and IP data connectivity needs for Intermountain Healthcare. All patch cables will support voice, data, and imaging applications within the Intermountain Healthcare Enterprise.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. Patch Cable, CAT 6A Shielded Skinny- Siemon SP6A-S (XX)-(XX)
1. Use 1st (xx) to specify length. Use 2nd (xx) for color.
- B. Patch Cable, CAT 6, Orange – Siemon MC6-(XX)-09-28
1. Use (xx) to specify length. For use with NURSE CALL only.
- C. Patch Cable, Fiber, Single mode Duplex W/LC Connectors, Yellow – Siemon FJ2-LCULCUL-(xx)
1. Use (xx) to specify length.
- D. Patch Cable, Fiber, Multimode Duplex W/LC Connectors, Aqua – Siemon FJ2-LCLC5V-(xx)AQ
1. Use (xx) to specify length. For use in the Data Center.

PART 3 - EXECUTION

3.1 PALLETTE

- A. Patch Cable Color Codes
1. The Intermountain Healthcare Enterprise standard for patch cable color is in Section 27 05 53.
2. The patch cable color shall match the feed cable color to identify the service provided.
- B. Contractor furnished.
1. All patch cables for the TEC, TDRs shall be included in the low voltage contract and will be required to match or exceed the existing level of the installed structured cabling system.
2. All patch cables for the user areas shall be Owner furnished and will be required to match or exceed the existing level of the installed structured cabling system.
3. All patch cables shall be Owner installed.
4. The quantity of patch cables provided by the low voltage contractor shall be specified in the plans.
a. 50% 5ft – 40% 7ft – 5% 10ft – 5% 15ft

END OF SECTION

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

SECTION 275113

OVERHEAD PAGING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. The Primary Division 27 subcontractor shall be accountable to closely coordinate the Overhead Paging system with the General Contractor.
 - 1. Division 27 is accountable for including the cabling, equipment, and installation thereof in their work; based upon the project drawings.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Basic Electrical Requirements.
 - 2. Basic Electrical Materials and Methods.

1.2 SUMMARY

- A. This Section includes the installation of an overhead paging system that shall be accessible through the telephone system. It includes requirements for paging system components including, but not limited to, the following:
 - 1. Speaker systems.
 - 2. Wiring
- B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the Division 27 installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of product) as listed in the drawings and these specifications:
 - 1. BiAmp – (Vocia)

2.2 SYSTEM REQUIREMENTS

- A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

2.3 EQUIPMENT AND MATERIALS

- A. General: Provide all solid-state components fully rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.

- B. Loudspeakers shall be Drop-In Tile speakers. To be 24" x 24" tile speakers, provided by one of the following manufactures.
 - 1. Bogen CSD2X2/VR
 - 2. Quam System 12/70RS
- C. Transformer must be capable of providing 25V/70V.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify compliance of the following items before beginning sound equipment installation.
 - 1. No cables spliced except at standard barrier terminal blocks inside equipment cabinet.
 - 2. Cables marked at each end with permanent wire labels such as Brady or equal.
 - 3. Isolated ground run back to main electrical panel from paging equipment cabinet.
 - 4. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.

3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Speakers:
 - 1. Confirm polarity of speaker before installation and wire to maintain uniform polarity.
 - 2. Mount transformers with screws securely to speaker brackets or enclosures.
 - 3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
 - 4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
 - 5. Identification:
 - a. Legibly identify user operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within equipment cabinet using similar labels or "Kroy" type labels.
- C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor shall be responsible to repair, restore, and refinish to original appearance.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.

3.4 COMMISSIONING

- A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

3.5 CLEANING AND PROTECTION

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION

SECTION 275319

**INTERNAL CELLULAR, PAGING
AND ANTENNA SYSTEMS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
 - 1. Basic Electrical Requirements.
 - 2. Basic Electrical Materials and Methods.

1.2 SUMMARY

- A. The DAS system is provided and installed as an Owner-provided, Owner installed (OFOI) system by a 3rd-party vendor, contracted and managed by Intermountain CTIS/Telecom Team.
- B. A/E to coordinate DAS requirements with the Owner's vendor to incorporate necessary infrastructure on their drawings to support all fully functional DAS system.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. DAS contractor is to install their equipment located in the TDRs in the assigned Rack location as noted in the ET TDR Room Elevation Drawings.
- B. DAS contractor is to install any wall mounted equipment in the TDRs in the assigned location as noted in the ET TDR Room Elevation drawings.
- C. Specific power requirements will need to be provided in the design phase of the project by the CTIS/Telecom team.
- D. Cable installation will follow Division 27 installation specifications.
- E. The fiber DAS distribution shall be installed in a star topology from the DAS room to all TEC/TDR's.

END OF SECTION

SECTION 276001

**APPENDIX 01 – DEVIATION
REQUEST PROCESS**

PART 1 - GENERAL

1.1 DEFINITIONS

- A. Cable Plant Deviation
 1. A business deviation to not fully comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
- B. Cable Plant Deviation Request form.
 1. The document is available from the Facilities Planning team, the Data Center Ops team, or the Infrastructure Cabling team.
 2. Usage:
 - a. The deviation request form shall be used if there is a business need to not comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document.”
 - b. The deviation request form should also be used to propose a change to that document. Always verify that you are using the current version of the Standard before requesting a modification.

PART 2 - PROCESS

2.1 STANDARDS MODIFICATION

- A. Check the box and explain why the standard should be modified.

2.2 ALTERNATE PRODUCT

- A. The deviation form must be completed, submitted through channels, and approved prior to any deviation from the specifications. This includes issuing change orders.

2.3 AUTHORIZED SIGNATURES

- A. Both the Standards Holder and the DCO Manager signatures are required for a deviation to be valid.

2.4 DEVIATION REVIEW PROCESS STEPS

- A. First be sure that there is an actual need. Then be certain that your manager, supervisor, or project manager agrees with the requested deviation. Be sure to state this or obtain their signature on the deviation form. By doing so you are confirming that your supervisor or project manager has approved.
- B. The requestor will then complete sections 1, 2, and 3 of the deviation form.
 1. The requestor should then digitally sign in the designated location at the end of Section 3. Do not write in the sections below 3.
- C. Forward the saved copy of this form to the Standards Holder via email.
 1. Email to: melissa.lopez2@imail.org
- D. The Standards Holder will then review and evaluate the request. The requestor should be prepared to provide plans, specifications, and competitive bids if requested. Any email threads or meeting discussions regarding the issue will be taken into consideration.

- E. The Standards Holder will then cast an Approve or Deny vote and forward the request to the DCO Manager for a decision.
- F. When the decision has been made by the DCO Manager, the Standards Holder will then notify the requester by returning the completed and signed form via email.
- G. An approved deviation will have the final disposition button 'Approved' and be signed by at least 2 people. One will be from the Standards Holder, and the other the DCO Manager. Other signatures may be required for specific features and areas such as Safety, Security, Print, Medical group, etc.
- H. The deviation request is only good for the specific project that it was submitted on. A change to Division 27 is required for the deviation to be in place moving forward on all future projects.

PART 3 - EXECUTION

3.1 POST DECISION EXECUTION

- A. DENIED
 - 1. If the requester is not satisfied with the decision, they may file an appeal with the Data Center Operations manager (shawn.folkman@imail.org), who will then escalate the issue to the appropriate business leaders as needed. The decision from the appeal is final.
- B. APPROVED
 - 1. If a deviation is approved for contracted material, labor, or method; the facilities project manager will arrange for fulfillment or contract adjustment as needed via appropriate contract channels such as change orders.

END OF SECTION

SECTION 276002

**APPENDIX 02 – DOCUMENT
REFRESH PROCESS**

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. The purpose of this section is to help ensure a current standards document.
- B. The product delivered will be a current revision or version of the Cable Plant Standards Document.
- C. All changes must be approved by the Enterprise Infrastructure Cabling team.

PART 3 - EXECUTION

3.1 REVIEWS AND UPDATES

A. Minor updates

- 1. Changes that do not significantly affect scope of work, or contract pricing will be made, and the Rev number will be updated. (i.e. updated part numbers, etc.)
- 2. Significant changes will be added to the Change Log for review and approval from the DCO/Infrastructure Cabling Team.
 - a. When approved, they will be implemented in the new Version.

B. Major updates

- 1. The DCO/Infrastructure Cabling Team will review the entire document at least once every three years.
- 2. This review will coincide with the release of new versions of NFPA70 (National Electrical Code) (2017, 2020, etc. - to be completed by the end of each designated year).
- 3. The review will cover standards adjustments that may be deemed necessary and ensure compliance with applicable codes and standards.
- 4. Upon completion of the reviews and updates, the standards document will be submitted for approval.

END OF SECTION

Model	Manufacture	Part Number	Description	Notes
Eaton Single-Phase UPS				
5S UPS	Eaton	5S550	550VA/330W, 120V Line Interactive UPS	
9PX UPS	Eaton	9PX1000RT	1000VA/900W, 120V Online UPS, RM or Tower	
9PX UPS	Eaton	9PX1500RTN	1500VA/1350W, 120V Online UPS, RM or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX2000RTN	2000VA/1800W, 120V Online UPS RM, or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX3000RTN	3000VA/2700W, 120V Online UPS RM, or Tower, Includes NETWORK-M3 Card	
9PX UPS	Eaton	9PX3K3UNP1	3000VA/2700W, 208/240V to 120V Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Bypass Option 9PX 1-3kVA	Eaton	9PXEBM72RT	EBM for use with 9PX2000RTN & 9PX3000RTN UPS	
Network Card option 9PX 1-3K	Eaton	NETWORK-M3	Eaton Gigabit Network Card	
Rack mount kit 9PX 1-3kVA Option	Eaton	RK2PC	2-post rack mounting kit for 1-6kVA UPS & EBM	
9PX SP UPS	Eaton	9PX6KSP	5500VA/4900W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Model	Manufacture	Part Number	Description	Notes

9PX SP UPS	Eaton	9PX8KSP	8000VA/7200W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
9PX SP UPS	Eaton	9PX10KSP	10000VA/9000W, 120/208 or 120/240V Split-Phase Online UPS, RM or Tower, Includes NETWORK-M3 Card	
Bypass 9PX SP 6-10kVA, 9PXM	Eaton	BPM125HW	Bypass Power Module for 6, 8 & 10kVA 9PX Split-Phase, 9PXM & 9155 UPS, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM8S8K	8kVA expandable to 16kVA, (1) 8-slot enclosure, (2) power modules, (4) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM8S12K	12kVA expandable to 16kVA, (1) 8-slot enclosure, (3) power modules, (6) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM8S16K	16kVA, (1) 8-slot enclosure, (4) power modules, (8) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM12S12K	12kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (3) power modules, (6) battery modules, (1) network card, Hardwired Input/Output	
Model	Manufacture	Part Number	Description	Notes

9PXM UPS	Eaton	9PXM12S16K	16kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (4) power modules, (8) battery modules, (1) network card, Hardwired Input/Output	
9PXM UPS	Eaton	9PXM12S20K	20kVA expandable to 20kVA N+1, (1) 12-slot enclosure, (5) power modules, (10) battery modules, (1) network card, Hardwired Input/Output	
PDU's				
Smart PRO1 PDU	Server Tech	C1C10SA-2CBA2B4	Smart Primary PRO1 PIPS PDU, 1U, (10) HDOT Outlets (6xC13 + 4xCx), Input Amp Meter, 208V 30A, NEMA L6-30P, 10 ft (3m) Input Cord, Circuit Breakers, (2) Temperature/Humidity Sensor Capable	Horizontal
Smart POPS PRO2 PDU	Server tech	C2SG36TE-DQME2M66/ZB	Smart POPS Primary PRO2 (36) Alt Phase HDOT Outlets (24xC13 + 12xCx), 208V 3PH Delta 6BR 60A, IP67 Water-tight IEC60309 3m/10ft cord, Auto-Orient Mid Display, Bottom Cord Entry, Doghouse Breakers, Phase Monitoring, Blue Highlights	Vertical
Smart POPS PRO2 PDU	Server tech	C2LG36TE-DQME2M66/ZR	Smart POPS Expansion PRO2 (36) Alt Phase HDOT Outlets (24xC13 + 12xCx), 208V 3PH Delta 6BR 60A, IP67 Water-tight IEC60309 3m/10ft cord, Auto-Orient Mid Display, Bottom Cord Entry, Doghouse Breakers, Phase Monitoring, Red Highlights	Vertical
Model	Manufacture	Part Number	Description	Notes

Smart POPS PRO2 PDU	Server Tech	C2SG36TE-DCMFAM66/C	Smart POPS Master PRO2 (36) Alt Phase HDOT Configurable Outlets, 208V 3PH Delta 3BR 30A L15-30P 3m/10ft cord, Auto-Orient Mid Display, Bottom Base Cord Entry, Doghouse Breakers, Phase Monitoring, WxD = 2.20in x 2.50in	Notes
Smart PRO1 PDU	Server Tech	C1S24VS-YCFA13C9/C	Smart PRO1 Primary, 0U, 18 x IEC C13 and 6 x IEC C19 Outlets, 1 x NEMA 5-20R Utility Outlet, 3 x LED Amp Meters, 3-phase Wye 30A Input w/ NEMA L21-30P Connector, 10ft (3m) Cord (Bottom/base Entry), (2) Temperature/Humidity Sensor Capable, with Retractable Fuses	Vertical
Smart PRO1 PDU	Server Tech	C1L24VS-YCFA13C9/C	Smart PRO1 Expansion, 0U, 18 x IEC C13 and 6 x IEC C19 Outlets, 1 x NEMA 5-20R Utility Outlet, 3 x LED Amp Meters, 3-phase Wye 30A Input w/ NEMA L21-30P Connector, 10ft (3m) Cord (Bottom/base Entry), (2) Temperature/Humidity Sensor Capable, with Retractable Fuses	Vertical
Smart PRO1 PDU	Server Tech	STV-3531C	Smart PRO1, PIPS (Per Input Power Sensing), 0U, (24) IEC C13 + (6) IEC C19 Outlets, (1) LED Current Meter w/ Auto-flip, 208-240V 30A, NEMA L6-30P Plug, 10 ft (3m) Cord w/ Power Pivot Cord Entry, Middle Display/Network, (2) Temperature/Humidity Sensor Capable, Circuit Breakers	Vertical
Model	Manufacture	Part Number	Description	Notes
Smart PRO1 PDU	Server Tech	SEV-3531C	Smart PRO1 (Expansion Unit), PIPS (Per Input Power Sensing), 0U, (24) IEC C13 + (6)	Vertical

			IEC C19 Outlets, (1) LED Current Meter w/ Auto-flip, 208-240V 30A, NEMA L6-30P Plug, 10 ft (3m) Cord w/ Power Pivot Cord Entry, Middle Display/Network, (2) Temperature/Humidity Sensor Capable, Circuit Breakers	
MN03E1R0-10D203-2TL5A0H10-S	Vertiv/Geist PDU	NI30202	Unit-level monitored PDU, 20A, 120V, rackmount, 10x rear NEMA 5-20R receptacles	Horizontal
MNR3E1R6-12CF18-3TL6A0H10-S	Vertiv/Geist PDU	NR30206	12-Outlets PDU - Monitored - NEMA L6-30P - 12 x Combination C13/C19 - 230 V AC - Network (RJ-45) - Horizontal - Rack-mountable - Horizontal	Horizontal
MN03E4W1-44MB19-3TL21A0B10-S	Vertiv/Geist PDU	VP8865	rPDU, Monitored Unit Level EC, 30A, 120/208V WYE, 8.6kW, Vertical, (36) IEC C13, (6) IEC C19, (2) NEMA 5-20R, 10ft power cord with L21-30P, Black Powder Coat.	Vertical
ePDU	Eaton	EMIT06-10	Metered Input ePDU, 208V, 5.76 Max. kW, L6-30P Input (10ft), (10) C13, (4) C19 Output, 1U	
ePDU	Eaton	EMIT09-10	Metered Input ePDU, 120V, 1.92 Max. kW, L5-20P (5-20P adapter) Input (10ft), (8) 5-20R Output, 1U	
Model	Manufacture	Part Number	Description	Notes
T- Sensor ePDU	Eaton	EMPDT1H1C2	Environmental Monitoring Probe Gen 2	
eATS	Eaton	EATS120	Rack Mount Automatic Transfer Switch, Non-phase Synchronized Switching Compatible,	

			120V, 1.92 Max. kW, (2) 5-20P (10ft) Input, (10) 5-20R Output, 1U	
eATS	Eaton	EATS30P	Rack Mount Automatic Transfer Switch, Non-phase Synchronized Switching Compatible, 208V, 5.76 Max. kW, (2) L6-30P (10ft) Input, (1) L-6-30R Output, 1U	
Power Cords				
Dual Lock Power Cord	StayOnline Power Cords	5656N	IEC320 C14 Male Plug to C13 Connector Dual-Lock 1.8 meters / 6 feet 10A/250V 18/3 SVT Red - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	6694N	IEC320 C14 Male Plug to C13 Connector Dual-Lock 1.8 meters / 6 feet 10A/250V 18/3 SVT Blue - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	5914N	IEC320 C20 Male Plug to C19 Connector Dual-Lock 1.8 meters / 6 feet 20A/250V 12/3 SJT Red - Locking Power Cord	
Dual Lock Power Cord	StayOnline Power Cords	6766N	IEC320 C20 Male Plug to C19 Connector Dual-Lock 1.8 meters / 6 feet 20A/250V 12/3 SJT Blue - Locking Power Cord	
NEMA to IEC Power Cord	StayOnline Power Cords	9008	NEMA 5-15 Male Plug to IEC320 C13 Connector 1.8 meters / 6 feet 15A/125V 14/3 SJT Red - Power Cord	
Model	Manufacture	Part Number	Description	Notes
NEMA to IEC Power Cord	StayOnline Power Cords	7978	NEMA 5-15 Male Plug to IEC320 C13 Connector 1.8 meters / 6 feet 15A/125V 14/3 SJT Blue - Power Cord	

P-Lock Power Cord	StayOnline Power Cords	9144	IEC320 C14 Male Plug to C15 Connector P-Lock 1.8 meters / 6 feet 15A/250V 14/3 SJT Red - Locking Power Cord	
P-Lock Power Cord	StayOnline Power Cords	9138	IEC320 C14 Male Plug to C15 Connector P-Lock 1.8 meters / 6 feet 15A/250V 14/3 SJT Blue - Locking Power Cord	
Mechanical				
VRC	Vertiv		3.5kW Rack Mounted Cooling Unit	VRC100 (Self Contained Version)
Mini-Mate 3	Liebert	MT036HE1A00XCH	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 4	Liebert	MT048HE1A00AP4	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 5	Liebert	MT060HE1A00WPZ	Ceiling mounted thermal management system, direct expansion unit.	
Mini-Mate 3	Liebert	MMD40C2AJ0D5	Ceiling mount chilled water unit	
Mini-Mate 5	Liebert	MMD92CDAJ0L5	Ceiling mount chilled water unit	
CRV	Liebert	CR020RA1A70A71	Row-Based Environmental Control System, DX direct expansion 5 ton Unit	
Model	Manufacture	Part Number	Description	Notes
CRV	Liebert	CR035RA1A70A71	Row-Based Environmental Control System, DX direct expansion 10 ton Unit	
CRV	Liebert	CR032RC1A2SH	Row-Based Environmental Control System, Chilled water 5 ton unit	

CRV	Liebert	CR040RC1A2SH	Row-Based Environmental Control System, Chilled water 10 ton unit	
Cable Ladder Tray				
Cable Runway	CHATSWORTH	10250-724	CABLE RUNWAY - 24", BLACK WITH ALL REQUIRED MOUNTING ACCESSORIES	
Cable Runway	CHATSWORTH	10250-718	CABLE RUNWAY - 18", BLACK WITH ALL REQUIRED MOUNTING ACCESSORIES	
Butt Splice	CHATSWORTH	11301-701	BUTT SPLICE KIT, Black	
Junction Splice	CHATSWORTH	11302-701	JUNCTION SPLICE KIT	
Foot kit	CHATSWORTH	11309-701	FOOT KIT, BLACK	
Rack to Runway	CHATSWORTH	12409-724	6" CHANNEL RACK TO RUNWAY, BLACK	
Triangle Bracket	CHATSWORTH	11746-718	18" TRIANGLE BRACKETS, BLACK	
Triangle Bracket	CHATSWORTH	11746-724	24" TRIANGLE BRACKETS, BLACK	
End Closing Kit	CHATSWORTH	11700-724	END CLOSING KIT, CABLE RUNWAY, BLACK	
Wall Angle Support Kit	CHATSWORTH	11421-718	18" WALL ANGLE SUPPORT KIT, CABLE RUNWAY, BLACK	
Model	Manufacture	Part Number	Description	Notes
Wall Angle Support Kit	CHATSWORTH	11421-724	24" WALL ANGLE SUPPORT KIT, CABLE RUNWAY, BLACK	
Elevation Kit	CHATSWORTH	10506-706	CABLE RUNWAY ELEVATION KIT, 6"	
Radius Drop	CHATSWORTH	12100-712	CABLE RUNWAY RADIUS DROP	

DC Fiber modules & Jumpers				
Wall Mount Module Box	SIEMON	WMF-A-01	Wall Mount Module Box, OM4 Aqua, LC/MTP	
Wall Mount Module Box	SIEMON	WMF-B-01	Wall Mount Module Box, OM4 Violet, LC/MTP	
Fiber Patch Cable	SIEMON	LBP-LCULCUL-(XX)	PATCH CABLE LBP, FIBER, SINGLEMODE DUPLEX W/LC CONNECTORS, YELLOW, (XX) = LENGTH IN METERS	
Fiber Patch Cable	SIEMON	LBP-LCLC5V-(XX)AQ	PATCH CABLE LBP, FIBER, MULTIMODE DUPLEX W/LC CONNECTORS, AQUA, (XX) = LEGTH IN METERS	
Fiber Patch Cable	SIEMON	LBP-LCLC5V-(XX)EQ	PATCH CABLE LBP, FIBER, MULTIMODE DUPLEX W/LC CONNECTORS, ERIKA VIOLET, (XX) = LEGTH IN METERS	
Foreseer Cable, 2 Pair	Belden	88723		
Cold/Hot aisle containment provided by Data Center Operations				
Electronic Key Cylinders				
Cylinder	Medeco	100500 G	1 ¼" Mortise Cylinder	
Cylinder	Medeco	100400H G	Rim Cylinder, Horizontal Tailpiece	
Cylinder	Medeco	EA-100108	Small Format Interchangeable Core (SFIC) Cylinder	
Model	Manufacture	Part Number	Description	Notes
Cylinder	Medeco	20200S1 G	Cylinder Package for Schlage	
Cam Lock	Medeco	EN-150002-219	7/8" Cam Lock Assembly, Key Retaining	
Cam Lock	Medeco	EN-150003-219	1 1/8" Cam Lock Assembly, Key Retaining	
Cylinder for Legrand cabinet front door	Medeco	232301S 800 G	Modular Profile Cylinder – 30mm Half Profile - Assembled	
Electronic Key	Medeco	94-0271	Medeco Slim Line Key (G2) & Charger Bundle	

Programming Station for Small Locations	Medeco	EA-100109	Medeco XT Desktop USB Programming Station (not preferred)	
Programming Station for Large Locations	Medeco	EA-100158	Medeco XT Wall USB Programming Station (preferred)	
Wall Mount for Wall Programmer	Medeco	94-0294	Medeco XT Remote Wall Programmer Wall Mount Kit	
Padlock	Master	6842D045KZ	Padlock for use with Electronic Cylinder	

SECTION 276004

APPENDIX 04 – REFERENCE STANDARDS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. ANSI/TIA-568.0-D and addenda "Generic Telecommunications Cabling for Customer Premises
 2. ANSI/TIA-568.1-D and addenda "Commercial Building Telecommunications Cabling Standard
 3. ANSI/TIA-568.2-D and addenda "Balanced Twisted-Pair Telecommunications Cabling and Components
 4. ANSI/TIA-568.3-D and addenda "Optical Fiber Cabling Components Standard"
 5. ANSI/TIA-568.4-D and addenda "Broadband Coaxial Cabling and Components Standard"
 6. ANSI/TIA-569-D and addenda "Telecommunications Pathways and Spaces"
 7. ANSI/TIA-606-C and addenda "Administration Standard for Commercial Telecommunications Infrastructure"
 8. ANSI/TIA-607-D and addenda "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
 9. ANSI/TIA-758-B "Customer-Owned Outside Plant Telecommunication Infrastructure Standard"
 10. IEEE 802.3at PoE Plus and Next Gen PoE CFI March 2013 and IEEE P802.3ba latest draft revision and amendments.
 11. "Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbp/s and 100 Gbp/s Operation".
 12. ANSI/TIA-526-7-A "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
 13. ANSI/TIA/EIA-526-14-C "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
 14. ANSI/TIA-942-B "Telecommunications Infrastructure Standard for Data Centers"
 15. ANSI/TIA - 1179-A "Healthcare Facility Telecommunications Infrastructure Standard"
 16. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments "Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling."
 17. ISO/IEC 11801-1 (2017) and amendments "Information technology - Generic cabling for customer premises – PART 1: General Requirements"
 18. EN 50173-1 and amendments "Information Technology - Generic cabling systems – PART 1 General Requirements"
 19. AIA Guidelines for Design and Construction of Hospital and Healthcare Facilities
 20. Construction Specification Institute Master Format
 21. BICSI: Comply with the most current editions of the following BICSI manuals:
 - a. BICSI - Telecommunications Distribution Methods Manual
 - b. BICSI – Installation Transport Systems Information Manual
 - c. BICSI – Network Design Reference Design Manual
 - d. BICSI – Outside Plant Design Reference Manual
 - e. BICSI – Wireless Design Reference Manual

- f. BICSI -Electronic Safety and Security Design Reference Manual
- g. Infocomm/BICSI – AV Design Reference Manual
- 22. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program.
- 23. National Electrical Manufacturers Association (NEMA)
- 24. American Society for Testing Materials (ASTM)
- 25. National Electrical Code (NEC) NFPA70 2020
- 26. National Electrical Safety Code (NESC) 2017
- 27. Institute of Electrical and Electronic Engineers (IEEE)
- 28. UL Testing Bulletin
- 29. Building Industry Consulting Services International (BICSI) Information Transport Systems Methods Manual (ITSMM)
- 30. Local, county, state and federal regulations and codes in effect as of date of installation.
- 31. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

END OF SECTION

SECTION 276005

APPENDIX 05 – DEFINITIONS AND ABBREVIATIONS

PART 1 - GENERAL

1.1 RELATED TERMS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
 2. BICSI: Building Industry Consulting Service International.
 3. CBC: Coupled Bonding Conductor
 4. CFCI: Customer Furnished Customer Installed
 5. Cable Run - A single cable to a single location
 6. Cable Drop - Two cables to a single location
 7. Cable Tri Drop - Three cables to a single location.
 8. CT Coupler A type of wall connector made by the Siemon Company
 9. DCO: Data Center Operations
 10. Div.1: Division 1 General and Performance Requirements
 11. Div. 23: Division 23 Heating, Ventilating, and Air Conditioning
 12. Div. 22: Division 22 Plumbing
 13. Div. 26: Division 26 Electrical
 14. Div. 27: Division 27 Communications and Audio Visual
 15. Div. 28: Division 28 Electronic Safety and Security
 16. E.E.: Electrical Engineer
 17. EMI: Electromagnetic Interference
 18. F/UTP: Foil over Unshielded Twisted Pair. Individual pairs are unshielded.
 19. GC: General Contractor
 20. GE: Ground Equalizer
 21. Horizontal Cabling: The cable and connecting hardware utilized to transport communications signals.
 22. ICT: Infrastructure Cabling Team
 23. LAN: Local Area Network
 24. N/A: Not Applicable
 25. NIC: Not in Contract
 26. OFCI: Owner Furnished Contractor Installed
 27. OFOI: Owner Furnished Owner Installed
 28. OTDR: Optical Time Domain Reflectometer
 29. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
 30. RCDD: Registered Communications Distribution Designer
 31. RFI: Radio Frequency Interference
 32. TBA or TBD: To Be Determined
 33. TDR: Technology Distribution Room
 34. TEC: Technology Equipment Center
 35. TGB: Telecommunications Ground Bus Bar
 36. TMBC: Telecommunications Main Bonding Conductor
 37. TMGB: Telecommunications Main Grounding Bus Bar
 38. TSER: Telecommunications Service Entrance Room
 39. UTP: Unshielded Twisted Pair
 40. Work Area: approx. 100 sq. ft. equipped for workstation equipment.

- 41. DCO = Data Center Operations - Boe.Sausedo@imail.org
- 42. ICT = Information and Communications Technology - Melissa.Lopez2@imail.org

END OF SECTION

SECTION 276006

APPENDIX 06 – MATERIAL SUPPLIERS

PART 1 - GENERAL

1.1 RELATED TERMS

- A. Siemon Authorized Suppliers are listed below. To help prevent counterfeiting and support warranties, known, factory authorized distributors are recommended.
1. Approved Suppliers of Siemon cable, patch panels, jacks, and parts:

Wesco/Anixter

Randi Whittaker
Inside Sales
3775 W. California Ave. Ste 400
Salt Lake City, UT 84104 US

Main Phone: (801) 973-2121
Fax: (801) 973-4472
Email: randi.whittaker@anixter.com

Karl Bartlam
End User/Outside Sales
3775 W. California Ave. Ste 400
Salt Lake City, UT 84104 US

Main Phone: (801) 973-2121
Fax: (801) 973-4472
Email: karl.bartlam@anixter.com

Graybar Electric

Elizabeth Vaughn
Inside Sales
2841 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 656-3016
Fax: (801) 973-4314
Email: Elizabeth.Vaughn@graybar.com

Erika Morrison
Contractor Outside Sales
2841 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 656-3014
Fax: (801) 973-4314
Email: Erika.Morrison@graybar.com

WESCO / CSC

Brian Walters
Inside Sales
3210 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 975-0600
Fax: (801) 907-4450
Email: Bwalters@gocsc.com

Adam Tueller
Contractor Outside Sales
3210 South 900 West
Salt Lake City, UT 84119 US

Main Phone: (801) 975-0600
Direct: (801) 618-6665
Email: Atueller@gocsc.com

- B. The Siemon Company is represented locally by: Easton.Jones@siemon.com

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
905 N 1000 W, Tremonton, UT 84337
Intermountain Healthcare

Construction Documents

END OF SECTION

SECTION 276007

**APPENDIX 07 – SIEMON CERTIFIED
INSTALLATION FIRMS**

PART 1 - GENERAL

1.1 RELATED TERMS

- A. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
- B. The firms selected to bid must be pre-approved by the local facility IT manager. Installation firms desiring to do work for Intermountain Health must be selected from the official CI list below.
- C. Current Siemon Approved/Certified Cable Installers for Siemon Network Cable. This list is up to date as of 2025-01-03.
1. **Orion Integration Group:** 8880 W. Barnes Street, Boise, ID 83709
 - a. Greg Chavez // Phone 208 321 8000 / Fax 208 321 8555 /
Direct 208 489 2230 // Gchavez@io-group.com / www.io-group.com
 2. **ACS Systems:** 925 North Main St. Meridian, ID 83642
 - a. Doug McCleery // Phone 208 331 8554 / Fax 208 884 5638
/ Mobile 208 412 5763 // doug@acs-systems.com / www.acs-systems.com
 3. **IES Commercial:** 16292 So. Bringham Boulevard, Suite 700, Bluffdale, UT 84065
 - a. Brad Davis – Branch Manager // Phone 801 975 8182 / Fax 385 242 7366 /
Mobile 385 448 7175 // Brad.Davis@iescomm.com / www.iescomm.com
 4. **Cache Valley Electric:** 1338 S. Gustin Rd., Salt Lake City, UT 84104
 - a. Travis Grant – Acct. Manager // Phone 801 908 4170 / Fax 801 908 7401
Mobile 801 870 7226 // Travis.Grant@cve.com / www.cve.com
Brad Readicker – Acct. Manager // Phone 801 908 2686 / Fax 801 908 7401
Mobile 801 870 4963 // Brad.Readicker@cve.com / www.cve.com
 5. **Hunt Electric, Inc.:** 1863 W. Alexander St., Salt Lake City, UT 84119
 - a. Colton – Technology Division Manager // Phone 801 975 8844 Mobile
385 505 2662 // Colton.@hunteletric.com / www.hunteletric.com
 6. **Linx:** 167 West 7065 South, Midvale UT 84047
 - a. Mike Herd – Account Executive // Mobile 801 702 7083 //
MHerd@teamlinx.com / www.teamlinx.com
Steve Faddis – Project manager // Mobile 385 707 5168 //
SFaddis@teamlinx.com / www.teamlinx.com
 7. **Data Plus:** 769 Middlegate Road, Henderson, NV 89118
 - a. Chris Tettamanti – Project Manager // Phone 702 795 3282
Chris@dpcnv.com
 8. **Bombard Electric:** 4380 West post Road, Las Vegas, NV 89118
 - a. Bob Reese – Project/Division Manager // Phone 702 263 3570
Bob.reese@bombardelec.com / www.bombardelec.com
 9. **Fisk Electric:** 6412 Arville Street, Las Vegas, NV 89118
 - a. Anthony Sant – Operations Manager // Phone 702 435 5053 /
Fax 702 435 2127 / Mobile 702 373 6969 // Asant@fiskcorp.com /
www.fiskcorp.com
 10. **Mojave Electric:** 3755 W. Hacienda Ave., Las Vegas, NV 89118
Phone 702 798 2970

11. **The Morse Group:** 3874 Silvestri Lane, Las Vegas, NV 89120
 - a. Chuck Sudberry – Group Manager Low Voltage // Phone 702 257 4452
Mobile 702308 4410 // Csudberry@themorsegroup.com/
www.themorsegroup.com
12. **Linx:** 9900 E 51st Ave., Denver, Co 80238
 - a. John Lopez // Phone 303 500 2860 // JLopez@teamlinx.com
13. **TelNet Systems:** 547 S 20th Street West, Suite #2, Billings, MT 59102
 - a. Clay Jensen // Phone 406 855 7478 // Clay.Jensen@telnetsystemsmt.com

END OF SECTION

SECTION 276008

APPENDIX 08 – LEAD WALL PENETRATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Sections 13090 & 134900

1.2 RELATED TERMS

Procedure Name: New Port and Electrical Box Installation Lead Lined Walls

Document Detail Information: (This section must be completed in full.)

Implements Policy:	Click here to enter policy title		
Content Owner	Craig Allen, Safety Security Environment Health Director, Central Office Jeremy Hawk Medical Physicist Radiation Safety Coordinator	Content Consultant(s):	Jeremy Hawk, Radiation Safety Officer, Medical Physicist Imaging John Ellis, Facilities Management Director, Central Office Steve Kelly, System Project Facility Design Manager, Planning Melissa Lopez, Cabling, IS
Date of Final Draft:	12/29/2015	Who Reviewed Content?	<Name, Title, Dept> <Name, Title, Dept> <Name, Title, Dept> <Committee Name>
Keywords (must have at least 3):	Searchable Keywords (e.g., PHI, EMTALA, Coding)		

1.3 PURPOSE

- A. Maintain radiation safety controls in lead lined walls during installation of new power and data outlets in existing lead lined walls.

1.4 SCOPE

- A. Intermountain Hospitals, Intermountain Clinics Medical Group

1.5 DEFINITIONS

- A. Lead lined Walls – Structured element designed to provide a barrier to block radiation penetration beyond the designated space.
B. Maintenance Manager – The person responsible for plant maintenance operations or his/her delegate.

- C. Radiation Safety Coordinator – The person responsible for Radiation Safety or his/her Delegate. Medical Physicist.
- D. Worker – The person responsible for completing work with the lead lined wall. This includes Intermountain Employees as well as any outside supplier or contractor.

1.6 PROVISIONS

- A. The Radiation Safety Program is following Utah regulation R313-15-101, R313-28 and U.S. Nuclear Regulatory Commission Regulation 1- CFR Part 20-1101.

1.7 PROCEDURE

- A. Prior to any work within a lead lined wall, the Worker reports to the Radiation Safety Coordinator, Maintenance Manager and completed a review of planned work “ACWP” Identification of specific description related to the lead lined wall planned work.
 - 1. Intermountain workers, outside suppliers or contractors hired to work in any Intermountain facility must contact the Maintenance Manager and Radiation Safety Coordinator prior to beginning work to discuss the project and ensure that the planned work will not interfere with facility operations, maintenance, or other projects.
 - 2. Failure to schedule and complete the planning meeting described above may result in the delay or rescheduling of work. Outside suppliers or contractors are responsible for any costs incurred because of their failure to schedule and complete this meeting.
- B. The Radiation Safety Coordinator, Maintenance Manager and the worker conduct a pre-work inspection of the areas in which work is to be performed. This inspection identified the following:
 - 1. Areas of special concern or sensitivity, including those noted or described on the facility Life Safety records and drawings, and Radiation Safety records and drawings.
 - 2. Appropriate areas or structures to use for support of any work, as applicable.
 - 3. Existing deficiencies in Barriers.
 - 4. The as act assemblies impacted by the work.
 - 5. The type of shielding material acceptable in the area.
 - a. Lead lined boxes
 - b. Lead lined wall “inside wall” installation, and OR
 - c. Lead shielding for wall installation of “outside wall” maintaining radiation safety barriers.
 - 6. The exact condition of the areas upon completion of work.
- C. Upon completion of the work and before closing the wall, the worker, Radiation Safety Coordinator and Maintenance Manager conduct a post-work inspection of the area in which the work was performed, this inspection verifies the following:
 - 1. No Tools, Supplies or debris are left within the walls.
 - 2. Lead lining is installed to maintain radiation safety protection according to regulatory requirements.
 - 3. All work affecting Radiation Safety Lead Barriers has been properly sealed.
 - 4. The overall condition of the area meets the expectation outline in the per-work inspection.

- D. The Maintenance Manager and Radiation Safety Coordinator signs and logs the completed "ACWP"

1.8 **EXCEPTIONS**

- A. None.

1.9 **PRIMARY SOURCES**

- A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

1.10 **SECONDARY MATERIALS**

- A. Radiation Safety Policy
B. Above Ceiling Work Permit
C. Lead lined wall requirements as defined by Radiation Safety Building Requirements



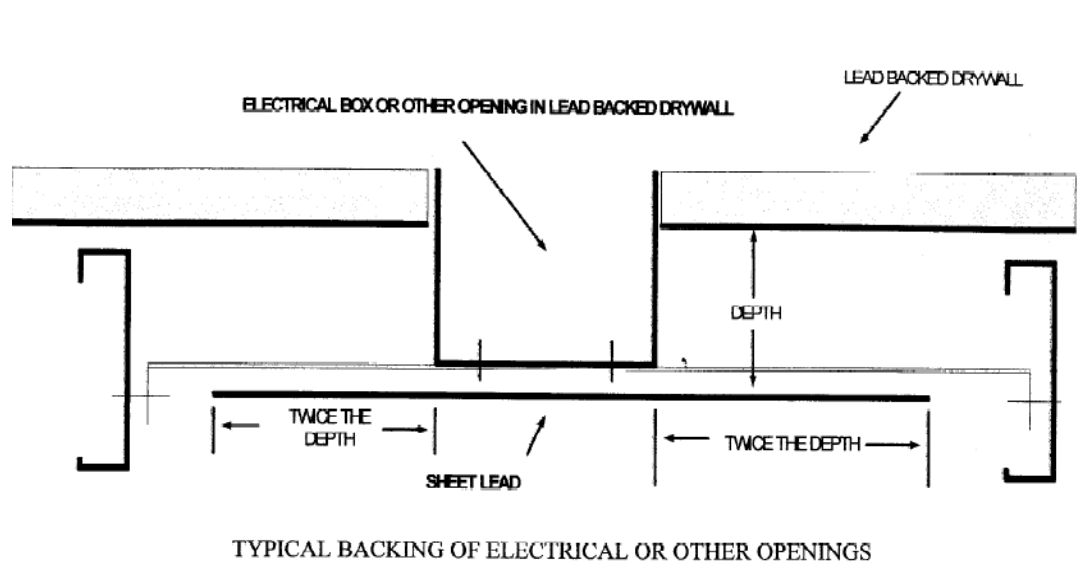
Option 1: worker to install new power utility wall box and add Lead Lining to wall behind box
If worker can access posterior wall entry



Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



Option 3: worker to install new power utility wall box - no additional lead lining required if installation does not disrupt the existing shielding



END OF SECTION

SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Nonsystem smoke detectors.
 - 5. Heat detectors.
 - 6. Notification appliances.
 - 7. Firefighters' two-way telephone communication service.
 - 8. Magnetic door holders.
 - 9. Remote annunciator.
 - 10. Addressable interface device.
 - 11. Digital alarm communicator transmitter.
 - 12. Radio alarm transmitter.
 - 13. System printer.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified FMG-placarded addressable system, with automatic sensitivity control of smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For fire-alarm system, submit shop drawings with product data in one submittal. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Include voltage drop calculations for notification appliance circuits.
 - 3. Include fire alarm zoning diagrams indicating zoning of the fire alarm system coordinated with the corresponding fire protection zones and smoke compartments. Comply with NFPA 99.
 - 4. Include battery-size calculations.

5. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 6. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations. Provide remote test switches (RTS) as required by NFPA 72.
 7. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
 8. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- C. General Submittal Requirements:
1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.
 - c. Licensed or certified by authorities having jurisdiction.
- D. Delegated-Design Submittal: For smoke and heat detectors 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. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.

- c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
- 5. Manufacturer's required maintenance related to system warranty requirements.
- 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.9 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 - 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
 - 3. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 1 unit of each type.
 - 5. Keys and Tools: One extra set for access to locked and tamperproofed components.
 - 6. Audible and Visual Notification Appliances: One of each type installed.
 - 7. Fuses: Two of each type installed in the system.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. 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.
- E. NFPA Certification: Obtain certification according to NFPA 72 by an NRTL.
- F. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.
- G. NFPA Certification: Obtain certification according to NFPA 72 in the form of a placard by an FMG-approved alarm company.
- H. NFPA Certification: Obtain certification according to NFPA 72 by the Authority Having Jurisdiction.

1.11 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 - 1. Notify Construction Manager no fewer than 7 days in advance of proposed interruption of fire-alarm service.
 - 2. Do not proceed with interruption of fire-alarm service without Construction Manager's written permission.

1.12 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

1.13 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide product by the following:
 - 1. Gamewell (Match Existing)

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices[and systems]:
 - 1. Manual stations.
 - 2. Smoke detectors.
 - 3. Duct smoke detectors.
 - 4. Verified automatic alarm operation of smoke detectors.
 - 5. Automatic sprinkler system water flow.
 - 6. Heat detectors in elevator shaft and pit.
 - 7. Fire-extinguishing system operation.
 - 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
 - 1. In the Clinic and Central Utility Plant (CUP), continuously operate alarm notification appliances.
 - 2. In the hospital, continuously operate chime/strobe appliances in smoke zone where alarm is initiated. Continuously operate strobe appliances throughout the hospital
 - 3. Identify alarm at fire-alarm control unit and remote annunciators.
 - 4. Transmit an alarm signal to the remote alarm receiving station.
 - 5. Unlock electric door locks in designated egress paths.
 - 6. Release fire and smoke doors held open by magnetic door holders.
 - 7. Activate voice/alarm communication system.
 - 8. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 - 9. Activate smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 10. Activate stairwell and elevator-shaft pressurization systems.
 - 11. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 - 12. Recall elevators to primary or alternate recall floors.
 - 13. Activate emergency lighting control.

14. Activate emergency shutoffs for gas and fuel supplies.
 15. Record events in the system memory.
 16. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. Elevator shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.

2.3 FIRE-ALARM CONTROL UNIT

- A. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder
 - c. Must be able to operate and monitor Pre-action systems throughout hospital
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.

- b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 7.
 - d. Install no more than 50 addressable devices on each signaling line circuit.
- 2. Serial Interfaces: Two RS-232 ports for printers.
- D. Stairwell Pressurization: Provide an output signal using an addressable relay to start the stairwell pressurization system. Signal shall remain on until alarm conditions are cleared and fire-alarm system is reset. Signal shall not stop in response to alarm acknowledge or signal silence commands.
 - 1. Pressurization starts when any alarm is received at fire-alarm control unit.
 - 2. Alarm signals from smoke detectors at pressurization air supplies have a higher priority than other alarm signals that start the system.
- E. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an NRTL-listed and -approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification Appliance Circuit: Operation shall sound in a temporal.
- G. Elevator Recall:
 - 1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 - 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
 - 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- 1. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system. Review Door Hardware Schedule for sequence of operation requiring an interface with the fire alarm system, such as release upon fire alarm. Provide all fire alarm system components to accomplish the specified sequence of operation which may require components beyond those that are indicated on drawings. Provide fire alarm release at all delayed egress doors and any other doors in the path of egress that are allowed to be locked.
- H. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- I. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

- J. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- K. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- L. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed, valve-regulated, recombinant lead acid.
- M. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
 - 7. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.

- b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).
 - c. Provide multiple levels of detection sensitivity for each sensor.
 - B. Photoelectric Smoke Detectors:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - C. Ionization Smoke Detector:
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
 - D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
 - 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
- 4. Each sensor shall have multiple levels of detection sensitivity.
- 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- 6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- 7. Remote Test Station (RTS): Provide keyed type RTS. Comply with NFPA 72, owner, AHJ, architect, and EOR locations.

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured **10 feet (3 m)** from the horn, using the coded signal prescribed in UL 464 test protocol.
- F. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum **1-inch- (25-mm-)** high letters on the lens.
 - 1. Rated Light Output:
 - a. 15/30/75/110 cd, selectable in the field.
 - 2. Mounting: Wall mounted unless otherwise indicated.
 - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 - 4. Flashing shall be in a temporal pattern, synchronized with other units.
 - 5. Strobe Leads: Factory connected to screw terminals.
 - 6. Mounting Faceplate: Factory finished, white.

2.8 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
 - 1. Electromagnet: Requires no more than 3 W to develop **25-lbf (111-N)** holding force.
 - 2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
 - 3. Rating: 24-V ac or dc.
 - 4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

2.9 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
 - 1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall to circuit-breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
 - 1. Verification that both telephone lines are available.
 - 2. Programming device.
 - 3. LED display.
 - 4. Manual test report function and manual transmission clear indication.
 - 5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
 - 1. Address of the alarm-initiating device.
 - 2. Address of the supervisory signal.
 - 3. Address of the trouble-initiating device.
 - 4. Loss of ac supply or loss of power.
 - 5. Low battery.
 - 6. Abnormal test signal.
 - 7. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire-alarm system.

2.13 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
 - 1. Factory fabricated and furnished by manufacturer of device.
 - 2. Finish: Paint of color to match the protected device.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Smoke- or Heat-Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
 - 2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
 - 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).

- 4. HVAC: Locate detectors not closer than **3 feet (1 m)** from air-supply diffuser or return-air opening.
- 5. Lighting Fixtures: Locate detectors not closer than **12 inches (300 mm)** from any part of a lighting fixture.
- D. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Install keyed remote test stations in acceptable locations.
- E. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- F. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- G. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- H. Remote Test Station (RTS): Install keyed test station in wall near each duct smoke detector that is not readily visible from normal viewing position. Provide in locations acceptable to owner, AHJ, Architect, & EOR.
- I. Audible Alarm-Indicating Devices: Install not less than **6 inches (150 mm)** below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least **6 inches (150 mm)** below the ceiling.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- L. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than **72 inches (1830 mm)** above the finished floor.
- M. Annunciator: Install with top of panel not more than **72 inches (1830 mm)** above the finished floor.

3.2 WIRING INSTALLATION

- A. Wiring Method: Install wiring in metal raceway according to Division 26 Section 260519 Conceal raceway except in unfinished spaces and as indicated.
- B. Wiring for Grid Ceiling Mounted Devices: Install junction box at accessible location above ceiling. Use flexible metal conduit for wiring between junction box and outlet box for ceiling mounted device. Secure flexible conduit within 12 inches of junction box.
- C. 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.
- D. Cable Taps: Use numbered terminal strips in junction, pull and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

- E. 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.
- F. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.
- G. Wiring to Remote Alarm Transmitting Device: 1-inch (25-mm) conduit between the FACP and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.3 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems. Provide end switches at each smoke and fire/smoke damper
 - 4. Alarm-initiating connection to elevator recall system and components.
 - 5. Alarm-initiating connection to activate emergency lighting control.
 - 6. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt trip breaker.
 - 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 11. Supervisory connections at fire-pump engine control panel.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.5 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.6 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

INTERMOUNTAIN BEAR RIVER VALLEY HOSPITAL
MRI Replacement
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Intermountain Healthcare

Construction Documents