PROJECT MANUAL FOR

Manti High School Shop and Wrestling Room Additions

100 West 500 North
Manti, UT 84642

SOUTH SANPETE
SCHOOL DISTRICT

39 South Main Street
Manti, Utah 84642

Bid Set

December 09, 2024

naylor wentworth lund
architects

SECTION 00 0102

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SECTION 00 0103

PROJECT DIRECTORY

OWNER

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Attention: Richard Judkins, AIA
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MECHANICAL ENGINEER

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ELECTRICAL ENGINEER

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Phone: (801) 523-2196

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AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining

provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 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 modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building

information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the

site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's

capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes

remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

.1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;

.2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and

.3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the

time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. 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 the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under

Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the

Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect 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 shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate

Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner 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, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The

Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable

by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall 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 the Owner, 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 shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The 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 the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The

foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

.1 defective Work not remedied;
.2 third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
.3 failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 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
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers

to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. 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.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner 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 the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner 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 warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and 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 the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not

constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

.1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
.2 failure of the Work to comply with the requirements of the Contract Documents;
.3 terms of special warranties required by the Contract Documents; or
.4 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

.1 employees on the Work and other persons who may be affected thereby;
.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
.3 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.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the

endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The

Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the

Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the 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 the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

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

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section

15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly

consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 7300

SUPPLEMENTARY CONDITIONS

THE FOLLOWING SUPPLEMENTS MODIFY THE GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AIA DOCUMENT A201, 2017 EDITION. WHERE A PORTION OF THE GENERAL CONDITIONS IS MODIFIED OR DELETED BY THESE SUPPLEMENTARY CONDITIONS, THE REMAINING UNALTERED PORTIONS OF THE GENERAL CONDITIONS SHALL REMAIN IN AS IS.

ARTICLE 1 GENERAL PROVISIONS

1.1 Basic Definitions

Add to Subparagraph 1.1.4 - The Project as follows:

1.1.4 The project is more completely defined under Section 01 1000, Summary of Work.

1.2 Correlation and Intent of the Contract Documents

Add to Subparagraph 1.2.1 as follows:

1.2.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities:

1) The Agreement.
2) Addenda, with those of later date having precedence over those of earlier date.
3) The Supplementary Conditions.
4) The General Conditions of the Contract for Construction.
5) Drawings and Specifications.

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation.

The Contractor shall not 'scale' the Contract Document drawings to define dimensions or locations of building walls, columns, etc. Review dimensioned drawings to define required locations, if not indicated, coordinate and review with the Architect prior to continuing construction.

Add new Subparagraph 1.2.4 as follows:

1.2.4 The omission of minor details of construction, installation, material or other essential items of usual or standard construction from the drawings or specifications shall not relieve the Contractor from furnishing the same in place complete. Such omission shall not entitle this Contractor to make claims for extras on material or labor.

ARTICLE 2 OWNER

2.2 Information and Services Required of the Owner

Delete Subparagraph 2.2.5. and substitute the following:

2.2.5 The Architect will furnish to the General Contractor a complete set of electronic format construction documents (drawings and specifications) for the project. It will then be the General Contractors responsibility to distribute said documents, either electronic or hard copy to his Subcontractors that will be necessary for the execution of the work.

ARTICLE 3 CONTRACTOR

3.6 Taxes

Delete Subparagraph 3.6.1 and substitute the following:

3.6.1 Beginning January 1, 1996, the State of Utah provided an exemption from sales tax for construction materials purchased for public education. The exemption applies to all construction materials purchased by or on behalf of institutions of the public education system, provided the construction materials are clearly identified and installed or converted to real property which is owned by the public education institution. It is the intent of the Owner to take advantage of the tax exemption on all construction material used in the Shop and Wrestling Room Additions. The Owner can take advantage of this exemption by structuring its agreements with its Contractor and suppliers so that title to construction material passes from the supplier to the Owner or the Contractor (on behalf of the Owner) upon delivery to the construction site after January 1, 1996. Tax exempt form TC-721 must be used by the vendors when purchasing construction materials. The Owner will provide a Form TC-721, signed by the Owner Director of Purchasing, or designee, authorizing the exemption of sales tax on material purchases for the Contractor's use in purchasing materials. Refer to State Tax Commission, Publication 35, Rev. 6/96 or Tax Bulletin 16-96.

3.7 Permits, Fees, Notices and Compliance with Laws

Delete Subparagraph 3.7.1 and substitute the following:

3.7.1 The Contractor shall secure and the Owner shall pay for any permits, fees and inspections required by work included in this Contract. All licensing shall be secured and paid for by the Contractor.

Modify Subparagraph 3.7.4 as follows:

3.7.4 Three (3) days in lieu of twenty-one (21) days.

Modify Subparagraph 3.7.5 as follows:

3.7.5 Amend the first sentence in this subparagraph to read, “If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, wetlands or hazardous waste deposits not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect.”

3.8 Allowances

Modify Subparagraph 3.8.2.1 as follows:

.1 Allowances shall cover the total cost to the Contractor of materials and equipment delivered to the site, labor, installation costs, overhead and profit, other expenses contemplated, and all required taxes (if any) less applicable trade discounts.

Omit Subparagraph 3.8.2.2.

No changes to Subparagraph 3.8.2.3.

Add Subparagraph 3.8.2.4 as follows:

.4 At closeout of contract, funds remaining in Contingency Allowance will be credited to the Owner by Change Order.

3.10 Contractor's Construction Schedules

Modify Subparagraph 3.9.1 as follows:

3.10.1 In the first sentence change the word "promptly" to "within seven days of Owner/Architect acceptance of Subcontractor List”.

Add new Subparagraph 3.9.1.1 as follows:

.1 The Contractor shall show this information in the form of either C.P.M. or bar graph.

Modify Subparagraph 3.9.2 as follows:

3.10.2 In the first sentence change the word “promptly” to “within seven (7) days of Owner/Architect acceptance of Subcontractor List”.

3.10.2 Substitute the words, "Architect's Review," for "Architect's Approval," in this paragraph.

3.11 Documents and Samples at the Site

Add new Subparagraph 3.11.1 as follows:

3.11.1 The Contractor shall also be responsible for providing a work table and dedicated set of documents with addenda, change orders, etc. for use only by the special inspector.

3.12 Shop Drawings, Product Data and Samples

Modify Subparagraph 3.12.8 as follows:

3.12.8 Substitute the words, "Architect's Review," for "Architect's Approval," in this paragraph.

ARTICLE 4 ARCHITECT

4.2 Administration of the Contract

Modify Subparagraph 4.2.7 as follows:

4.2.7 Omit the words, "and approve" and add “and review” in the first sentence in this subparagraph.

4.2.7 Amend the last sentence in this subparagraph to read, "The Architect's review of a specific item shall not indicate approval of the item or the assembly of which the item is a component."

ARTICLE 5 SUBCONTRACTORS

5.2 Award of Subcontracts and other Contracts for Portions of the Work

Revise Subparagraph 5.2.1 as follows:

5.2.1 No later than twenty-four (24) hours after the date of commencement, the Contractor shall furnish in writing to the Owner, through the Architect, the names of persons or entities proposed as manufacturers for each of the products identified in the General Requirements (Division 1 of the Specifications) and, where applicable, the name of the installing Subcontractor. Coordinate with with Section 9.2.

Modify Subparagraph 5.2.4 as follows:

5.2.4 The Contractor shall not change a Subcontractor, person or entity previously selected without written notification and acceptance of the Owner and Architect.

ARTICLE 6

CONSTRUCTION BY THE OWNER OR BY SEPARATE CONTRACTORS

No modifications.

ARTICLE 7 CHANGES IN THE WORK

7.3 Construction Change Directives

Add new Subparagraph 7.3.7.6 as follows:

7.3.7.6 Refer to Section 01 2000 - Price and Payment Procedures, for allowed profit and overhead.

ARTICLE 8 TIME

8.2 Progress and Completion

Add new Subparagraph 8.2.4 as follows:

8.2.4 Substantial completion of the Work shall be achieved as stipulated on Bid Form and in Owner/Contractor Agreement..

ARTICLE 9 PAYMENTS AND COMPLETION

9.3 Applications for Payment

Add the following sentence to Subparagraph 9.3.1:

9.3.1 The form of Application for Payment shall be notarized AIA Documents G702 Application and Certificate for Payment and G703 Continuation Sheet.

Add new Subparagraph 9.3.1.3 as follows:

9.3.1.3 Until the Work is one hundred percent (100%) complete, the Owner shall pay ninety-five percent (95%) of the amount due the Contractor on account of progress payments.

9.6 Progress Payments

Modify Subparagraph 9.6.1 to read as follows:

9.6.1 Notice of extended payment provision. Application and certification for payment received by the fifth day of the month shall be reviewed and accepted or rejected by the tenth day of the month.

This Contract shall allow the Owner to make payment within thirty (30) days after acceptance of billings.

Delete Subparagraph 9.6.7 and substitute the following:

9.6.7 Upon the written request of the Contractor, made within ten days after the execution of the Contract. An escrow account shall be established in a financial institution chosen by the Contractor and approved by the Owner.

Add new Subparagraphs 9.6.8 through 9.6.12 as follows:

9.6.8 The escrow agreement shall provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of the Owner as set forth below. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the escrow account.

9.6.9 As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account.

9.6.10 The interest earned on funds in the account shall accrue for the benefit of the Contractor until the completion date named in the Construction Contract or the expiration of any authorized extension of such date. Interest earned after such date shall accrue for the benefit of the Owner. Cost of compensation to the escrow agent paid out of interest earned shall be borne by the Contractor.

9.6.11 When the Contractor has fulfilled all of the requirements of the Contract providing for the reduction of retained funds, the escrow agent shall release to the Contractor one-half of the accrued funds but none of the interest thereon. When the Work has been fully completed in a satisfactory manner and the Architect has issued a final Certificate for Payment, the escrow agent shall pay to the Contractor the full amount of funds remaining in the account, including net balance of the interest paid to the account, less any interest that may have accrued for the benefit of the Owner, which thereupon shall be paid to the Owner.

9.6.12 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, the escrow agent shall make payment to the Contractor as provided in Subparagraph 9.10.3.

9.8 Substantial Completion

Add the following sentence to Subparagraph 9.8.5:

9.8.5 The payment shall be sufficient to increase the total payments to 100 percent of the Contract Sum, less such amounts the Architect shall determine for incomplete Work and unsettled claims.

ADD NEW PARAGRAPH 9.11 AS FOLLOWS:

9.11 Liquidated Damages

9.11.1 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner the sums hereinafter stipulated as **liquidated damages** for each calendar day of delay until the Work is substantially complete: Liquidated damages amount as noted in Notice to Contractors.

9.11.2 Should the Contractor fail to complete the Work within the time agreed upon in the Contract Documents, or within such additional time as may have been allowed by extension, there shall be deducted from any moneys due or that may become due the Contractor the sum as stated in paragraph 9.11.1. Such sum is fixed and agreed upon by the Owner and Contractor as liquidated damages due the Owner by reason of inconvenience and added costs of administration, engineering, and supervision resulting from the Contractor's default, and not as a penalty.

9.11.3 Permitting the Contractor to continue and finish the Work or any part of the Work after the time fixed for its completion, or after the date to which the time for completion may have been extended, shall in no way operate as a waiver on the part of the Owner of any of his rights under the Agreement.

ARTICLE 10

PROTECTION OF PERSONS AND PROPERTY

No modifications.

ARTICLE 11 INSURANCE AND BONDS

INSURANCE AND BONDS (VERIFY AMOUNTS FOR EACH PROJECT WITH OWNER)

In addition to the insurance required under Article 11, the Contractor shall effect and maintain the following insurance:

COVERAGE	HAZARDS	LIMITS OF LIABILITY
Liability	Other than auto	$1,000,000 each occurrence
		$1,000,000 aggregate
Property Damage	Other than auto	$1,000,000 aggregate
Bodily Injury	Automobile	$1,000,000 each person
		$1,000,000 aggregate
Property Damage	Automobile	$500,000 each occurrence
		$1,000,000 annual aggregate

The above policy shall name the Owner and the Architect as additional insured.

Reference is made to Paragraph 3.18, Indemnification, of AIA Document A201.

Contractor shall furnish the Owner with certificates of insurance complying with all requirements. The certificates shall be signed by a person authorized to bind coverage on the insurer's behalf. Coverage on a claims-made basis will not be acceptable.

11.3 Property Insurance

Delete Subparagraph 11.3.1.4 and substitute the following:

11.3.1.4 The Contractor shall provide insurance coverage for portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also for portions of the Work in transit.

11.4 Performance Bond and Payment Bond

Delete Subparagraph 11.4.1 and substitute the following:

11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment obligations arising there under. Costs of bonds shall be included in the Contractor's bid. The amount of each bond shall be equal to one hundred percent (100%) of the Contract Sum.

11.4.1.1 The Contractor shall deliver the required bonds to the Owner not later than three days following the date the Agreement is entered into.

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

ARTICLE 12

UNCOVERING AND CORRECTION OF WORK

No modifications.

ARTICLE 13 MISCELLANEOUS PROVISIONS

13.5 Tests and Inspections

Modify Subparagraph 13.5.1 as follows:

13.5.1 Substitute the words, "review or reviews," wherever the words, "approve, approval, or approvals," occur in this paragraph.

ADD NEW PARAGRAPH 13.8 AS FOLLOWS:

13.8 Equal Opportunity

13.8.1 The Contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

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

ADD NEW PARAGRAPH 13.9 AS FOLLOWS:

13.9 Compliance with Labor Laws

13.9.1 The Contractor and the Contractor's Subcontractors shall comply with all applicable Laws and Regulations relating to labor on Public Works in the State of Utah, including *U.S. Code Title 8 USC Sec.1324a, Utah Code Title 34 Chapter 30 ant Title 13 Chapter 47*:

13.9.2 The following references are included herein so that the Contractor shall be aware of specific requirements of these sections. Other Law sections are not shown herein, but this in no way relieves the Contractor of His obligation to comply with all Federal, State, and Local Labor Laws.

.1 ***U.S. Code Title 8 USC Sec. 1324a Unlawful Employment*** (1)(A) It is unlawful for a person or other entity - to hire, or to recruit or refer for a fee, for employment in the United States an alien knowing the alien in an unauthorized alien. (2) ***Continuing Employment*** - It is unlawful for a person or other entity, after hiring an alien for employment in accordance with paragraph (1) to continue to employ the alien in the United States knowing the alien in (or has become) an unauthorized alien with respect to such employment. (4) ***Use of labor through contract*** - For purposes of this section, a person or other entity who uses a contract, subcontract, or exchange, entered into, renegotiated, or extended after November 6, 1986, to obtain the labor of an alien in the United States knowing that the alien is an unauthorized alien (as defined in subsection (h)(3) in this section) with respect to performing such labor, shall be considered to have hired the alien for employment in the United States in violation of paragraph (1)(A).

.2 ***Ut Code 34-30-1. Citizens to be given preference*** - In employing workmen in the construction of public works by the state or any county or municipality, or by persons contracting with the state or any county or municipality, preference shall be give to citizens of the United States, or those having declared their intention of becoming citizens. In each contract for the construction of public works a provision shall be inserted to the effect that, if the provisions of this section are not complied with, the contract shall be void.

.3 ***Ut Code 34-30-8. Forty-hour work week*** - Forty hours shall constitute a working week on all works and undertakings carried on by the state, county, or municipal governments, or by any officer of the state or of any county or municipal government. Any persons, corporation, firm, contractor, agent, manager, or foreman, who shall require contract with any person to work upon such works or undertakings longer than 40 hours in one week shall pay such employees at at rate not less than one and one-half times the regular rate at which he is employed. (Piece work rates have to by greater than or equal to minimum wage and one and one-half times minimum wage for hours worked over 40; Minimum wage and overtime laws still apply).

.4 ***Ut Code 34-30-9. Violation of chapter*** - Any officer, agent, or representative if the state or of any political subdivision, district or municipality of it who shall violate, or omit to comply with any of the provisions of this chapter, and any contractor or subcontractor, or agent or representative thereof, doing such public work, who shall neglect to keep, or cause to be kept, an accurate record of the names, occupation and actual wages paid to each laborer, workman and mechanic employed by him, in connection with this public work or who shall refuse to allow access to same at any reasonable hour to any person authorized to inspect same under this chapter shall be guilty of a misdemeanor.

.5 ***Ut Code 13-47-201. Verification required for new hires*** - (1) A private employer who employs 15 or more employees as of July 1, 2010, may not hire a new employee on or after July 1, 2010, unless the private employer: (a) is registered with a status verification system to verify the federal legal working status of any new employee; and (b) uses the status verification system to verify the federal legal working status of the new employee in accordance with the requirements of the status verification system. (2) This section does not apply to a private employer of a foreign national if the foreign national holds a visa issued in response to a petition by the private employer that is classified as H-2A or H-2B.

ARTICLE 15 CLAIMS AND DISPUTES

15.1 Claims

Add this sentence to the end of Subparagraph 15.1.1:

15.1.1 A claim must contain the following explicit language in order to be recognized as a "Claim": **"THIS IS A CLAIM AS DEFINED BY CLAUSE 15.1.1 OF AIA DOCUMENT A201."**

Modify Subparagraph 15.1.2 as follows:

15.1.2 Substitute 10 days for 21 days, where the latter occurs in this subparagraph.

ADD NEW PARAGRAPH 15.5 AS FOLLOWS:

15.5 Time Limits on Claims

15.5.1 For time limits on claims, refer to Section 13.7.

END OF SUPPLEMENTARY GENERAL CONDITIONS

Utah State Tax Commission

Exemption Certificate for Governments & Schools

(Sales, Use, Tourism and Motor Vehicle Rental Tax)

TC-721G
Rev. 3/16

Name of institution claiming exemption (purchaser)			Telephone Number	
Street Address		City	State	ZIP Code
Authorized Signature	Name (please print)		Title	
Name of Seller or Supplier:			Date	

The person signing this certificate MUST check the applicable box showing the basis for which the exemption is being claimed.

Email questions to **taxmaster@utah.gov.** You may also write or visit the Tax Commission at 210 N 1950 W, Salt Lake City, UT 84134, or call 801-297-2200 or toll free 1-800-662-4335.

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

☐ **UNITED STATES GOVERNMENT OR NATIVE AMERICAN TRIBE**
I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of essential governmental or tribal functions. **NOTE:** Includes sales of tangible personal property to federally chartered credit unions. "Directly" does not include per diem, entity advances, or government reimbursements for employee credit card purchases.

☐ **CONSTRUCTION MATERIALS PURCHASED FOR SCHOOLS OR PUBLIC TRANSIT DISTRICTS**
I certify the construction materials purchased are on behalf of a public elementary or secondary school, or public transit district. I further certify the purchased construction materials will be installed or converted into real property owned by the school or public transit district.
Name of school or public transit district: _____
Name of project: _____

☐ **FOREIGN DIPLOMAT**
I certify the purchases are authorized by a diplomatic tax exemption card issued by the United States.
Foreign diplomat number: _____

☐ **UTAH LOCAL GOVERNMENTS AND PUBLIC ELEMENTARY AND SECONDARY SCHOOLS**
Sales Tax License No. _____
I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of that entity's essential functions. For construction materials, if the purchaser is a Utah local government, these construction materials will be installed or converted into real property by employees of this government entity.
CAUTION: This exemption does not apply to government or educational entities of other states and is not valid for lodging-related purchases.

☐ **UTAH STATE GOVERNMENT**
Sales Tax License No. _____
I certify the tangible personal property or services purchased are to be paid directly with funds from the entity noted on this form and will be used in the exercise of its essential functions. For construction materials, they will be installed or converted into real property by employees of this government entity.
CAUTION: This exemption does not apply to other states and is not valid for lodging-related purchases.

☐ **HEBER VALLEY HISTORIC RAILROAD**
I certify these purchases and sales are by the Heber Valley Historic Railroad Authority or its operators and are related to the operation and maintenance of the Heber Valley Historic Railroad.

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

A sales tax license number is required only where indicated.

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

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

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

If you need an accommodation under the Americans with Disabilities Act, email **taxada@utah.gov**, or call 801-297-3811 or TDD 801-297-2020. Please allow three working days for a response.

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SECTION 01 1100

SUMMARY OF WORK

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Manti High School Shop and Wrestling Room Additions.
B. Owner's Name: South Sanpete School District
C. Architect's Name: Naylor Wentworth Lund Architects
D. Additional Project contact information is specified in Section 00 0103 - Project Directory.
E. The Project consists of the selective demolition, existing building renovation, new building construction, and site improvements as shown in the Contract Documents prepared by Naylor Wentworth Lund Architects, 723 West Pacific Ave #101, Salt Lake City, UT 84104.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in the Standard Form of Agreement Between Owner and Construction Manager/General Contractor.

1.03 DESCRIPTION OF WORK

A. New construction for an addition to the existing wood and metal shops (approximately 4,800 square feet) and an addition to the wrestling room (approximately 2,300 square feet). The structures are a combination of load-bearing masonry and structural steel framing, with steel joists and metal roof deck.

1.04 DESCRIPTION OF DEMOLITION WORK

A. Selective demolition of existing building area and demolition of site elements, as indicated on drawings and specified in:
    1. 02 4100 Demolition.

1.05 WORK BY OWNER

A. Owner will supply the following for installation by Contractor:
    1. Wireless transmission ports.

1.06 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
B. Owner intends to occupy the Project upon Substantial Completion.
C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
D. Schedule the Work to accommodate Owner occupancy.

1.07 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas identified by the CM/GC.
B. Arrange use of site and premises to allow:
    1. Owner occupancy.
    2. Use of site and premises by the public.
C. Provide access to and from site as required by law and by Owner:
    1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
    2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions:
   1. Limit conduct of especially noisy exterior/interior work to hours approved by Owner.
E. Utility Outages and Shutdown:
   1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
   2. Limit shutdown of utility service to hours approved by Owner.
   3. Prevent accidental disruption of utility services to other facilities.

1.08 WORK SEQUENCE

A. Coordinate construction schedule and operations with the CM/GC.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 1100

SECTION 01 2000

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.
B. Documentation of changes in Contract Sum and Contract Time.
C. Change procedures.
D. Correlation of Contractor submittals based on changes.
E. Procedures for preparation and submittal of application for final payment.
F. Samples of AIA documents required are included and follow this Section:
    1. AIA G702 - Application and Certificate for Payment.
    2. AIA G703 - Continuation Sheet.

1.02 RELATED REQUIREMENTS

A. AIA Document A101 - Standard Form of Agreement Between Owner and Contractor: Contract Sum, retainages, and payment period.
B. AIA Document A201 - General Conditions and Document 00 7300 - Supplementary General Conditions: Additional requirements for progress payments, final payment, changes in the Work.

1.03 SCHEDULE OF VALUES

A. Form to be used: AIA G703.
B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
C. Forms filled out by hand will not be accepted.
D. Submit Schedule of Values within 21 days after date of Owner-Contractor Agreement.
E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
F. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
G. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
H. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.
B. Form to be used: AIA G702 and G703.
C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
D. Forms filled out by hand will not be accepted.
E. For each item, provide a column for listing each of the following:
    1. Item Number.
    2. Description of Work.
    3. Scheduled Values.
    4. Previous Applications.
    5. Work in Place and Stored Materials under this Application.
    6. Authorized Change Orders.

7. Total Completed and Stored to Date of Application.
8. Percentage of Completion.
9. Balance to Finish.
10. Retainage (5 percent).

F. Execute certification by signature of authorized officer.

G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

I. Submit Applications for Payments in electronic PDF format.

J. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 01 3000.
2. Construction progress schedule, revised and current as specified in Section 01 3000.
3. Partial release of liens from major subcontractors and vendors, if requested by owner.
4. Project record documents as specified in Section 01 7800, for review by architect, at the construction site office.
5. Affidavits attesting to off-site stored products.

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

L. Contractor, nor subcontractor will be allowed to bill over 90 percent of the contract amount until closeout documents have been submitted. This is irrespective of retention being held.

M. Notice of Extended Payment Provision: As sti

1.05 MODIFICATION PROCEDURES

A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.

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

C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.

D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change . Contractor shall prepare and submit a fixed price quotation within 7 days.

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

F. Computation of Change in Contract Amount: Costs for all changes shall be fully documented at each level for evaluation. Provide the following data:
1. Quantities of materials, labor, and equipment and unit prices for each.
2. Insurance and bonds, if any. Do not include sales tax.
3. Predetermined unit prices if applicable.
4. For Time and Material work:
   a. Dates and times work was performed and by whom.
   b. Time records and wage reports.

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

5. Overhead and profit: See paragraph G for maximums.
6. Justification for any change in Contract Time.
7. Credit for deletions from contract, similarly documented.

G. Allowable Mark-Up:
1. The Contractor shall be limited to the following maximum mark-ups on any change order under $5,000:
a. Subcontractor (limited to a single (1) level of mark-up), 15 percent
1) CM/GC self performed work.
b. General Contractor - Profit and Overhead, 7 percent
1) Not applied in addition to self performed work.
c. General Contractor - Bonding, 1 percent.
2. The Contractor shall be limited the following maximum mark-ups on any change order equal to or exceeding $5,000:
a. Subcontractor (limited to a single (1) level mark-up), 10 percent
1) or CM/GC self performed work.
b. General Contractor - Profit and Overhead
1) 15 percent of first $5,000 and 5 percent of remainder over $5,000.
c. General Contractor - Bonding, 1 percent.

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

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

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

K. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

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

B. Application for Final Payment will not be considered until the following have been accomplished:
1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2000

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SECTION 01 2300

ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.
B. Procedures for pricing Alternates.
C. Documentation of changes to Contract Sum and Contract Time.

1.02 RELATED REQUIREMENTS

A. AIA Document A701 - Instructions to Bidders: Instructions for preparation of pricing for alternatives.
B. AIA Document A101 - Owner-Contractor Agreement: Incorporating monetary value of accepted alternatives.

1.03 COSTS INCLUDED

A. Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of Work, including overhead and profit.

1.04 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.05 SCHEDULE OF ALTERNATES

A. Bid Alternate #1 - Wrestling Room Addition: Provide a separate cost
B. Bid Alternate #2 - Existing Wood and Metal Shops Lighting Upgrade: Provide a separate cost to add the upgrade of lighting in the existing Metal and Wood Shops.
C. Bid Alternate #3 - Existing Wrestling Room Lighting Upgrade: Provide a separate cost to add the upgrade of lighting in the existing Wrestling Room.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 2300

SECTION 01 3216

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.
B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 1100 - Summary of Work: Work sequence.

1.03 SUBMITTALS

A. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
    1. Include written certification that major contractors have reviewed and accepted proposed schedule.
D. Within 10 days after joint review, submit complete schedule.
E. Submit updated schedule with each Application for Payment.

1.04 QUALITY ASSURANCE

A. Contractor's Administrative Personnel: Three years' minimum experience using and monitoring CPM schedules on comparable projects.

1.05 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
B. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
B. Identify each item by specification section number.
C. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
D. Coordinate content with schedule of values specified in Section 01 2000 - Price and Payment Procedures.
E. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.
B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.
B. Evaluate project status to determine work behind schedule and work ahead of schedule.
C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.
B. Indicate progress of each activity to date, with projected completion date of each activity.
C. Update diagrams to graphically depict current status of Work.
D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
E. Indicate changes required to maintain Date of Substantial Completion.
F. Submit reports required to support recommended changes.

3.06 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.
B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION 01 3216

SECTION 01 3300.01

NWL COPYRIGHT RELEASE FORM

1.01 COPYRIGHT RELEASE FORM

A. **In response to the contractor's (subcontractor's) request to utilize portions of the copyrighted electronic files produced by Naylor Wentworth Lund Architects for the Manti High School Manti High School Shop and Wrestling Room Additions Project Located in Manti, Utah, NAYLOR WENTWORTH LUND ARCHITECTS AGREES TO provide the electronic files and ALLOW SUCH usage for THE CONTRACTOR'S (SUBCONTRACTOR'S) convenience and use in the preparation of shop drawings, subject to the following terms and conditions:**

B. Our electronic files are compatible with: AutoCad 2018. Naylor Wentworth Lund Architects (hereafter us/we/our) makes no representation as to the compatibility of these files with the Contractor's (Subcontractor's) [hereafter you/your] hardware or software.

C. The electronic files are for use only to aid you in producing your portion of this project. Data contained on these electronic files are part of our instruments of service and shall not be used by you or anyone else receiving these data through or from you for any purpose other than as a convenience in the preparation of shop drawings for this project. Any other use or reuse by you or by others will be at your sole risk and without liability or legal exposure to us. You agree to make no claim and hereby waive, to the fullest extent permitted by law, any claim or cause of action of any nature against our firm, our officers, directors, employees, agents or subconsultants that may arise out of or in connection with your use of the electronic files.

D. Furthermore, you shall, to the fullest extent permitted by law, indemnify and hold us harmless against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising out of or resulting from your use of these electronic files.

E. These electronic files are not construction documents. Differences may exist between these electronic files and corresponding hard-copy construction documents. We make no representation regarding the accuracy or completeness of the electronic files you receive. In the event that a conflict arises between the signed or sealed hard-copy construction documents prepared by us and the electronic files, the signed or sealed hard-copy construction documents shall govern. You are responsible for determining if any conflict exists. By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.

F. Because information presented on the electronic files can be modified, unintentionally or otherwise, we reserve the right to remove all indicia of ownership and/or involvement from each electronic display. If present, any title blocks, and other references to Naylor Wentworth Lund Architects, our consultants, or our client, must be removed. Submitted drawings shown otherwise will be subject to rejection.
   Under no circumstances shall delivery of the electronic files for use by you be deemed a sale by us, and we make no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall we be liable for any loss of profit or any consequential damages as a result of your use or reuse of these electronic files.

G. You agree to pay us the sum of Two Hundred Fifty Dollars ($250.00) to cover administrative expenses associated with this request.

H. We will furnish you the following electronic files (please note which file(s) are being requested):

1. We will furnish only drawings that are directly related to the subcontractor's specific work. Project details will not be released. Furnishing the entire drawing set will not be accommodated. It is up to the sole discretion of NWLA whether files will be released or not. Please note which drawings/files are being requested:

I. You agree to all of the conditions listed above by signing this document.

_____	Naylor Wentworth Lund Architects_____
Contractor (Subcontractor)	Architect
_____	_____
Signature	Signature
_____	_____
Printed Name and Title	Printed Name and Title
_____	_____
Date	Date

END OF SECTION 01 3300.01

SECTION 01 4219

REFERENCE STANDARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements relating to referenced standards.

1.02 QUALITY ASSURANCE

A. For products or workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
B. Comply with the reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
C. Obtain copies of standards when required by Contract Documents.
D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Date of Substantial Completion.
E. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Architect shall be altered by Contract Documents by mention or inference otherwise in any reference document.

END OF SECTION 01 4219

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SECTION 01 4300

QUALITY ASSURANCE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. References and standards.
C. Testing and inspection agencies and services.
D. Control of installation.
E. Mock-ups.
F. Tolerances.
G. Manufacturers' field services.
H. Defect assessment.

1.02 RELATED REQUIREMENTS

A. AIA Document A201 - General Conditions: Inspections and approvals required by public authorities.
B. Section 01 3000 - Administrative Requirements: Submittal procedures.
C. Section 01 6000 - Product Requirements: Requirements for material and product quality.
D. Section 31 0000 - Geotechnical Investigation: Soil investigation data.

1.03 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).
B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.
C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.
D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2018.
F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
    1. Include:
        a. Date issued.
        b. Project title and number.
        c. Name of inspector.
        d. Date and time of sampling or inspection.
        e. Identification of product and specifications section.

f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

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

D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

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

F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit report in duplicate within 30 days of observation to Architect for information.
2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.
2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.05 REFERENCES AND STANDARDS- SEE SECTION 01 4219

1.06 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
B. Contractor shall be responsible to schedule all specified testing and inspection.
C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
D. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
4. Laboratory: Authorized to operate in the State in which the Project is located.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required,construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
C. Perform tests under provisions identified in this section and identified in the respective product specification sections.
D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
F. Use accepted mock-ups a a comparison standard for the remaining Work.
G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.
B. Testing Agency Duties:
    1. Test samples of mixes submitted by Contractor.
    2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
    3. Perform specified sampling and testing of products in accordance with specified standards.
    4. Ascertain compliance of materials and mixes with requirements of Contract Documents.

5. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
6. Perform additional tests and inspections required by Architect.
7. Attend preconstruction meetings and progress meetings.
8. Submit reports of all tests/inspections specified.

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

D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
   a. To provide access to Work to be tested/inspected.
   b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
   c. To facilitate tests/inspections.
   d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

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

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

3.05 MANUFACTURERS' FIELD SERVICES

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

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

3.06 DEFECT ASSESSMENT

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

B. If, in the opinion of Architect and Owner, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION 01 4300

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.
B. Temporary sanitary facilities.
C. Temporary Controls: Barriers, enclosures, and fencing.
D. Security requirements.
E. Vehicular access and parking.
F. Waste removal facilities and services.
G. Field offices.
H. Temporary fire protection.

1.02 RELATED REQUIREMENTS

A. Section 01 5100 - Temporary Utilities.

1.03 TEMPORARY UTILITIES - SEE SECTION 01 5100

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

1.04 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
B. Ensure that telecommunications services include:
    1. Windows-based personal computer dedicated to project tcommunications, with necessary software and printer.
    2. Telephone Lines: One line, minimum (cellular phone).
    3. Internet Connections: Continous highest speed available.
    4. Printer: Ability to print on site.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
B. Maintain daily in clean and sanitary condition.
C. At end of construction, remove facilities off site.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers, students/school staff, or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
B. Provide barricades required by governing authorities for public rights-of-way and for public access to existing building.
C. Provide protection for plants designated to remain. Replace damaged plants.
D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Construction: Commercial grade chain link fence.

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

1.08 EXTERIOR ENCLOSURES

A. Keep building enclosed and secure when not on site.
B. Provide temporary insulated weather-tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.09 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as determined necessary to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces.

1.10 SECURITY

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

1.11 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
B. Coordinate access and haul routes with governing authorities and Owner.
C. Provide and maintain access to fire hydrants, free of obstructions.
D. Provide means of removing mud from vehicle wheels before entering streets.
E. Designated existing on-site roads may be used for construction traffic. Coordinate with owner.
F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, arrange for additional off-site parking.

1.12 WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
B. Provide containers with lids. Remove trash from site weekly, or more frequently, as required.
C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 FIELD OFFICES, JOB TRAILERS, AND MATERIAL STOCKPILE AREA

A. Coordinate with Governing Authorities, Owner, and neighboring properties.
B. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.
C. Provide space for Project meetings, with table and chairs to accommodate 12 persons minimum.
D. Locate offices a minimum distance of 20 feet from existing and new structures, or as directed by the authority having jurisdiction.

1.14 TEMPORARY FIRE PROTECTION

A. Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with IFC 906, "Code for Portable Fire Extinguishers," and IBC Chapter 33 and IFC Chapter 14 "Fire Safety During Construction," and as directed by the authority having jurisdiction.
   1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities. Smoking is not allowed on the school property..
   4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.

1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition.
E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION 01 5000

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SECTION 01 5100

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls:
   1. Temporary telecommunications services for administrative purposes.
   2. Temporary sanitary facilities required by law.

1.03 TEMPORARY ELECTRICITY

A. New Construction Area - Cost by Contractor: Contractor to provide and pay for temporary power to the new addition construction area.
B. Interior Remodel Areas - Cost by Owner. Contractor may utilize existing power within the existing building areas. Abuse of this utility use will be subject to termination. At such time, the contractor would be responsible for providing temporary power to the project site at his own expense.
C. Provide power service required from utility source, or connect to Owner's existing power service, if applicable.
   1. Do not disrupt Owner's need for continuous service.
   2. Exercise measures to conserve energy.
D. Power Service Characteristics: Verify existing power service characteristics and provide connection equipment as required for construction power needed.
E. Complement existing power service capacity and characteristics as required.
F. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor and locations as required. Provide flexible power cords as required.
G. Provide main service disconnect and over-current protection at convenient location and meter, if required.
H. Permanent convenience receptacles may be utilized during construction.
I. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.
   1. Provide 20 ampere, duplex outlets, single phase for circuits for power tools.
   2. Provide 20 ampere, single phase branch circuits for lighting.

1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .
B. Provide and maintain 1 watt/sq ft lighting to exterior staging and storage areas after dark for security purposes.
C. Provide and maintain 0.25 watt/sq ft H.I.D. lighting to interior work areas after dark for security purposes.
D. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
E. Maintain lighting and provide routine repairs.
F. Permanent building lighting may be utilized during construction.

1.05 TEMPORARY HEATING

A. Cost of Energy: By Contractor.
   1. New Construction Area - Cost by Contractor: Contractor to provide and pay for temporary heating to the new addition construction areas.
B. Interior Remodel Areas - Cost by Owner. Use of existing building system in remodel areas will be allowed. Abuse of this utility use will be subject to termination. At such time, the contractor would be responsible for providing temporary heating to the project area at his own expense.
C. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
D. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.06 TEMPORARY COOLING

A. Cost: By Owner. New and existing building areas with in-place cooling systems may be used by the Contractor. Abuse of this utility use will be subject to termination.
B. Provide supplementary cooling devices and cooling as needed to maintain specified conditions for construction operations.
C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
D. Prior to operation of permanent equipment for temporary cooling purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.08 TEMPORARY WATER SERVICE

A. Existing building/site water is available for used during construction. Larger amounts of water need shall be provided via city water sources, i.e. hydrants. Contractor shall arrange and pay for such water source with the local water jurisdiction. Abuse of this building/site water use will be subject to termination. At such time, the contractor would be responsible for providing all temporary water to the project site at his own expense.

END OF SECTION 01 5100

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.
B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
C. Restoration of areas eroded due to insufficient preventive measures.
D. Performance bond.
E. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.
F. Coordinate submittal of the S.W.P.P.P. with the owner and Civil Contract Documents.

1.02 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus; 2014 (Reapproved 2018).
B. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2017.
C. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.; 1999a (Reapproved 2014).
D. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.
E. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
F. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2020.
G. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
H. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
I. USDA TR-55 - Urban Hydrology for Small Watersheds; USDA Natural Resources Conservation Service; 2015.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
B. Comply with requirements of State of Utah Erosion and Sedimentation Control Manual.
C. Runoff Calculation Standard for Urban Areas: USDA TR-55.
D. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
    1. Obtain and pay for permits and provide security required by authority having jurisdiction.
    2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.

F. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.
G. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.
H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
    1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
    2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
    1. Control movement of sediment and soil from temporary stockpiles of soil.
    2. Prevent development of ruts due to equipment and vehicular traffic.
    3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
    1. Prevent windblown soil from leaving the project site.
    2. Prevent tracking of mud onto public roads outside site.
    3. Prevent mud and sediment from flowing onto sidewalks and pavements.
    4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
    2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
    1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
M. Open Water: Prevent standing water that could become stagnant.
N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Erosion and Sedimentation Control Plan:
    1. Submit within 2 weeks after Notice to Proceed.
    2. Include:
        a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
        b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.

c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
e. Other information required by law.
f. Format required by law is acceptable, provided any additional information specified is also included.

3. Obtain the approval of the Plan by authorities having jurisdiction.

C. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.

D. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

E. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Mulch: Use one of the following:
1. Straw or hay.
2. Wood waste, chips, or bark.
3. Erosion control matting or netting.
4. Cutback asphalt.
5. Polyethylene film, where specifically indicated only.

B. Bales: Air dry, rectangular straw bales.
1. Cross Section: 14 by 18 inches, minimum.
2. Bindings: Wire or string, around long dimension.

C. Bale Stakes: One of the following, minimum 3 feet long:
1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
2. Wood, 2 by 2 inches in cross section.

D. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
2. Permittivity: 0.05 sec^-1, minimum, when tested in accordance with ASTM D4491/D4491M.
3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
4. Tensile Strength: 100 pounds-force, minimum, in cross-machine direction; 124 pounds-force, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
5. Elongation: 15 to 30 percent, when tested in accordance with ASTM D4632/D4632M.
6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
8. Manufacturers:
a. TenCate: www.tencate.com.
b. North American Green: www.nagreen.com.
c. Propex Geosynthetics: www.geotextile.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Silt Fence Posts: One of the following, minimum 5 feet long:
   1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot.
   2. Softwood, 4 by 4 inches in cross section.
   3. Hardwood, 2 by 2 inches in cross section.
F. Gravel: See Section 32 1123 for aggregate.
G. Concrete: See Section 03 3000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
B. Construction Entrances: Traffic-bearing aggregate surface.
   1. Width: As required; 20 feet, minimum.
   2. Length: 50 feet, minimum.
   3. Provide at each construction entrance from public right-of-way.
   4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
C. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:
      a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
      b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
      c. Along the toe of cut slopes and fill slopes.
      d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space at maximum of 200 feet apart.
      e. Across the entrances to culverts that receive runoff from disturbed areas.
   2. Space sediment barriers with the following maximum slope length upslope from barrier:
      a. Slope of Less Than 2 Percent: 100 feet.
      b. Slope Between 2 and 5 Percent: 75 feet.
      c. Slope Between 5 and 10 Percent: 50 feet.
      d. Slope Between 10 and 20 Percent: 25 feet.
      e. Slope Over 20 Percent: 15 feet.
D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
   1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1 1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
   2. Straw bale row blocking entire inlet face area; anchor into pavement.
E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
G. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with polyethylene film, secured by placing soil on outer edges.

2. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

H. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
2. Asphalt: Use only where no traffic, either vehicular or pedestrian, is anticipated.

3.04 INSTALLATION

A. Traffic-Bearing Aggregate Surface:
1. Excavate minimum of 6 inches.
2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.

B. Silt Fences:
1. Store and handle fabric in accordance with ASTM D4873/D4873M.
2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
5. Install with top of fabric at nominal height and embedment as specified.
6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
8. Fasten fabric to wood posts using one of the following:
   a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gauge, 0.083 inch shank diameter.
   b. Five staples per post with at least 17 gauge, 0.0453 inch wire, 3/4 inch crown width and 1/2 inch long legs.
9. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
10. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Straw Bale Rows:
1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

D. Mulching Over Large Areas:
1. Dry Straw and Hay: Apply 2 1/2 tons per acre; anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
2. Wood Waste: Apply 6 to 9 tons per acre.
3. Asphalt: Apply at 1200 gallons per acre.
4. Erosion Control Matting: Comply with manufacturer's instructions.

E. Mulching Over Small and Medium Areas:

1. Dry Straw and Hay: Apply 4 to 6 inches depth.
2. Wood Waste: Apply 2 to 3inches depth.
3. Asphalt: Apply 1/4 gallon per square yard.
4. Erosion Control Matting: Comply with manufacturer's instructions.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
B. Repair deficiencies immediately.
C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
D. Straw Bale Rows:
   1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
   2. Remove silt deposits that exceed one-half of the height of the bales.
   3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
E. Clean out temporary sediment control structures weekly and relocate soil on site.
F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.
B. Clean out temporary sediment control structures that are to remain as permanent measures.
C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 5713

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Transportation, handling, storage and protection.
C. Product option requirements.
D. Substitution limitations.
E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 1100 - Summary of Work: Lists of products to be removed from existing building, if applicable.
B. Section 01 4300 - Quality Assurance: Product quality monitoring.
C. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
    1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.
B. Use of products having any of the following characteristics is not permitted:
    1. Made using or containing CFC's or HCFC's.
    2. Made of wood from newly cut old growth timber.
    3. Containing lead, cadmium, or asbestos.
C. Where other criteria are met, Contractor shall give preference to products that:
    1. Are extracted, harvested, and/or manufactured closer to the location of the project.
    2. Have longer documented life span under normal use.
    3. Result in less construction waste.
D. Provide all Finish Material Products used in any individual system from the same manufacturer; no exceptions.

2.02 PRODUCT OPTIONS

A. In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, provide the better quality or greater quantity of work in accordance with the Architect's interpretation.
B. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
C. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
D. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer or product not named.
E. Manufacturers other than Basis of Design Manufacturers shall provide products or systems that meet or exceed Basis of Design products or systems. Do not issue change order solely based on bid product or system not meeting Basis of Design and being rejected through submittal process.
F. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.03 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
    1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
    2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    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.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES FOR APPROVAL PRIOR TO BIDDING

A. Architect will only consider requests for proposed substitutions made prior to 72 hours of bid time.
B. Proposed substitutions may be considered after this date when a specified product becomes unavailable through no fault of the Contractor.
C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
D. A request for substitution constitutes a representation that the submitter:
    1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
    2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension that may subsequently become apparent.
5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

E. Proposed 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.

F. Proposed Substitution Submittal Procedure:
1. Submit one electonic copy of request for substitution for consideration. Limit each request to one proposed substitution.
2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
3. Architect will notify Contractor in writing of decision to accept or reject request.

3.02 TRANSPORTATION AND HANDLING

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

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

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

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

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

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

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

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

3.03 STORAGE AND PROTECTION

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

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

C. Store with seals and labels intact and legible.

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

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

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

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

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

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

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

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

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION 01 6000

SECTION 01 7000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.
B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
C. Pre-installation meetings.
D. Cutting and patching.
E. Surveying for laying out the work.
F. Cleaning and protection.
G. Starting of systems and equipment.
H. Demonstration and instruction of Owner personnel.
I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
J. General requirements for maintenance service.
K. Samples for AIA documents required are included and follow this Section:
    1. AIA G704 Certificate for Substantial Completion.
    2. AIA G706 Contractor's Affidavit of Payment of Debts and Claims.
    3. AIA G706A Contractor's Affidavit of Release of Liens.
    4. AIA G707 Consent of Surety Company to Final Payment.

1.02 RELATED REQUIREMENTS

A. Section 01 1100 - Summary of Work: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials, if any.
B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.
C. Section 01 4300 - Quality Assurance: Testing and inspection procedures.
D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.
E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.
F. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
G. Section 01 5713 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
H. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, guaranties, warranties and bonds.
I. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
J. Section 02 4100 - Demolition: Demolition of whole structures and/or parts thereof; site utility demolition.
K. Individual Product Specification Sections:
    1. Advance notification to other sections of openings required in work of those sections.
    2. Limitations on cutting structural members.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
    1. On request, submit documentation verifying accuracy of survey work.
    2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
    3. Submit surveys and survey logs for the project record.
C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
    1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
    2. Identify demolition firm and submit qualifications.
    3. Include a summary of safety procedures.
D. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
    1. Structural integrity of any element of Project.
    2. Integrity of weather exposed or moisture resistant element.
    3. Efficiency, maintenance, or safety of any operational element.
    4. Visual qualities of sight exposed elements.
    5. Work of Owner or separate Contractor.
    6. Include in request:
        a. Identification of Project.
        b. Location and description of affected work.
        c. Necessity for cutting or alteration.
        d. Description of proposed work and products to be used.
        e. Effect on work of Owner or separate Contractor.
        f. Written permission of affected separate Contractor.
        g. Date and time work will be executed.
E. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.
    1. Minimum of 5 years of documented experience.
B. For surveying work, employ a land surveyor registered in the state of Utah and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the state of Utah. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.
D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.
B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
    1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
    2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.
F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
    1. Minimize amount of bare soil exposed at one time.
    2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
    3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
    4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
    1. Limit conduct of especially noisy interior/exterior work to hours approved by South Sanpete School District.
H. Pest and Rodent Control: Provide methods, means, and facilities to:
    1. Prevent pests and insects from damaging the work.
    2. Prevent rodents from accessing or invading premises.
I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 01 1100 for occupancy-related requirements.
B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
C. Notify affected utility companies and comply with their requirements.
D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
G. Coordinate completion and clean-up of work of separate sections.
H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

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

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
C. Examine and verify specific conditions described in individual specification sections.
D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
    1. Review conditions of examination, preparation and installation procedures.
    2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Contractor shall locate and protect survey control and reference points.
D. Control datum for survey is that established by Owner provided survey.
E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations, etc.
    4. Building wall locations, door and window opening locations, etc.
    5. Assist subcontractors relative to layout and coordination of their work to successfully complete the project.
K. Construction Related Services: The Contractor will provide construction related services including construction staking, site visits, weekly construction meetings, and shop drawings review.
    1. Construction staking will include the following:
        a. Stake rough grade.
        b. Blue top pads.
        c. Red top street, parking lot subgrade.
        d. Provide sewer stakes.
        e. Provide water line and fire hydrant stakes.
        f. Provide power installation stakes.
        g. Stake curb and gutter.
        h. Blue top street and parking lot finished gravel.
        i. Stake property corners.
        j. Stake finish grades at playfields and landscape areas per Civil Engineers requirements.
L. Periodically verify layouts by same means.
M. Maintain a complete and accurate log of control and survey work as it progresses.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Provide or Install means Contractor shall: Furnish all labor, materials, equipment, tools and services required to fully complete installation of specified work as is indicated on the drawings and/or specifications.
B. Install products as specified in individual sections, in accordance with manufacturer's printed instructions and recommendations, and so as to avoid waste due to necessity for replacement.
C. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
D. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
F. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
G. Make neat transitions between different surfaces, maintaining texture and appearance.

3.06 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
    1. Verify that construction and utility arrangements are as indicated.
    2. Report discrepancies to Architect before disturbing existing installation.
    3. Beginning of alterations work constitutes acceptance of existing conditions.
B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

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

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
   2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
   3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
      a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
      b. See Section 01 1100 for other limitations on outages and required notifications.
      c. Provide temporary connections as required to maintain existing systems in service.
   4. Verify that abandoned services serve only abandoned facilities.
   5. Remove abandoned pipe, ducts, conduits, and equipment , including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

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

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

4. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.

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

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

J. Clean existing systems and equipment.

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

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

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

3.07 CUTTING AND PATCHING

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

B. See Alterations article above for additional requirements.

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

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

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

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

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

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

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

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

3.08 PROGRESS CLEANING

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

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
D. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Prohibit traffic from landscaped areas.
H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10 SYSTEM STARTUP

A. Coordinate with requirements of Individual Specification Sections.
B. Coordinate schedule for start-up of various equipment and systems.
C. Notify Architect and Owner seven days prior to start-up of each item.
D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
F. Verify that wiring and support components for equipment are complete and tested.
G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11 DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.12 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems: See Division 23.

3.13 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
    1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Replace filters of operating equipment.
G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems as needed
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14 CLOSEOUT PROCEDURES

A. State Fire Marshal's Certificate of Fire Clearance:
    1. Inspections will be limited to a 70 Percent Completion Inspection and a Final Completion Inspection. However, State Fire Marshal personnel do conduct additional "construction-in-progress" inspections, and it is rare that a final inspection consists of only one visit to the project. It is most important that the Architect, Contractor, Representatives for South Sanpete School District and the Local Fire Department be present for the 70 Percent Completion Inspection. To this is added all appropriate subcontractors for the Final Completion Inspection.
    2. 70 Percent Completion Inspection:
        a. The State Fire Marshal's Office will check all of, but not limited to the following:
            1) Fire department access.
            2) Fire hydrant placement and operation.
            3) Fire walls (areas and/or occupancy separation; complete to the deck: penetrations, dampers, etc.).
            4) Exiting (any obstructions).
            5) Sprinkler piping, risers, stand pipes and hydrostatic tests.
            6) Certificates of underground piping tests.
            7) Door and window frames (ratings).
            8) Insulation and coverings.
            9) Wood usage in structure (non-combustible).
            10) Fireproofing and/or firestopping.
            11) Penetrations of structure (non-combustible).
            12) Impediments.
            13) Heating procedure (fuel location and piping).
            14) Welding and cutting procedures.
            15) Roofing procedures; roofing materials.
    3. Final Completion Inspection:
        a. Prior to requesting the Final Completion Inspection, the Contractor shall complete the following:
            1) Assure that the project is complete and ready for inspection.
            2) Perform a complete test of the fire alarm, fire protection, and life safety systems. Coordinate this test with the Architect and South Sanpete School District prior to scheduling the Final Completion Inspection. The electrical, fire alarm, and fire protection subcontractors shall be present at this test. Repeat this test until all elements of the test are acceptable. Refer to Section 01 4000 for testing requirements.

(a) The Contractor shall perform a complete test of the fire sprinkler system noting coverage, and completeness of the riser. The fire alarm system is completely checked for operation and adequate coverage. This also includes the 24 hour battery test. Emergency lighting and exit signs as well as door operation and hardware are also checked. The mechanical systems are inspected and hood fire suppression system is also inspected and tested, including fire alarm tie-in and fuel shut-offs (if required). Inspect and text the Proscenium Fire Curtain and all special doors such as roll-up doors or horizontal folding doors. Also ensure that appropriate certificates, where applicable, have also been obtained.

3) Provide a Key Plan, showing fire alarm zones and the fire sprinkler plan, installed next to the fire alarm control panel to aid the local fire department if there is a fire in the building.

b. The State Fire Marshal's office will generate a written Final Inspection Report and send it to the Project Architect. The Certificate of Fire Clearance will only be issued after all fire and life safety items previously listed as deficient are resolved appropriately.
   1) No occupancy is permitted without the State Fire Marshal's Certificate of Fire Clearance.

B. Certificate of Substantial Completion:
   1. Pre-Substantial Completion Observation:
      a. Before requesting the Substantial Completion Observation, complete the following:
         1) Prepare a Punch List of outstanding items and deficiencies to be completed.
         2) Complete all items on the Punch List.
         3) Submit the completed Punch List to the Architect with verification that it has been completed.
         4) Provide completed Closeout Submittals as specified in Section 01 7800.
         5) Advise South Sanpete School District of any pending insurance change-over requirements.
         6) Deliver maintenance stock items to South Sanpete School District.
         7) Conduct Owner demonstration and instruction for all systems as specified in Section 01 7900.
         8) Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements as specified in Section 01 5000.
         9) Complete final clean up requirements, touch-up and otherwise repair and restore marred exposed finishes.
   2. Substantial Completion Observation:
      a. The State Fire Marshal's Office should, if acceptable, deliver to South Sanpete School District the Certificate of Fire Clearance. (Original to follow in the mail.)
         1) The Owner may not occupy the building until the Certificate of Fire Clearance has been signed.
      b. The Date of Occupancy must be agreed to by the appropriate Building Official who will issue the Occupancy Permit.
      c. The Architect will prepare a Punch List of items remaining to be finished.
      d. Architect's Consultants (Electrical, Mechanical, Civil, Kitchen, Landscape, etc.) will prepare a Punch List of items remaining to be finished.
         1) Landscape Observation may be scheduled for a separate date.
      e. The Substantial Completion Observation requires the participation of the following:
         1) General Contractor.
         2) Electrical Contractor.
         3) Temperature Control Contractor.

4) Fire Alarm Contractor.
5) Fire Protection Sprinkler Contractor.
6) Mechanical Contractor.
7) Test and Balance Contractor (with completed test and balance report).
8) Food Service Equipment Contractor.
9) Elevator Contractor.
10) Platform Curtain and Rigging Contractor.
11) Landscape Contractor.
12) In addition to the above participants, the following persons shall attend:
    (a) School District Representative.
    (b) Building Inspectors.
    (c) Representative of the State Fire Marshal's Office (if required).
    (d) Architect.
    (e) Project Engineers and Consultants.
13) Coordinate attendance OF ALL the above listed subcontractors, and the Architect will coordinate the remainder as required.

f. Observation Procedures: On receipt of a request for this Observation, the Architect will either proceed with the same or advise the Contractor of unfulfilled requirements. The Architect will prepare the Certificate of Substantial Completion following this Observation, or advise the Contractor of work that must be completed or corrected before the certificate will be issued.
    1) The Architect will repeat the Observation only when assured that the Work has been substantially completed.
    2) Results of this Observation will form the basis of requirements for final acceptance.

g. When the Substantial Completion Certificate is awarded, be prepared to obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities.
    1) AIA Document G706, Contractor's Affidavit of Payment of Debts and Claims.
    2) AIA Document G706A, Contractor's Affidavit of Release of Liens.
    3) AIA Document G707, Consent of Surety Company to Final Payment.

C. Final Acceptance Observation:
1. Before requesting Final Acceptance Observation for certification of final acceptance and final payment, complete the following:
    a. Submit the final payment request and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
    b. Submit an updated final statement accounting for final additional changes to the Contract Sum.
    c. Submit a certified copy of the Architect's final observation list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
    d. Submit AIA Document G707 Consent of Surety Company to Final Payment.
    e. Submit a final liquidated damages settlement statement.
    f. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
2. Re-Observation Procedure: The Architect will re-observe the Work upon receipt of notice that the Work, including observation list items from earlier observations, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Architect.

a. Upon completion of this observation, the Architect will advise the Contractor the project is acceptable and to proceed with final project closeout as listed above, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
b. If necessary, the Architect will conduct additional re-observations as required to obtain final acceptance. Each subsequent re-observation will be back charged against the project Contract for the Architect's, Engineer's, and Owner's time.

D. Proposed Time Schedule:
1. The Architect is suggesting the following dates for Project Closeout. These dates are to be considered latest possible dates to meet the Owner's requirements. Earlier dates are preferred.
a. Date to be announced - Fire Marshal 70 Percent Inspection.
b. Date to be announced - Substantial Completion Observation and Fire Marshal Observation.
c. Date to be announced - Final Acceptance Observation.

E. Make submittals that are required by governing or other authorities.
1. Provide copies to Architect and Owner.

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

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

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

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

3.15 MAINTENANCE

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

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

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

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

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

END OF SECTION 01 7000

SECTION 01 7801
FORM OF GUARANTEE/WARRANTY

PROJECT INFORMATION

Project Name: Manti High School Shop and Wrestling Room Additions.
Project Address: Manti High School: 100 West 500 North, Manti, Utah, 84642.
Owner: South Sanpete School District. Attn: Jake Hill, Business Administrator.
Owner's Address: 39 South Main, Manti, Utah, 84642.

CONTRACTOR

Contractor Name: _____

Contractor's Address: _____

_____

GUARANTEE/WARRANTY

Date: _____

Know all persons by these present that, in consideration of my (our) having been awarded the Contract for complete furnishing and installation of (List specific sections and extent of work):

_____
_____
_____
_____

In conformity with the drawings and specifications prepared by Naylor Wentworth Lund Architects, 723 West Pacific Ave, Salt Lake City, UT 84104.

We do hereby agree to return to the project with three (3) working days upon notification by the Owner that materials and/or workmanship has proven faulty and to repair, replace or otherwise make good to the full satisfaction of the Owner and/or Architect all such work (including adjacent work disturbed in completing required work under this warranty) without cost to the Owner.

This agreement shall remain in full force and effect until one year from date of Substantial Completion established for the project by the Architect on the Certificate of Substantial Completion.

_____ Authorized Signature

_____ Title

_____ Contractor

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SECTION 01 7900

DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.
B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Door hardware.
   6. Items specified in individual product Sections.
C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
   2. Finishes, including flooring, wall finishes, ceiling finishes.
   3. Fixtures and fittings.
   4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.
B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Architect for transmittal to Owner.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.
   5. Include at least the following for each training session:
      a. Identification, date, time, and duration.
      b. Description of products and/or systems to be covered.
      c. Name of firm and person conducting training; include qualifications.
      d. Intended audience, such as job description.
      e. Objectives of training and suggested methods of ensuring adequate training.
      f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
      g. Media to be used, such a slides, hand-outs, etc.
      h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
   1. Include applicable portion of O&M manuals.
   2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
   3. Provide one extra copy of each training manual to be included with operation and maintenance data.
D. Training Reports:

1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings (if requested by the owner): Submit digital video recording of each training session for Owner's subsequent use.
1. Format: USB flashdrive.
2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
B. Demonstration may be combined with Owner personnel training if applicable.
C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.
B. Owner will provide classroom and seating at no cost to Contractor.
C. Provide training in minimum two hour segments.
D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:
1. Review the applicable O&M manuals.

2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 01 7900

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SECTION 02 4100

DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Demolition work as indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Selective Building Demolition:
   1. Refer to drawings for extent of work.
   2. Selective demolition of doors, windows, building components, and site improvements designated to be removed.
   3. Selective demolition of exterior components designated to be removed.
   4. Protection of portions of building adjacent to or affected by selective demolition.
   5. Removal of abandoned utilities and wiring systems.
   6. Notification to Owner of schedule of shut-off of utilities which serve occupied spaces.
   7. Pollution control during selective demolition, including noise control.
   8. Removal and legal disposal of materials.
   9. Protection of designated site improvements and adjacent construction.
   10. Salvage of designated items.
   11. Interruption, capping or removal of utilities as applicable.
C. Selective Site Demolition:
   1. Refer to drawings for extent of work
   2. Demolition of designated site improvements including paving, curbing, site walls, and utility structures.
   3. Salvage of designated items.
   4. Protection of site work and adjacent structures.
   5. Disconnection, capping, and removal of utilities.
   6. Pollution control during building demolition, including noise control.
   7. Designated site improvements and adjacent construction.
   8. Interruption, capping or removal of utilities as applicable.
   9. Removal of fences, fence posts, and miscellany.
   10. Clearing site of plant life, root systems and shrubs.
   11. Removal and legal disposal of materials.
   12. Selective demolition of built site elements.
   13. Selective demolition of building elements for alteration purposes.
D. Hazardous Materials:
   1. Hazardous materials not anticipated.
      a. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos, or materials containing lead, PCBs, and mercury.
E. Abandonment and removal of existing utilities and utility structures.
F. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 01 1100 - Summary of Work: Limitations on Contractor's use of site and premises.
B. Section 01 1100 - Summary of Work: Sequencing and staging requirements.

C. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
D. Section 01 5713 - Temporary Erosion and Sediment Control.
E. Section 01 6000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
F. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
G. Section 31 2323 - Fill: Fill material, including installation, for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.
B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.
C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Section 01 3100 - Project Management and Coordination. Review methods and procedures related to selective demolition including, but not limited to, the following:
   1. Convene minimum two weeks prior to starting work of this section.
   2. Inspect and discuss condition of construction to be demolished.
   3. Review structural load limitations of existing structure.
   4. Review and finalize demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   5. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
   6. Review areas where existing construction is to remain and requires protection.
   7. Review shoring plans and methods of shoring placement.
B. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 5 years of documented experience.

1.06 SEQUENCING

A. Immediate areas of the remaining building will not be occupied during selective demolition. The public, including children, may occupy adjacent areas surrounding the building to be demolished.
B. No responsibility for buildings and structures to be demolished will be assumed by the Owner.

PART 2 PRODUCTS -- NOT USED

2.01 MATERIALS

A. Fill Material: As specified in Section 31 2323 - Fill.

PART 3 EXECUTION

3.01 SCOPE

A. Refer to Drawing for extent of work.
B. Remove existing building portion identified for removal, including all below grade footings, foundations, boiler rooms, pipe tunnels etc. Refer to Drawings.
C. Remove vegetation from site improvement area, including trees, stumps, roots, and tree debris, along with plant life, root systems, and shrubs. Refer to Drawings.
D. Cap and remove remaing utilities. Verify during site visit.
E. Remove other items indicated for salvage.
F. Backfill of excavations, open pits and holes in the ground generated as results of demolition, will be performed as identified by the Construction Manager
G. Fill excavations, open pits, and holes in ground areas generated as result of removals using specified fill; compact fill as required so that required rough grade elevations do not subside within one year after completion.
    1. By Division 31.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
    1. Obtain required permits.
    2. Comply with applicable requirements of NFPA 241.
    3. Use of explosives is not permitted.
    4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
    5. Provide, erect, and maintain temporary barriers and security devices.
    6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
    7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
    8. Do not close or obstruct roadways or sidewalks without permit.
    9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
B. Do not begin removal until built elements to be salvaged have been removed.
C. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
D. Protect existing structures and other elements that are not to be removed.
    1. Provide bracing and shoring.
    2. Prevent movement or settlement of adjacent structures.
    3. Stop work immediately if adjacent structures appear to be in danger.
E. Minimize production of dust due to demolition operations; do not use water if doing so will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos or materials containing lead, PCBs, and mercury.
G. Perform demolition in a manner that maximizes salvaging and recycling of materials.
    1. Dismantle existing construction and separate materials.
    2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

H. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with utility company's requirements. Obtain required permits.
B. Protect existing utilities from damage.
C. Do not disrupt public utilities without permit from authority having jurisdiction.
D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type. Protect from damage due to subsequent construction, using substantial barricades if necessary.
G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
H. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
    1. Verify that construction and utility arrangements are as indicated.
    2. Report discrepancies to Architect before disturbing existing installation.
    3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
B. Demolition Operations: Do not damage building elements and improvements indicated to remain. Items of salvage value, not included on schedule of salvage items to be returned to Owner, shall be removed from structure. Storage or sale of items at project site is prohibited.
C. Shoring and Bracing: Provide and maintain interior and exterior shoring and bracing.
D. Occupied Spaces: Do not close or obstruct streets, walks, drives or other occupied or used spaces or facilities without the written permission of the Owner and the authorities having jurisdiction. Do not interrupt utilities serving occupied or used facilities without the written permission of the Owner and authorities having jurisdiction. If necessary, provide temporary utilities.
E. Operations: Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.
F. Security: Provide adequate protection against accidental trespassing. Secure project after work hours.
G. Restoration: Restore finishes of patched areas.
H. Separate areas in which demolition is being conducted from other areas that are still occupied.
    1. Provide, erect, and maintain temporary dustproof partitions of construction as required to protect existing building areas.
I. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
J. Remove existing work as indicated and as required to accomplish new work.
    1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
    2. Remove items indicated on drawings.
K. Services (including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment only as indicated.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

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

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.
B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 5000 - Temporary Facilities and Controls.
C. Leave site in clean condition, ready for subsequent work.
D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 02 4100

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SECTION 03 1000

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Concrete Forming work as required by the Drawings and/or specified herein including, but not limited to, the following described items.
B. Formwork for cast-in-place building concrete, with shoring, bracing and anchorage.
   1. Architectural-grade finishes for all exposed walls.
C. Openings for other work.
D. Form accessories.
E. Form stripping.
F. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Reinforcing.
B. Section 03 3000 - Cast-in-Place Concrete.
C. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.
D. Section 05 2100 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.
E. Section 31 2316 - Excavation: Shoring and underpinning for excavation.

1.03 REFERENCE STANDARDS

A. ACI 117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
B. ACI 301 - Specifications for Concrete Construction; 2020.
C. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).
D. ACI 347R - Guide to Formwork for Concrete; 2014, with Errata (2017).
E. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2018, with Editorial Revision.
F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
G. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on form and void filler materials, form release compounds, form ties and installation requirements.
C. Shop Drawings: Submit formwork and shoring shop drawings. Indicate the following:
   1. Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
   2. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
   3. Means of leakage prevention for concrete exposed to view in finished construction.
   4. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift and height of drop during placement.
   5. Vertical, horizontal, and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.

6. Notes to formwork Erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.

D. Design Data: As required by authorities having jurisdiction.
   1. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
   2. Means of leakage prevention for concrete exposed to view in finished construction.
   3. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift and height of drop during placement.
   4. Vertical, horizontal, and special loads in accordance with ACI 347, Section 2.2 and camber diagrams, when applicable.
   5. Notes to formwork Erector showing size and location of conduits and piping embedded in concrete in accordance with ACI 318, Section 6.3.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.
B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store all form materials and accessories above ground on framework or blocking. Cover form materials with a suitable waterproof covering that provides adequate air circulation and ventilation.
B. Handling: Lift form panels by methods that will protect panels from damage and distortion.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Formwork Standards: Unless otherwise indicated, design, construct, erect, maintain, and remove forms and related structures for concrete work in accordance with applicable requirements of ACI 301, ACI 318, and ACI 347.
   1. Architectural Concrete: Ensure that forms for architectural concrete are designed and constructed in accordance with ACI 301.
   2. Deflection: Where dead and live loads on forms will be more than 20 percent greater than the weight of the concrete, provide framing lumber of required strength, and comply with ACI 301 and ACI 347 for design of framing members. Keep deflection within the specified tolerances herein.
   3. Concrete Mix Design: Coordinate design of formwork with the concrete mix design as specified in Section 03 3000 - Cast-In-Place Concrete so that form materials, form surfaces, and formwork strength will produce the desired concrete tolerances and finishes.
B. Formwork Surface Materials: Provide material and work quality which will produce clean, smooth, and uniform finished surfaces within the allowable tolerances specified and which will conform with the following requirements:
   1. Concrete Exposed to View: Provide material and work quality that will produce clean, smooth, and uniform concrete surfaces. Transfer of wood grain to concrete is not acceptable. Refer to Section 03 3000 - Cast-In-Place Concrete and ACI 301 for requirements.
   2. Concrete Concealed from View: Provide material and work quality that will produce aligned concrete surfaces free of fins, honeycomb, and stains.

C. Special Formwork Sections: Provide openings, offsets, sinkages, keyways, recessed, moldings, rustication strips, chamfers, blocking, screeds, bulkheads, anchorages, embedded items, and other features. Select materials and provide workmanship that will ensure indicated finishes.
D. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
E. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
F. Chamfered Corners: Ensure that all outside corners of beams, joists, columns, and walls are chamfered unless otherwise indicated.
G. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
H. Comply with relevant portions of ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, ACI 347R, ACI 301, ACI 318, and ACI 347R.
I. Removal Features: Design formwork to be readily removable without impact, shock, and damage to concrete surfaces and adjacent materials.
J. Tolerances for Formed Surfaces: For buildings and similar structures, comply with the requirements of ACI 301, as applicable. For those items of work or parts of the structure not covered by ACI 301, comply with the requirements of ACI 117, as applicable. Coordinate with the requirements specified in Section 03 3000 - Cast-In-Place Concrete.

2.02 WOOD FORM MATERIALS

A. Softwood Plywood Forms: Ensure that plywood is graded and grade-marked in accordance with U.S. Product Standard PS 1.
   1. B-B Plyform: Provide Class I, EXT-APA, sanded, APA trademarked.
   2. B-C Plyform: Provide Class I, EXT-APA, APA trademarked.
   3. High Density Overlay (HDO) Plyform: Provide A-A, 60-60, Class I, EXT-APA, APA trade marked.
   4. Thickness: As required to maintain surface smoothness without deflection, but no thinner than 5/8 inch (16 mm).
B. Lumber Forms: Douglas Fir species; No. 2 grade; with grade stamp clearly visible.
   1. Boards: Use dressed side of lumber for surface in contact with the concrete, and provide boards with shiplapped or tongue and groove edges to prevent mortar leakage.
C. Framing, Studding and Bracing Lumber: Stud or No. 2 structural light framing grade.

2.03 REMOVABLE PREFABRICATED FORMS

A. Manufacturers:
   1. Symons - Dayton Superior Corporation: www.symons.com.
   2. Advance Concrete Form, Inc: www.advanceconcreteform.com.
   3. EFCO Corporation: www.efcoforms.com.
   4. Western Forms: www.westernforms.com.
B. Preformed Steel Forms: Fabricated steel forms, using standard or commercial quality, uncoated steel sheet or plate, 3/16 inch (5 mm) minimum thickness, for panel facings. Provide surfaces that will not impart corrosion residue to concrete. Include panel framing, reinforcement, and erection accessories.

2.04 FORMWORK ACCESSORIES

A. Leakage Control Materials: Provide materials capable of producing flush, watertight, and non-absorbent surfaces and joints, and compatible with forming material and concrete ingredients. Seal form edges with gasketing material or sealant placed in the joint in such a way that neither a fin nor groove is made in the face of the cast concrete.
   1. Caulking Compound: Silicone or polyurethane construction sealant conforming to ASTM C1184 or ASTM C920, as applicable.

2. Tapes: Form film tape of polypropylene plastic treated with waterproof adhesive, for joint conditions not exposed to view.

B. Form Release Agent: Commercial formulation, designed for use on all types of forms, capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, and not requiring removal for satisfactory bonding of coatings to be applied.

C. Form Ties: Rod type, with ends of end fasteners which can be removed without spalling the concrete and which leave a hole equal in depth to the required reinforcement clearance. Ensure that form ties are of a design in which the hole left by the removed end or end fastener is easily filled to match the surface of the hardened concrete. Provide removable cones 1 1/4 inches (32 mm) in diameter by 1 1/2 inches (38 mm) deep. Provide preformed mortar plugs to match the color of the concrete, recessed 1/4 inch (6 mm), adhered with an approved epoxy adhesive.

D. Inserts: Cast stainless steel or welded stainless steel, Type 316 or similar 300 Series, complete with anchors to concrete and fittings such as bolts, wedges, and straps. Provide hanger inserts where detailed.

E. Filler Strips for Chamfered Corners: Rigid plastic or wood strip type; 3/4 x 3/4 inch size; maximum possible lengths.

F. Dovetail Anchor Slot: Galvanized steel, at least 22 gauge, 0.0299 inch thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

G. Flashing Reglets: Galvanized steel, at least 22 gauge, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

H. Vapor Retarder: As specified in Section 03 3000.

I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

J. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

K. Waterstops: As specified in Section 03 3000.

L. Joint Filler: As specified in Section 32 1313.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 and approved Shop Drawings, and in a manner that will produce finished concrete surfaces conforming to indicated design and within specified tolerances.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads. Support joints with extra studs or girts, and in a manner that will ensure true, square intersections.

C. Brace temporary closures to prevent warpage or displacement and set tightly against forms in a manner that will prevent loss of concrete mortar.

D. Kerf wood inserts for forming keyways, reglets, and recesses in a manner that will prevent swelling and ensure ease of removal.

E. Construct molding shapes, recesses, and projections with smooth finish materials and install in forms with sealed joints.

F. Maintain forms clean and free from indentations and warpage. Do not use rust-stained steel surfaces for forms in contact with concrete. Do not sandblast steel form surfaces to remove rust or mill scale; remove these imperfections by grinding.
G. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.
H. Make joints and and seams mortar-tight. Install leakage control materials in accordance with the manufacturer's installation instructions, and in a manner that will maintain a smooth continuity of plane between abutting form panels and which will resist displacement by concreting operations.
I. Provide camber in formwork as required to compensate for deflections caused by weight and pressures of fresh concrete and construction loads and as otherwise indicated. Provide camber strips to compensate for deflections due to permanent loads and long-term deflections due to shrinkage and creep as required.
J. Ensure that formed stair risers within a stair are equal.
K. Edge Forms and Screed for Slabs: Set edge forms or bulkheads and intermediate screeds for slabs to obtain required elevations and contours in the finished slab surface. Support screeds substantially without penetrating waterproof membranes and vapor barriers.
L. Corner Treatment: Form chamfers with 3/4 inch (19 mm) on each leg, unless otherwise indicated, and accurately shape and surface in a manner which will produce uniformly straight lines and edge joints and which will prevent mortar runs. Extend terminal edges to limits, and miter chamfer strips at changes in direction.
M. Construction Joints:
    1. Locate joints as indicated. Support forms for joints in concrete so as to rigidly maintain their positions during placement, vibration, and curing of concrete. Install keys in all joints.
    2. Locate and install construction joints, for which locations are not indicated, so as not to impair strength and appearance of structure, and indicate such joints on Shop Drawings. Locations of construction joints will require approval of the Engineer.
    3. Position joints perpendicular to longitudinal axis of pier, beam or slab as the case may be.
    4. Locate joints in walls, vertically as indicated; at top of footing; at top of slabs on grade; at bottom of door openings; and at underside of the deepest beam or girder framing into wall; or as required to conform to indicated details.
    5. Provide keyways as indicated in construction joints in walls and slabs, and between walls and footings unless otherwise indicated. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
N. Obtain approval before framing openings in structural members that are not indicated on drawings.
O. Coordinate this section with other sections of work that require attachment of components to formwork.
P. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.04 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
C. Do not apply form release agent where concrete surfaces will receive special finishes or applied coverings that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.
B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 2001.
E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.
F. Install waterstops in accordance with manufacturer's instructions, so they are continuous without displacing reinforcement. Heat seal joints so they are watertight.
G. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
H. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.06 FORM CLEANING AND RE-USE

A. Clean forms as erection proceeds, to remove foreign matter within forms.
B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.
C. Clean and repair surfaces of forms to be reused in the work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable. Remove such material from the site. Apply form release coating as specified for new formwork.
D. Align and secure joints in a manner that will preclude offsets. Do not use patched forms for exposed concrete surfaces.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.
B. Camber slabs and beams 1/4 inch per 10 feet.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4300 - Quality Assurance.
B. Before placing concrete, check lines and grades of erected formwork and positioning of embedded inserts, blockouts, and joints for correctness. Verify that embedded piping and conduit are free from obstruction. Make corrections or adjustments to ensure proper size and location of concrete members and stability of forming systems.
C. While placing concrete, provide quality control to assure that formwork and related supports have not been displaced, that loss of cement paste through joints is prevented, and that completed work will be with specified tolerances.
D. During form removal, verify that architectural features meet form and texture requirements.
E. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.09 DETECTION OF MOVEMENT

A. Check movement using methods, such as plumb lines, tell tales, and survey equipment, to detect movement of formwork during concrete placement.

3.10 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Remove forms by methods which will not injure, mar, gouge, or chip concrete surfaces, overstress concrete members, or distort formwork. Use air pressure or other approved methods. Do not pry against concrete. Cut off nails flush. Leave surfaces clean and unblemished.
C. When repair of surface defects or finishing is required at an early age, forms may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations and its own weight.
    1. Repair concrete work that has been damaged by removal operations as specified in Section 03 3000 - Concrete. Where exposed surfaces are damaged beyond acceptable repairing measures, remove the damaged concrete and repair with new concrete.
D. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
E. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 1000

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SECTION 03 1515

SITE EXPANSION AND CONTRACTION JOINTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Site Expansion and Contraction Joint work as required by the Drawings and/or specified herein including, but not limited to, the following described items.
B. Joints and joint sealants in horizontal traffic surfaces for cast-in-place concrete sidewalks, curb, gutter and pavement slabs.
C. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCES

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
B. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
C. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
D. ASTM D1752 - Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2018.
E. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).
F. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991 (Reapproved 2016).
G. ASTM D5329 - Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements; 2016.
H. ASTM D545 - Standard Test Methods for Preformed Expansion Joint Fillers for Concrete Construction (Nonextruding and Resilient Types); 2014.
I. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements; 2015.
J. ASTM D7116 - Standard Specification for Joint Sealants, Hot Applied, Jet Fuel Resistant Types, for Portland Cement Concrete Pavements; 2016.
K. ASTM D994/D994M - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type); 2011 (Reapproved 2016).

1.04 SYSTEM PERFORMANCES

A. Pavement joints include longitudinal and transverse expansion joints, contraction joints, construction joints, and crack control joints.
B. Provide joint sealants that maintain watertight and airtight continuous seals.

1.05 SUBMITTALS

A. Manufacturer's product data and samples for each joint sealant product used.

1.06 QUALITY ASSURANCE

A. Obtain joint sealing materials from a single manufacturer for each different product required.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with label identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time, and mixing instructions for multicomponent materials.
B. Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants, or other causes.

PART 2 PRODUCTS

2.01 GENERAL

A. Compatibility: Provide joint fillers, sealant backings, sealants, and other related materials that are compatible with one another and with joint substrate under conditions or service and application, as demonstrated by sealant manufacturer based on testing and field experience.
B. Comply with the relevant provisions of:
   1. ASTM C920
   2. ASTM D545
   3. ASTM D994/D994M
   4. ASTM D1056
   5. ASTM D6690
   6. ASTM D5329
   7. ASTM D1751
   8. ASTM D1752
   9. ASTM D2240
   10. ASTM D2628
   11. ASTM D7116

2.02 JOINT VOID - FORMER

A. 1/4 depth of concrete structural section or as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not proceed with installation of joint sealants under unfavorable weather conditions.
B. Install elastomeric sealants when temperature is stable in temperature range recommended by manufacturer for installation.
C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrate.

3.02 PREPARATION

A. Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter which might impair adhesion of sealant.
B. Verify that joint shaping materials and release tapes are compatible with sealant.
C. Examine joint dimensions and size materials to achieve required width to depth ratio.
D. Adjust joint depths to allow sealants to perform properly.
E. Remove moisture on substrate.
F. Bond Breaker Tape: Install where needed or required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

3.03 JOINTS - GENERAL

A. Construct all joints as follows:

1. At right angles to top surface of placement.
2. Straight unless indicated otherwise.
3. Before uncontrolled shrinkage cracking takes place.
4. To prevent concrete edge slump.

3.04 EXPANSION JOINTS

A. Do not extend reinforcement through an expansion joint. Place dowel mechanisms.
B. Set joint fillers at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods, and sealants. Do not leave voids or gaps between ends of joint filler units. Secure holders and supports to prevent joint filler movement.
C. Form transverse expansion joints at structures and concrete approaches using filler strips, backer rods and joint sealant. Support as needed with holders which will remain in place.

3.05 CONSTRUCTION JOINTS

A. Construction joints (contact joints) are those made by placing concrete against cured concrete. When indicated construct construction joints with an indented keyway or tie-bar.
B. Place tie-bar to eliminate edge slump.
C. Maintain tie bars perpendicular to joint unless indicated otherwise. Before placing concrete in adjoining slab, straighten tie bars to proper position. If a "S" shape bend results from straightening, the offset from a straight line cannot exceed 0.1 feet.

3.06 CONTRACTION CRACK CONTROL JOINTS

A. Ensure that joint spacing in feet does not exceed twice the slab thickness in inches. Regardless of the thickness, joint spacing is not to exceed 15 feet. Coordinate joint locations with architectural plans.
B. Contraction crack control joints are those made by sawing or tooling joints 1/4 depth of concrete structural section and 3/8 inch wide. Use of a plastic control joint-void former is acceptable in lieu of saw cutting or tooling.
C. Make longitudinal joints the same dimension as transverse joints.
D. Except where shown to be omitted or recommended to be omitted by sealant manufacturer, clean saw cut or tooled joint of loose debris, cement, dust, etc.; install 25 percent oversized backer rod to fit tightly in joint and seal joint.

3.07 JOINT SEALING

A. Surface Preparation:
   1. Remove oil, grease, wax, form-release-agents, curing compounds, bitumens, latency and old chalking material by sandblast, or water blast as recommended by manufacturer of sealant. Maximum sand blast angle: 25 degrees, plus or minus 5 percent.
   2. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants.
   3. Remove frost and moisture in concrete joint substrate before commencing sealing.
B. Installation:
   1. Ensure that sealants are installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides.
   2. Except as otherwise indicated, fill sealant rubbed flush with surface.
   3. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to from a slight cove so that joint will not trap moisture and dirt.
C. Depths: Saw cut joints if necessary to provide the required sealant thickness and depth. Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:
   1. For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.

2. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/4 inch deep.
3. For joints sealed with non elastomeric sealants and caulking compounds, fill joints to a depth in range of 75 percent to 125 percent of joint width.

D. Spillage: Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.
E. Heating: Do no overheat hot-applied sealants.
F. Edges: Unless indicated otherwise, recess exposed edges of gasket and exposed joint fillers slightly behind adjoining surfaces so compressed units will not protrude from joints.

3.08 CURE AND PROTECTION

A. Cure sealants and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
B. Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Substantial Completion.

3.09 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of products in which joints occur.
B. Remove protective coating and oil from metals with solvent recommended by the sealant manufacturer.

3.10 PROTECTION

A. Protect joint sealant during and after curing period from contact with contaminating substances or from damage resulting from deterioration or damage at time of Substantial Completion.
B. If damage of deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work at no additional cost to OWNER.

END OF SECTION 03 1515

SECTION 03 2000

REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Reinforcing work as required by the Drawings and/or specified herein including, but not limited to, the following described items.
B. Reinforcing steel for cast-in-place concrete.
C. Supports and accessories for steel reinforcement.
D. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.
B. Section 03 3000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. ACI SP-66 - ACI Detailing Manual; 2004.
B. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
C. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
D. CRSI (DA4) - Manual of Standard Practice; 2009.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Comply with requirements of ACI SP-66. Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
    1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.
C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
E. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.
    1. Maintain one copy of each document on project site.
B. Provide Architect with access to fabrication plant to facilitate inspection of reinforcement. Provide notification of commencement and duration of shop fabrication in sufficient time to allow inspection.
C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: As indicated in the General Structural Notes.

1. Deformed billet-steel bars.
2. Unfinished.

B. Reinforcement Accessories:
1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
3. Provide stainless steel components for placement within 1 1/2 inches of weathering surfaces.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.
B. Welding of reinforcement is not permitted.
C. Locate reinforcing splices not indicated on drawings at point of minimum stress.
1. Review locations of splices with Architect.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
B. Do not displace or damage vapor barrier.
C. Accommodate placement of formed openings.
D. Maintain concrete cover around reinforcing as shown on Structural Drawings.
E. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4300 - Quality Assurance, will inspect installed reinforcement for compliance with contract documents before concrete placement.
B. Refer to Structural Drawings for special inspection requirements.

3.03 SCHEDULES- REFER TO STRUCTURAL DRAWINGS

END OF SECTION 03 2000

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Work included: Provide all labor, materials, equipment, fabrication, incidentals, transportation, placing and supervision necessary to complete all Cast-in-Place Concrete work, its finishing, and all related work called for by the Contract Drawings and/or Specifications, or reasonably inferable from either or both, as needed for a complete and proper installation. Including but not limited to the following described items:
B. Concrete slabs on grade.
C. Exterior concrete paving, sidewalks, stairs, curbs, and gutters.
D. Concrete footings and foundation walls.
E. Joint devices associated with concrete work.
F. Miscellaneous concrete elements, including equipment pads, thrust blocks, and bollards.
G. Underslab Vapor Retarder.
H. Concrete curing.
I. Concrete sealing on all exterior sidewalks, drive, curbs and gutters.
J. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.
B. Section 03 2000 - Reinforcing.
C. Section 03 3511 - Exposed Concrete Floor Finishes: Densifiers, hardeners, applied coatings, and polishing.
D. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
E. Divisions 21, 22, 23: Mechanical items for casting into concrete.
F. Division 26: Electrical items for casting into concrete.

1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
B. {RSTEMP#undefined}
C. {RSTEMP#87}ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International{CH#17564}.
D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
E. ACI 305R - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2010).
F. ACI 306R - Guide to Cold Weather Concreting; 2016.
G. {RSTEMP#92}ACI 308R - Guide to Curing Concrete; American Concrete Institute International{CH#17570}.
H. ACI 318 - Building Code Requirements for Structural Concrete; 2019, with Errata (2021).
I. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2018.
J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2021.
K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021b.

L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
M. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2020.
N. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).
O. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
P. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2017a.
Q. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.
R. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2019.
S. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.
T. ASTM C1202 - Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration; 2019.
U. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.
V. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2018.
W. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2018.
X. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.
Y. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.
Z. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.
AA. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017.
BB. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.
CC. NSF 61 - Drinking Water System Components - Health Effects; 2021.
DD. NSF 372 - Drinking Water System Components - Lead Content; 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. In areas receiving Special Concrete Floor Finishes, coordinate with Finish Manufacturer and Installer for special requirements.
   2. Topics for discussion may include: Design mixture, placement schedule, placement methods, tolerances, curing method, jointing, and slab protection.
   3. Record, type, and distribute meeting minutes within 5 days of the meeting to all concerned parties, including but not limited to the Owner's Representative, Architect, and all attendees.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives and special concrete finishes.
C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.
3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
4. Indicate proposed mix design complies with admixture manufacturer's written recommendations.

D. Shop Drawings: Submit plans showing locations of construction and control joints for Engineer/Owner review.
E. Samples: Submit samples of underslab vapor retarder to be used.
F. Samples: Submit two,12 inch long samples of construction joint devices.
G. Test Reports: Submit report for each test or series of tests specified.
H. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.
I. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of Portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
J. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.
   1. Maintain one copy of each document on site.
B. Follow recommendations of ACI 305R when concreting during hot weather.
C. Follow recommendations of ACI 306R when concreting during cold weather.
D. Vapor Barrier Installation: Conduct pre-installation conference and installation review prior to concrete placement, either in-person or digitally.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Contractor shall guarantee his/her work for a period of One (1) year(s) from date of Substantial Completion. Guarantee form will be found in Section 01 7800.

PART 2 PRODUCTS

2.01 FORMWORK

A. Comply with requirements of Section 03 1000.
B. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   1. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
   2. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 2000.

2.03 CONCRETE MATERIALS

A. Cement: See General structural notes.
   1. Acquire cement for entire project from same source.
B. Fine and Coarse Aggregates: See General structural notes.
   1. Acquire aggregates for entire project from same source.
C. Lightweight Aggregate: ASTM C330/C330M.
D. Fly Ash: See General structural notes.
E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

A. Chemical Admixture:
   1. Manufacturers:
      a. Sika Corporation: www.sikaconstruction.com.
      b. GCP Applied Technologies; www.gcpat.com.
      c. Master Builders Solutions US LLC: www.master-builders-solutions.com.
      d. Euclid Chemical Company: www.euclidchemical.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.
B. All admixtures to come from same manufacturer. Verify that admixtures are compatible.
C. Air Entrainment Admixture: ASTM C260/C260M.
   1. Ensure that certification attesting to compliance with ASTM C260/C260M is furnished.
   2. Ensure that all exterior concrete flatwork, curbs and gutters, and catch basins have an air-entraining agent.
   3. Manufacturers:
      a. Airalon 3000 manufactured by Grace Construction Products.
      b. MasterAir Series manufactured by Master Builders Solutions US LLC.
      c. Substitutions: See Section 01 6000 - Product Requirements.
D. Water Reducing (set controlling) Admixtures:
   1. Adjust concrete to produce the required rate of hardening for varied climatic and job site conditions.
   2. Ensure that admixture does not reduce the amount of cement required. Amounts as accepted by Architect/Engineer. Do not use calcium chloride or admixtures that contain calcium chloride.
   3. Ensure that Field Service, a qualified concrete technician employed by the manufacturer, is available upon request to assist in proportioning concrete materials for optimum use, and to advise on proper use of the admixture and adjustment of concrete mix proportions to meet the jobsite and climatic conditions.
   4. High Range Water Reducing Admixture: ASTM C494/C494M Type F.
      a. Approval in writing required from Architect.
   5. Water Reducing and Accelerating Admixture: ASTM C494/C494M Type E.
      a. Under 40 degrees F ambient temperature - Accelerate (Approval in writing required from Architect).
   6. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.
      a. Over 80 degrees F ambient temperature - Retard.
   7. Water Reducing Admixture: ASTM C494/C494M Type A.
      a. Between 40 degrees F and 80 degrees F ambient temperature - Normal rate of hardening.
   8. Shrinkage Reducing Admixture:
      a. ASTM C494/C494M, Type S.
      b. Products:
         1) GCP Applied Technologies; Eclipse 4500: www.gcpat.com.

2) Substitutions: See Section 01 6000 - Product Requirements.

9. Waterproofing Admixture: Admixture formulated to reduce permeability to liquid water, with no adverse effect on concrete properties.
   a. Admixture Composition: Crystalline, functioning by growth of crystals in capillary pores.
   b. Admixture Composition: Hydrophobic polymer waterproofing and corrosion inhibitor, functioning by closing concrete pores and chemical bonding.
   c. Permeability of Cured Concrete: No measurable leakage when tested in accordance with COE CRD-C 48 at 200 psi; provide test reports.
   d. Potable Water Contact Approval: National Science Foundation (NSF) certification for use on structures holding potable water, based on testing in accordance with NSF 61 and NSF 372
   e. Products:
      1) ConShield Technologies, Inc; Crystal X: www.conshield.com.
      2) MasterLife 300 Series; Master Builders Solutions US LLC: www.master-builders-solutions.com
      3) W. R. Meadows, Inc; ADI-CON CW Plus: www.wrmeadows.com.
      4) Substitutions: See Section 01 6000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Barrier: 15 mil high performance multi-layered virgin polyolefin, complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs.Maintain water vapor permeance less than 0.01 perms before and after mandatory conditioning testing per ASTM E1745 Section 7.1.

Single-ply polyethylene is prohibited.

1. To be installed under all Slabs on Grade.
2. Installation: Comply with ASTM E1643.
3. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations in vapor barrier.
4. Products:
   a. Stego Industries, LLC: www.stegoindustries.com.
   b. Tex-Trude, LP; Xtreme Vapor Barrier (15-mil): www.tex-trude.com.
   c. Tex-Trude, LP; Xtreme Vapor Barrier (20-mil): www.tex-trude.com.
   d. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.
   e. Fortifiber Building Systems Group; Moistop Ultra 15: www.fortifiber.com
   f. Raven Industries; VaporBlock 15 mil: www.ravenind.com.
   g. Substitutions: Not permitted.

B. Non-Shrink Epoxy Grout: Moisture-insensitive, two-part; consisting of epoxy resin, non-metallic aggregate, and activator.
   1. During epoxy mixing and application process follow the epoxy manufacturer's instructions exactly.
   2. Manufacturers:
      a. Sika: Product - "Sikadur-42"
      b. BASF: Product - "MasterFlow678"
      c. Substitutions: See Section 01 6000 - Product Requirements.

C. Post-installed Adhesive Anchors: Use only at locations indicated on the Structural Drawings
   1. All bars anchored in epoxy or acrylic are to be observed by the Engineer or inspected by the Special Inspector prior to covering up.
   2. Manufacturers:
      a. Refer to Structural Notes.

b. Substitutions: See Section 01 6000 - Product Requirements.

2.06 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application and moisture insensitive.
   2. Products:
      a. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.

C. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

2.07 CURING MATERIALS

A. Evaporation Retarder: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
   1. Manufacturers:
      a. Dayton Superior Corporation: www.daytonsuperior.com.
      b. Euclid Chemical Company; EUCOBAR: www.euclidchemical.com.
      c. SpecChem, LLC; SpecFilm Concentrate or SpecFilm: www.specchemllc.com.
      d. W. R. Meadows, Inc; Evapre or Evapre-RTU: www.wrmeadows.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound, that dissipates within 3 to 5 weeks; complying with ASTM C309, Type I, Classes A and B.
   1. Manufacturers:
      a. Dayton Superior Corporation: www.daytonsuperior.com.
      b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com.
      c. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net.
      d. SpecChem, LLC; SpecRez: www.specchemllc.com.
      e. W.R. Meadows, Inc: www.wrmeadows.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.

C. Removable Curing Compound: VOC-compliant curing compound designed to be easily removed by the application of a cleaner/remover for all slabs that will receive stains, dyes, sealers, densifiers, coatings, or adhesives. For interior use only.
   1. Products:
      a. Euclid Chemical Company: www.euclidchemical.com.
         1) Removable Curing Compound: Kurez RC-100.
         2) Cleaner/Remover: Kurez RC-off.
      b. Substitutions: See Section 01 6000 - Product Requirements.

D. Curing and Sealing Compound, Moisture Emission-Reducing, Penetrating: Clear, water-based, non-film-forming curing agent; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission, moisture vapor emission, and alkalinity.
   1. Contractor's option to use this product to cure and seal slabs to receive adhesively applied flooring or roofing.

2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C39/C39M.
3. Chloride Ion Resistance of Treated Concrete: Equal to or greater than strength after 28-day water cure when tested according to ASTM C1202.
4. Comply with ASTM C309 and ASTM C1315 Type I Class A.
5. VOC Content: Zero.
6. UL GREENGUARD Gold certified.
7. Products:
    a. Sinak Corporation; VC5: www.sinak.com.

E. Curing Compound, Non-dissipating: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C309.
1. Vehicle: Water-based.
2. Gloss: Low.
3. Solids by Mass: 15 percent, minimum.
4. VOC Content: OTC compliant.
5. Products:
    a. Kaufman Products Inc; Krystal 15 Emulsion: www.kaufmanproducts.net.
    b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Dress & Seal WB: www.lmcc.com.
    c. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; Dress & Seal WB 30: www.lmcc.com.
    d. The QUIKRETE Companies; QUIKRETE® Acrylic Concrete Cure & Seal: www.quikrete.com.
    e. W. R. Meadows, Inc; VOCOMP-20: www.wrmeadows.com.
    f. Substitutions: See Section 01 6000 - Product Requirements.

F. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
1. To be used on all exterior concrete.
2. Vehicle: Solvent-based.
3. Solids by Mass: 30 percent, minimum.
4. VOC Content: OTC compliant.

G. Moisture-Retaining Sheet: ASTM C171.
1. White burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

H. Liquid Surface Sealer: Waterborne silane/siloxane sealer.
1. Acceptable Products:
    a. L&M Construction Chemicals; Aquapel: www.lmcc.com.
    b. Dayton Superior; Weather Worker 10% J26WB: www.daytonsuperiorchemical.com.
    c. Euclid Chemical Company; Chemstop WB: www.euclidchemical.com.
    d. US Spec; PWR: www.uspec.com.
    e. W.R. Meadows: Peneseal WB: www.wrmeadows.com.
    f. Substitutions: See Section 01 6000 - Product Requirements.

I. Water: Potable, not detrimental to concrete.

2.08 CONCRETE MIX DESIGN

A. General Concrete Mix Requirements:

1. Obtain design of concrete mixes, including recommended amounts of admixture and water to be used in the mixes, from a qualified independent testing laboratory or agency, or from a mill or ready-mix plant properly equipped to design concrete mixes. A professional engineer currently registered as a civil or structural engineer in the State of Utah will perform and certify the design. Contractor shall ensure that the laboratory, agency, mill, or ready-mix plant used meets applicable requirements of ASTM E329. Contractor shall pay costs of obtaining the mix designs.
2. Ensure that selection of mix proportions conforms to the applicable requirements of ACI 211.1 and ACI 211.2. Ensure that concrete complies with ACI 301 and ACI 318, as applicable. Ensure that mix designs will produce concrete suited for proper placement and finishing.
3. Indicate brands, types and quantities of admixtures included in mix designs. If fly ash is proposed, identify it as such (e.g., “fly ash”), and identify the percentage of cement replacement in the mix design.
4. If concrete is to be placed by pumping, ensure concrete mixes are designed in accordance with the applicable requirements of ACI 304R and ACI 304.2R, and that strengths and slumps are included.
5. Ensure that mix designs indicate the location of each mix within the structure.
6. Ensure that fly ash does not exceed 35 percent in mix designs with replacement of Portland cement by weight with fly ash.
7. Ensure that mix design for architectural concrete and formed concrete that will be exposed to the public includes 10 percent minimum replacement of the cement with fly ash along with a plasticizing admixture, conforming with ASTM C1017, to provide a dense and plastic concrete mix that completely fills out the forms and form detail without air holes and rock pockets.
8. Ensure that mix design for integrally colored concrete indicates brand type of natural or synthetic metallic oxide or pigment, and quantity used, all prepared as specified in ASTM C979/C979M. Compensate for fly ash with additional pigment as applicable. Ensure that concrete encasements of below-grade electrical conduits and ductbanks containing circuits over 600 Volts are integrally colored .
9. Ensure that mix design for mass concrete has a percentage of fly ash replacement of cement by weight to reduce the amount of heat generated during heat of hydration.
10. Ensure that mix designs of exterior concrete include air entrainment by total volume of concrete: 4 to 6 percent for 1 1/2 inch maximum size coarse aggregate; 5 to 7 percent for 3/4 or 1 inch maximum size coarse aggregate in accordance with ASTM C173/C173M.
11. Ensure that aggregates conform to Standard Specifications for Concrete Aggregates ASTM C33.
12. Ensure that calcium chloride or other materials containing chlorides are corrosive to reinforcing steel are not used as an admixture in post-tensioned concrete.
13. Concrete Strength: Establish required average strength for concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
14. Drying Shrinkage of Concrete: Establish required “Drying Shrinkage” for concrete on the basis of field experience or trial mixtures, as specified in ASTM C157and ASTM C490.

B. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
   1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

D. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.
E. Type - A - Concrete - all building and exterior concrete.
    1. Normal Weight Concrete:
        a. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days:
            1) Refer to structural notes.
        b. Cement Type:
            1) Refer to structural notes.
F. It is the Contractor's responsibility to recommend adjustments to mix design to meet specification requirements, based on job site conditions. Refer to Paragraph FLOOR FLATNESS AND LEVELNESS TOLERANCES of this Section for floor flatness tolerances.
    1. Maximum Aggregate Size: 3/4 inch.

2.09 MIXING

A. Ensure that concrete is ready-mixed batched, mixed, and transported in accordance with ASTM C94/C94M, "Specifications For Ready-Mixed Concrete," unless a higher standard is called for.
    1. Ensure that plant equipment and facilities conform to the "Checklist for Certification of Ready Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association.
B. For each load of concrete delivered, ensure that a delivery ticket is submitted that shows the following information:
    1. Number of cubic yards.
    2. The exact amount of cement and fly ash (if allowed); this can be indicated either by weight or quantity.
    3. The amount of mixing water including free moisture in aggregates; this can be indicated either by weight or quantity.
    4. Amount of slump in inches.
    5. Type of cement.
    6. Amount of air entrainment when delivered at job site.
    7. Do aggregates meet ASTM specified - yes or no. Indicate maximum size aggregate.
    8. Amount and brand (or ASTM) of admixture other than air entraining agent (if any) previously accepted in writing by Architect.
C. Contractor shall ensure that delivery tickets are given to the Job Superintendent or Foreman; Job Superintendent and Foreman shall see that tickets are delivered to the Architect and Testing Contractor once a week. Note exact location of concrete on job.
D. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.
B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's written instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink epoxy grout.

E. Interior Slabs on Grade:
   1. More than 4 inches minimum of compactible granular fill, unless noted otherwise.
   2. Level and compact base material.
   3. Install vapor barrier under all interior slabs on grade in accordance with ASTM E1643.
   4. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.
   5. Extend vapor barrier to the perimeter of the slab. If practical, terminate at the top of slab, otherwise (a) at point acceptable to the structural engineer or (b) where obstructed by impediments, such as rebar, dowels, waterstops, or any other site condition requiring early termination of the vapor barrier.
   6. At point of termination, seal vapor barrier to foundation wall, grade beam, or slab itself. If sealing to foundation wall use double-sided perimeter sealing tape as recommended by manufacturer. When sealing to placed slab, use textured tape engineered to bond to newly placed concrete slabs per manufacturer's instructions.
   7. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.
   8. Repair damaged vapor barrier before covering. Avoid use of non-permanent stakes driven through vapor barrier.

F. Subgrade Preparation: Provide final check of finish grading before reinforcing is placed, and make any required adjustments. Provide ground surfaces at optimum moisture content (as determined by Soils Engineer).

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. At locations shown on architectural and/or mechanical drawings, provide 6 inch (150 mm) high concrete housekeeping pads where indicated for equipment.

D. Where floors are indicated to be recessed for topping slab, or for floor tile that slope to drains, ensure that the concrete subfloor is sloped to provide for consistent thickness of setting bed, no exceptions.
   1. Any recessed floor which does meet the required slope will be replaced at no cost to the owner.

E. Be aware that an Underslab Vapor Retarder will be installed and protect vapor retarder during all concrete floor forming and installation. Do not allow screed stakes or other penetrations. Take all required precautions to prevent excess moisture from entering the base under the vapor retarder prior to, during, and after installing the concrete slab on grade.
   1. Repair underslab vapor retarder damaged during placement of concrete reinforcing. Repair with vapor retarder material; lap over damaged areas minimum 6 inches (150 mm) and seal watertight.

F. The Soils Engineer shall determine the moisture content of the base material prior to placing the concrete and shall make the final determination as to whether the moisture content of the base material is appropriate for concrete placement.

G. Notify Architect not less than 24 hours prior to commencement of placement operations.

H. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

I. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

J. Place concrete continuously between pre-determined expansion, control, and construction joints.
K. Place floor slabs in checkerboard or saw cut pattern indicated.
L. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.04 SLAB JOINTING

A. Locate joints as indicated on the drawings. For any areas not shown, coordinate joint placement with Architect prior to placing concrete.
B. Install joint devices in accordance with manufacturer's written instructions.
C. Anchor joint fillers and devices to prevent movement during concrete placement.
D. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
    1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.
E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.
F. Install joint device anchors for expansion joint assemblies specified in Section 07 9513. Maintain correct position to allow joint cover to be flush with floor and wall finish.
G. Apply sealants in joint devices in accordance with Section 07 9200.

3.05 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 4300, will inspect finished slabs for compliance with specified tolerances.
B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
    1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15.
    2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15.
    3. Under Carpeting: F(F) of 25; F(L) of 20.
    4. Under Thin LVL Flooring, Thinset Tile, and resinous flooring: F(F) of 35; F(L) of 25.
C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.
D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.
E. Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot (3.05 m) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed the following:
    1. 1/8 inch (3.2 mm).
F. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.06 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.
B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.
C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
    1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.
D. Concrete Slabs: Finish to requirements of ACI 302.1R and as follows:

1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI 302.1R; thick floor coverings include ceramic tile.
2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, LVL, seamless flooring, and thin set ceramic tile.
3. Exposed Surfaces: Trowel as described in ACI 302.1R; use steel-reinforced plastic trowel blades instead of steel blades to avoid black-burnish marks; exposed surfaces include all other exposed slab surfaces.
    a. **Coordinate with Finish Manufacturer and Installer for special requirements, Refer to Section 03 3515.**

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:50 nominal.
F. Concrete Polishing: See Section 03 3511.

3.07 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
    1. At ceramic/paver tile locations, DO NOT USE liquid curing compounds except removable curing compounds so as to promote enhanced tile installation.
    2. In areas receiving Special Concrete Floor Finishes coordinate with Finish Manufacturer and Installer for special requirements, refer to Section 03 3511.
B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
    1. Normal concrete: Not less than seven days.
C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.
D. Surfaces Not in Contact with Forms:
    1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
    2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
    3. Final Curing: Begin after initial curing but before surface is dry.
        a. Curing Compound: Apply in two coats at right angles.
            1) Apply curing compound at the application rate at which it meets ASTM C309.
            2) If sprayed on, backroll with short nap roller.

3.08 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4300 - Quality Assurance.
B. Provide free access to concrete operations at project site and cooperate with appointed firm.
C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.09 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.
B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances, visual appearance or specified requirements as determined by the Architect.
C. Repair or replacement of defective concrete will be determined by the Architect. Contractor shall bear the cost of additional testing when defective concrete is identified.
D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.10 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.
B. Protect corners, edges, and surfaces of cast-in-place architectural concrete from damage; use guards and barricades.
C. Protect cast-in-place architectural concrete from staining, laitance, and contamination during remainder of construction period.

END OF SECTION 03 3000

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SECTION 03 3511

EXPOSED CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Exposed Concrete Floor Finish work as required by the drawings and/or specified herein including, but not limited to, the following described items. (Rooms/spaces with exposed concrete floor finishes).
B. Clear coatings.
   1. Concrete hardener (densifier).
C. Joint filler.
D. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
B. Section 03 3000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.
C. Section 07 9200 - Joint Sealants: Colored sealant for joints.

1.03 REFERENCE STANDARDS

A. {RSTEMP#86}
B. {RSTEMP#87}
C. ACI 303R - Guide to Cast-in-Place Architectural Concrete Practice; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with concrete floor placement and concrete floor curing.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; review concrete finishes and finishing, concrete repair procedures, and concrete protection of concrete floor surfaces.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's published data on each finishing product, including information on compatibility of different products and limitations.
C. Samples for Initial Color Selection: Manufacturer's color charts showing full range of colors available.
D. Verification Samples: 6 inch (150 mm) square color samples of custom colors.
E. Maintenance Data: Provide data on maintenance and renewal of applied finishes.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with {RS#86}, {RS#87}, ACI 303R
   1. Maintain one copy of each on project site.
B. Manufacturer Qualifications: Company specializing in manufacturing the product specified in this section, with minimum five years of documented experience.
C. Applicator Qualifications: Company specializing in performing the work of this section and approved by the manufacturer.

D. Source Limitations: Obtain primary floor treatment materials through one source from a single manufacturer. Provide secondary materials, including honing and polishing material of type and from source recommended by manufacturer of primary materials.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original sealed packaging, including application and storage instructions.
B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.08 FIELD CONDITIONS

A. General:
   1. Protection of Unfinished Slab (No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.):
      a. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
      b. No trade will park vehicles on the concrete slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
      c. No pipe cutting machine will be used on the concrete slab.
      d. Steel will not be placed on concrete slab to avoid rust staining.
      e. Acids and acidic detergents will not come into contact with concrete slab.
      f. All trades to be informed that the concrete slab must be protected at all times.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

1.10 GUARANTEE

A. This Contractor shall guarantee his/her work for a period of one (1) year from date of Substantial Completion. Guarantee will be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 CONCRETE HARDENER (DENSIFIER)

A. Manufacturers:
   1. Basis of Design Manufacturer:
      a. Sherwin-Williams. Product: Cemlack Densifier Concrete Hardener; www.sherwin-williams.com.
   2. Other Approved Manufacturers:
      a. L&M Construction Chemicals, Inc.
      b. Dayton Superior.
      c. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT FILLERS

A. Moisture insensitive, self-leveling, 100 percent solids, two-component Polyurea Elastomer joint and crack fller.
   1. Designed for concrete with low to medium thermal cycling. Cures rapidly and consistently in applications ranging from 30 degrees F to 130 degrees F.
   2. Tack free in 4 minutes and areas can be reopened to vehicle or foot traffc within 1 hour after installation.

3. Basis of Design: PE85MI Polyurea Joint Filler by HighTech.
4. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that floor surfaces are acceptable to receive the work of this section.
B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.

3.02 GENERAL

A. Apply materials in accordance with manufacturer's instructions.

3.03 COATING APPLICATION

A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.04 CONCRETE HARDENER (DENSIFIER)

A. Preparation:
   1. Prepare surfaces using the methods recommended by the Manufacturer for achieving the best result for the substrate under the project conditions.
B. Application:
   1. Apply hardener/densifier per manufacturer's written instruction to new concrete work.

3.05 PROTECTION FOR CONCRETE HARDENER (DENSIFIER)

A. Protect floors for a period as recommended by manufacturer.
   1. Do not allow traffic on floors for 3 hours after application.
   2. Do not allow parking of vehicles on concrete slab.
   3. If vehicles must be temporarily parked on slab, place drop cloths under vehicles during entire time parked.
   4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.
   5. Do not allow temporary placement and storage of steel members on concrete slab.
   6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
   7. Clean floor regularly in accordance with manufacturer's recommendations.

3.06 PROTECTION GENERAL

A. Protect finished surface as required and as recommended by manufacturer of finish system.

END OF SECTION 03 3511

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SECTION 03 4500

PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Precast Architectural Concrete work as required by the Drawings and/or specified herein including, but not limited to, the following described items.
B. Architectural Precast Concrete Units:
   1. Exterior windowsills.
C. Supports, anchors, and attachments.
D. Installation for Windowsills Units by Section 04 2001 - Brick Veneer.
E. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Admixtures.
B. Section 04 2001 – Brick Veneer: Installation of all pre-cast windowsill units.
C. Section 07 1900 - Water Repellents: Exterior concrete sealers.
D. Section 07 9005 - Joint Sealers: Sealants and application requirements.

1.03 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International ; 2008.
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel ; 2008.
C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products ; 2009.
D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware ; 2009.
E. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength ; 2010.
F. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts ; 2007a.
G. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric] ; 2007.
H. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement ; 2009b.
I. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars ; 2007b.
J. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field ; 2010.
K. ASTM C33 - Standard Specification for Concrete Aggregates ; 2011.
L. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete ; 2010a.
M. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete ; 2010a.
N. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete ; 2009.
O. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete ; 2010.
P. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars ; 2001 (Reapproved 2007).
Q. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; Precast/Prestressed Concrete Institute ; 2005.
R. PCI MNL-120 - PCI Design Handbook - Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute ; Sixth Edition, 2004.

S. PCI MNL-122 - Architectural Precast Concrete; Precast/Prestressed Concrete Institute ; 2007, Third Edition.
T. PCI MNL-123 - Design and Typical Details of Connections for Precast and Prestressed Concrete; Precast/Prestressed Concrete Institute ; 1988, Second Edition.
U. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; Precast/Prestressed Concrete Institute ; 2000.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: For each type of product indicated.
C. Design Mixtures: For each precast concrete mixture. Include results of compressive strength and water-absorption tests.
D. Shop Drawings:
    1. Detail fabrication and installation of architectural precast concrete units.
    2. Indicate locations, plan views, elevations, dimensions, shapes, and cross-sections of each unit.
    3. Indicate aesthetic intent including joints, drips, chamfers, rustications or reveals, and extent and location of each surface finish.
    4. Indicate separate face and backup mixture locations and thicknesses.
    5. Indicate welded connections by AWS standard symbols and show size, length, and type of each weld.
    6. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
    7. Indicate locations, extent, and treatment of dry joints for locations with multiple units.
    8. Indicate plan views and elevations showing unit location and dimensions, erection sequences, and bracing plan for special conditions.
    9. Indicate location of each architectural precast concrete unit by same identification mark placed on unit.
    10. Indicate relationship of architectural precast concrete units to adjacent materials.
    11. Design Modifications: If design modifications are proposed to meet performance requirements and field conditions, notify the Architect and submit design calculations and Shop Drawings. Do not adversely affect the appearance, durability, or strength of units when modifying details or materials and maintain the general design concept.
    12. Comprehensive engineering design signed and sealed by qualified professional engineer responsible for its preparation licensed in the jurisdiction in which the project is located. Show governing panel types, connections, concrete cover and reinforcement types, including special reinforcement such as epoxy coated carbon fiber grid. Indicate location, type, magnitude, and direction of loads imposed on the structural frame by the architectural precast concrete.
E. Fabricator Qualifications: Present in writing proof of compliance with Quality Assurance Requirement.
F. Maintenance Data: Indicate surface cleaning instructions.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in producing architectural precast concrete units similar to those indicated for this Project and with a record of successful in-service performance.

1. Participates in PCI's Plant Certification program at the time of bidding and is designated a PCI-Certified plant for Group A, Category A1/AT- Architectural Precast Units/Architectural Trim Units.
2. Has sufficient production capacity to produce required units without delaying the Work.
3. Certification shall be maintained throughout the production of the precast concrete units. Production shall immediately stop if at any time the fabricator's certification is revoked, regardless of the status of completion of contracted work. Production will not be allowed to re-start until the necessary corrections are made and certification has been re-established. In the event certification(s) cannot be re-established in a timely manner, causing project delays, the fabricator, at no additional cost, will contract out the remainder of the units to be manufactured at a PCI certified plant.

B. Professional Engineer Qualifications: A professional engineer who is licensed in the 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 architectural precast concrete that are similar to those indicated for this Project in material, design, and extent.

C. Design Standards: Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, PCI Design Handbook - Precast and Prestressed Concrete, applicable to types of architectural precast concrete units indicated.

D. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.
   1. Supply a written Quality Assurance Program and Procedure Manual to Architect.

E. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel"; AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel" and AWS D1.6/D1.6M Structural Welding Code-Stainless".

F. Sample: As part of the submittal process, provide a minimum 6 inch long sample of each precast unit.

G. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Packaging and Shipping: Precast concrete to be palletized and shrink wrapped, delivered in original unopened packaging with legible manufacturer identification, including size, piece number, quantities, manufacture date and inspectors initials.

B. Handling: Lift and support precast units only from support points.

C. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

D. Protect units to prevent staining, chipping, or spalling of concrete.

E. Mark units with date of production in location that will be concealed after installation.

1.08 GUARANTEE

A. This Contractor shall guarantee his work for a period of 1 year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:

1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www.pci.org.
2. Dura-Crete, Inc: www.duracrete.com.
3. Hanson Structural Precast: www.eagleprecast.com.
4. Upwall Precast Concrete, St. George, Utah, (435) 673-9377.
5. Wausau Tile, Inc: www.wasautile.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PRECAST UNITS

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI 318.
   1. Concrete Mix: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent; comply with ACI 301.
   2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   3. Calculate structural properties of units in accordance with ACI 318.
   4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

2.03 FINISHES

A. Exposed unit faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform and straight. Finish exposed-face surfaces of architectural precast concrete units to match approved sample units, mockups, and as follows:
   1. Exterior Window Sills: Form Finish with grooved edge drip, refer to drawings.
      a. Impart texture by form liner, to match accepted sample or mockup units. No surface air voids, pin holes, sand streaks, and honeycombs.

2.04 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true precast concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.
   1. Form-Release Agent: Commercially produced form-release agent that will not bond with, stain, or affect hardening of precast concrete surfaces and will not impair subsequent surface or joint treatments of precast concrete.

2.05 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M Grade 60 (420).
   1. Plain billet-steel bars.
   2. Epoxy coated in accordance with ASTM A775/A775M.

2.06 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I/II - Normal/Moderate Portland type.
B. Fine and Coarse Structural Aggregates: ASTM C 33.
C. Lightweight Structural Aggregate: ASTM C 330.
D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979.
   1. Concentration: Base dosage rates on weight of Portland cement, fly ash, silica fume, and other cementitious materials but not aggregate or sand.
   2. Colors: To match Architect's samples when incorporated into specified mix design(s).
   3. Manufacturers:

a. Butterfield Color: www.butterfieldcolor.com.
b. Davis Colors: www.daviscolors.com.
c. Lambert Corporation: www.lambertusa.com.
d. Substitutions: See Section 01 6000 - Product Requirements.

E. Water: Clean and not detrimental to concrete.
F. Air Entrainment Admixture: ASTM C260.

2.07 SUPPORT DEVICES

A. Connecting and Support Devices: ASTM A 36/A 36M steel; hot-dip galvanized in accordance with ASTM A153/A 153M.
   1. Clean surfaces of rust, scale, grease, and foreign matter.
   2. Galvanize after fabrication in accordance with requirements of ASTM A123/A123M.
B. Bolts, Nuts, and Washers: ASTM A307 heavy hex bolts, Type A, hot-dip galvanized, with matching ASTM A563 (A 563M) nuts and matching washers.
C. Primer: Zinc rich type.

2.08 ACCESSORIES

A. Sealant: As specified in Section 07 9005.

2.09 FABRICATION

A. Fabricate in conformance with PCI MNL-117 and PCI MNL-135.
B. Fabricate and handle epoxy-coated reinforcing bars in accordance with ASTM D3963/D3963M.
C. Maintain plant records and quality control program during production of precast units. Provide records to Architect.
D. No onsite cutting allowed. Field verify all unit sizes before fabrication.
E. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.
F. Use form liners in accordance with manufacturer's instructions.
G. Maintain consistent quality during manufacture.
H. Fabricate connecting devices, plates, angles, items fit to steel framing members, inserts, bolts, and accessories. Fabricate to permit initial placement and final attachment.
I. Embed reinforcing steel, anchors, inserts plates, angles, and other cast-in items.
J. Locate hoisting devices to permit removal after erection.
K. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.

2.10 FABRICATION TOLERANCES

A. Conform to PCI MNL-117 and PCI MNL-135 .

2.11 SOURCE QUALITY CONTROL

A. Provide testing of concrete mix.
B. Take 1 concrete test cylinders for every 5 cu yd (3.8 cu m) of concrete placed; make and cure in accordance with ASTM C31/C31M.
C. Take 1 slump tests for every 6 test cylinders in accordance with ASTM C143/C143M.
D. Take one air entrainment test cylinders for each set of exterior concrete test cylinders taken.
E. Take water absorption test in accordance with PCI MNL-117.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.
B. Examine areas to receive precast concrete for the following:

1. Defects in existing work or substrate.
2. Dimensional verification of architectural drawings, shop drawings, and substrate.
3. Deviation beyond allowable tolerances for the substrate.

C. Start work only when defects have been corrected.

3.02 PREPARATION

A. Provide for erection procedures and induced loads during erection. Maintain temporary bracing in place until final support is provided.

3.03 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.
B. Erect units level and plumb within allowable tolerances.
C. Align and maintain uniform horizontal and vertical joints as erection progresses.
D. When units require adjustment beyond design or tolerance criteria, discontinue affected work; advise Architect.
E. Window Sills:
   1. Set accurately as recommended by manufacturer.
   2. Set units plumb and level.
   3. Alignment of precast should be straight and true to all dimensions.
   4. Install anchors as shown on shop drawings.
F. Exposed Joint Dimension: 3/8 inch (9.5 mm). Adjust units so that joint dimensions are within tolerances.

3.04 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-135 .

3.05 PROTECTION

A. Upon completion, the work shall be ready for final inspection and acceptance by the Owner.
B. Protect the finished work until substantial completion.

END OF SECTION 03 4500

SECTION 04 2001

MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Masonry Veneer work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Clay facing brick.
C. Mortar.
D. Integral water-repellent admixtures.
E. Reinforcement and anchorage.
F. Flashing and drainage.
G. Installation of lintels.
H. Accessories.
I. Installation only of precast concrete window sill units integral with masonry walls.
J. Installation only of metal flashings.
K. Do not include sales tax, refer to 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 4500 - Precast Architectural Concrete: Precast concrete window sill units.
B. Section 05 1200 - Structural Steel Framing
C. Section 05 4000 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.
D. Section 05 5000 - Metal Fabrications: Loose steel lintels.
E. Section 07 1900 - Exterior Water Repellents and Graffiti Resistant Sealers: Exterior and interior masonry sealers.
F. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings.
G. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.
C. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
D. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.
E. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).
F. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2021.
G. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.
H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2021.
K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

L. ASTM D1056 - Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber; 2020.
M. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
O. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. See Section 01 3000 - Administrative Requirements, for meeting procedures.
   2. Coordinate with Section 07 2500 - Weather Barriers for compatibility with flashing materials.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data for masonry units, reinforcement and anchorage, mortar, integral water repellent admixture, flashing, drainage, expansion joints, and cleaning solution.
C. Samples:
   1. Submit four samples of each type of masonry unit to illustrate color, texture, and extremes of color range.
   2. Submit two sections of the flashing demonstrating lap joint.
   3. Submit two sections of the expansion joint material, flashing accessories and drainage materials.
D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
E. Manufacturers and Installers Qualifications
F. Test Reports: Test reports for each type of veneer block used are to be submitted to the Architect/Engineer for review. Testing and reports are to be completed by an independent laboratory. Test reports shall show:
   1. Compressive strength.
   2. 24-hour cold water absorption.
   3. Saturation coefficient.
   4. Initial rate of absorption (suction).

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.
B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
D. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
E. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.07 REGULATORY REQUIREMENTS

A. Conform to the International Building Code ICC (IBC) for necessary requirements for fire-rated masonry construction.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
   1. Store block off ground to prevent contamination by mud, dust or material likely to cause staining or other defects.
   2. Cover materials when necessary to protect from elements.
   3. Protect reinforcement from elements.
   4. Mortar Materials:
      a. Sand shall be kept dry and protected from freezing.
      b. Cement and lime shall be stored off the ground and protected from moisture. In extreme weather, it should be stored in an enclosed space such as a building or trailer.

1.09 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.10 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MASONRY CONTRACTORS

A. All masonry contractors must be prequalified by CM/GC.

2.02 BRICK UNITS

A. Clay Facing Brick: ASTM C216, Type FBS, Grade SW.
   1. Color: As selected by Architect from manufacturer's full line.
   2. Texture: Matte.
   3. Nominal size: Emperor 16 inches by 4 inches (400 mm by 100 mm) and depth of 4 inches (100 mm) unless otherwise indicated on the drawings.
   4. Special shapes: Molded units as required for lintels, control joints, and other special applications to minimize cutting.
   5. Compressive Strength: ASTM C216, Grade SW, Type FBX with minimum gross compressive strength of 6000 psi.
   6. Admixtures: Integral Water Repellent Admixtures.
   7. Accepted Manufacturers:
      a. Interstate Brick Co: www.interstatebrick.com.
      b. Substitutions: See section 01 6000 - Product requirements.

2.03 MORTAR MATERIALS

A. Refer to General Structural Notes on Drawings.
B. Use type S mortar only.
C. Masonry Cement: ASTM C91/C91M.
   1. Colored mortar: Premixed cement, colors as selected by Architect from manufacturer's full range. (The intent is to match the existing building masonry mortar.)
D. Portland Cement: 1, Type I/II; color as required to produce approved color sample.
E. Hydrated Lime: ASTM C207
F. Water: Clean and potable.
G. Accelerating Admixture: Nonchloride type for use in cold weather.

2.04 ADMIXTURES

A. Water Repellent Admixture System: Water repellent compound designed to reduce capillarity. . **For all masonry units and mortar.**
   1. Units with Integral Water Repellent: Masonry units, mortar and grout as specified in this section with polymeric liquid or powder admixture added at the time of manufacture.
      a. Performance of Units and Mortar and Grout with Integral Water Repellent:
         1) Water Permeance: Use water-repellent admixtures capable of providing masonry assembly performance of no visible dampness on backs of three wall specimens after 72 hours of testing when evaluated using ASTM E514/E514M
            (a) No water visible on back of wall above flashing at the end of 24 hours.
            (b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
            (c) No more than 25 percent of wall area above flashing visibly damp at end of test.
         2) Flexural Bond Strength: ASTM C1357, ASTM C1072: minimum 10 percent increase.
         3) Compressive Strength of Masonry Prisms: ASTM C1314; maximum 5 percent decrease.
         4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
      b. Use only in combination with mortar and grout that also has integral water repellent admixture.
      c. Use water repellent admixtures for masonry units, mortar and grout by a single manufacturer.
   2. Acceptable Products:
      a. GCP Applied Technologies, Dry-Block: https://gcpat.com/construction/en-us/masonry-technology.
      b. BASF, Rheopel: www.basf-admixtures.com.
      c. Euclid Chemical Co., Eucon Blocktite: www.euclidchemical.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Hohmann & Barnard, Inc. (including Dur-O-Wal brand): www.h-b.com.
   2. Blok-Lok Limited: www.blok-lok.com.
   3. WIRE-BOND: www.wirebond.com.
   4. Halfen Anchoring Systems: www.halfenusa.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Masonry Veneer Seismic Anchors (Steel Stud Backup Conditions): 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.
   1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.
   2. Wire ties: Trapezoidal shape, 0.1875 inch thick.
   3. Vertical adjustment: Not less than 3-1/2 inches.
   4. Continuous Horizontal Joint Reinforcement Wire: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B2; 0.1483 inch (3.8 mm).
   5. Reinforcement Retaining Clip: Rigid polyvinyl chloride clip, conforming to ASTM D1784 and ASTM D2240, with ridge to secure continuous wire in mortar and 3 additional ridges to secure masonry wire tie.

6. Self-Sealing Transition Anchor Tape: Reinforced polyolefin base, laminated to a polypropylene layer; seals around the shaft of the screw and legs of anchors at the point of penetration.
7. Fasteners: Self-drilling stainless steel, Type 410, self-tapping screws; hex washer head, size #10 - 16, lengths required for indicated insulation and sheathing thicknesses. Provide neoprene sealing washers.
8. Acceptable Product: X-Seal S.I.S. Anchoring System manufactured by Hohmann & Barnard, Inc.

2.06 FLASHING AND DRAINAGE

A. Manufacturers:
   1. York Manufacturing, Inc.: www.yorkmfg.com.
   2. Hohmann & Barnard, Inc. (including Blok-Lok Limited): www.h-b.com.
   3. WIRE-BOND: www.wirebond.com.
   4. Dupont Tyvek: www.construction.tyvek.com.
   5. Mortar Net USA Ltd.: www.mortarnet.com.
   6. CavClear/Archovations, Inc.: www.cavclear.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Cavity Mortar Control: Polyester mesh trapezoidal shaped panels impregnated with UV protection, biocide to resist mold and flame retardant, designed to prevent mortar droppings from clogging weeps and allow proper cavity drainage. Sized to thickness of wall cavity.
   1. Acceptable Product: Mortar Net with Insect Barrier manufactured by Mortar Net USA Ltd.

C. Weeps: Medium density polyethylene, clear round plastic weep tubes, 3/8 inch outside diameter by 1/4 inch inside diameter by 4 inches long.

D. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
   1. Manufacturers:
      a. STS Coatings, Inc.: www.stscoatings.com.
      b. York Manufacturing, Inc.: Flash-Vent SS, www.yorkmfg.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

E. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.
   1. Manufacturers:
      a. York Manufacturing, Inc: www.yorkmfg.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.

F. Factory-Fabricated Flashing Corners and Ends: Stainless steel.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc.: www.h-b.com.
      b. Mortar Net Solutions; CompleteFlash: www.mortarnet.com.
      c. York Manufacturing, Inc.: www.yorkmfg.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

G. Termination Bars: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc: www.h-b.com.
      b. Mortar Net Solutions; Termination Bars: www.mortarnet.com.
      c. York Manufacturing, Inc: www.yorkmfg.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

H. Drip Edge: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers:
      a. Hohmann & Barnard, Inc: www.h-b.com.

b. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com.
c. York Manufacturing, Inc: www.yorkmfg.com.

2.07 ACCESSORIES

A. Expansion Joints:
1. Vertical Expansion Joint: Closed cell neoprene conforming to ASTM D1056, RE41 Grade 2A1; non-adhesive; compression up to 50 percent; 3/8 inch thick by 3 inches wide by length required.
2. Horizontal Expansion Joint: Closed cell neoprene conforming to ASTM D1056, RE41 Grade 2A1; adhesive on one side; compression up to 50 percent.
3. Sealants: Types as specified in Section 07 9200 - Joint Sealants.
4. Manufacturers:
a. Hohmann & Barnard, Inc: www.h-b.com.
b. WIRE-BOND: www.wirebond.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

B. Weeps: Polyethylene tubing, clear round plastic weep tubes, 3/8 inch outside diameter by 1/4 inch inside diameter by 4 inches long.
1. Manufacturers:
a. Blok-Lok Limited: www.blok-lok.com.
b. Hohmann & Barnard, Inc: www.h-b.com.
c. WIRE-BOND: www.wirebond.com.

C. Cavity Vents: Cell vent with UV resistant polypropylene co-polymer, consisting of many small, adjacent passageways bonded together in one unit providing easy drainage for moisture along the full height of the head joint, 3/8 inch wide by 2 1/2 inches deep by 3 3/8 inches long.
1. Color: As selected by Architect from manufacturer's full range.
2. Manufacturers:
a. Blok-Lok Limited; Cellvent: www.blok-lok.com.
b. Hohmann & Barnard, Inc: www.h-b.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

D. Cavity Mortar Control: Polyester mesh trapezoidal shaped panels impregnated with UV protection, biocide to resist mold and flame retardant, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
1. Manufacturers:
a. Substitutions: See Section 01 6000 - Product Requirements.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.08 MORTAR MIXING

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
1. Exterior, non-load-bearing masonry, Type N.
2. Interior, non-load-bearing masonry, Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Use only mortar containing integral water repellent mortar admixture at the manufacturer's recommended addition rate and mixed according to the manufacturer's recommendations.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.
1. Add integral water repellent admixture during mixing in conformance with the admixture label instructions and the recommendations of the manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 FLASHING INSTALLATION

A. Surface Preparation: Prepare surface in accordance with manufacturer's written recommendations. Verify that flashing materials are compatible with Section 07 2500 - Weather Barrier systems.
B. Install flashing in accordance with manufacturer's instructions.
C. Accurately fit, align, securely fasten and install free from distortion or defects.

3.03 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.
B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
C. Brick Units:
    1. Bond: Running unless noted otherwise on the drawings.
    2. Coursing: Three units and three mortar joints to equal 8 inches.
    3. Mortar Joints: Concave.

3.04 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.
B. Lay hollow masonry units with face shell bedding on head and bed joints.
C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
D. Remove excess mortar as work progresses.
E. Interlock intersections and external corners, except for units laid in stack bond.
F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
H. Isolate top joint of masonry veneer from horizontal structural framing members or support angles with horizontal expansion joint material.

3.05 WEEPS/CAVITY VENTS

A. Install weeps in veneer walls at 24 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.
B. Install cavity vents in veneer walls at 32 inches on center horizontally below shelf angles and lintels and at top of walls.
C. Install cavity mortar diverter at base of cavity as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.
D. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

3.06 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.
B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions.
   1. Verify that airspace width is no more than 3/8 inch greater than panel thickness.
   2. Hold cavity mortar control panel tight to face wythe.
   3. Install horizontally between joint reinforcement.
   4. Stagger end joints in adjacent rows.
   5. Fit to perimeter construction and penetrations without voids.

D. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.07 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Install masonry reinforcement system components in accordance with manufacturer's printed installation instructions.

B. Stud Back-Up:
   1. Install sealing tape at stud locations to receive veneer anchors; install tape vertically, continuous full stud length.
   2. Install veneer anchors at stud locations; 16 inches on center vertically, 16 inches on center horizontally.
   3. Screw-attach veneer anchor to stud face; bridging insulation and sheathing to ensure full contact of veneer anchor legs with stud face.
   4. Install masonry wall tie at each veneer anchor location; install ties as exterior wythe of masonry construction progresses.
   5. Set reinforcement retaining clip in full mortar bed at each masonry wall tie location; secure tie wires in correct size ridges.
   6. Secure continuous masonry joint reinforcement wire in correct size ridge in reinforcement retaining clip.

3.08 MASONRY FLASHING

A. Surface Preparation: Prepare surface in accordance with manufacturer's written recommendations. Verify that flashing materials are compatible with Section 07 2500 - Weather Barrier systems.

B. Install flashing in accordance with manufacturer's instructions.

C. Accurately fit, align, securely fasten and install free from distortion or defects.

D. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

E. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.

F. Lap end joints of flashings at least 4 inches and seal watertight as directed by flashing manufacturer.

3.09 CONTROL AND EXPANSION JOINTS

A. Install expansion joint components in accordance with manufacturer's installation instructions.

B. Do not continue horizontal joint reinforcement through control or expansion joints.

C. Form expansion joint as detailed on drawings.

D. This Contractor shall coordinate locations of joints with structural columns, masonry layout, and suggested joint layout on the Drawings, including those that extend to upper floor levels.

1. Maximum spacing shall be 30 feet (9.1 m) on center, unless approved by the Architect, and preferred spacing of 24 feet (7.3 m) to 28 feet (8.5 m) on center.

E. Where masonry veneer occurs at concrete block backup, joints shall align.

3.10 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

3.11 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 CLEANING

A. Remove excess mortar and mortar smears as work progresses.
B. Replace defective mortar. Match adjacent work.
C. Thoroughly wet surface of masonry on which no green efflorescence appears.
D. Clean soiled surfaces with cleaning solution.
    1. Follow block/brick manufacturer's recommendations for cleaning.
    2. Protect all sash, metal lintels, and other corrodible parts when masonry is cleaned with acid solution.
    3. Immediately rinse with clear water.
    4. Do small sections at a time.
    5. Work from top to bottom.
E. Remove all efflorescence in accordance with block/brick manufacturer's recommendations.
F. Use non-metallic tools in cleaning operations.
G. If using pressure washers for cleaning, adjust pressure so as not to "pock," sandblast or otherwise damage the face of masonry units. All units damaged in such manner shall be removed and replaced by the masonry contractor at no expense ot the Owner.

3.13 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
B. Protection of Masonry:
    1. Wall Covering:
        a. During erection, and after completion, cover top of all walls with strong waterproof membrane.
        b. Extend cover minimum of 24 inches (610 mm) down both sides.
        c. Hold cover securely in place and maintain throughout construction until all walls are covered with roofing membrane and/or cap flashings.
C. Staining:
    1. Prevent grout or mortar from staining the face of masonry to be left exposed or painted:
        a. Immediately remove grout or mortar in contact with face of such masonry.
        b. Protect all sills, ledges and projections from droppings of mortar, protect door jambs and corners from damage during construction.
D. Cold Weather Protection:

1. Preparation:
    a. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
    b. Remove all masonry frozen or damaged.
2. When brick suction exceeds recommendations, sprinkle with heated water:
    a. When units are above 32 degrees F, heat water above 70 degrees F.
    b. When units are below 32 degrees F, heat water above 130 degrees F.
3. Use dry masonry units.
4. Do not use wet or frozen units.

E. Construction requirements while work is progressing:
1. Air Temperature 40 degrees F to 32 degrees F:
    a. Heat sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
    b. Cover walls and materials to prevent wetting and freezing. Covers should be plastic or canvas.
2. Air Temperature 32 degrees F to 25 degrees F:
    a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
    b. Maintain temperatures of mortar on boards above freezing.
    c. With wind velocities over 15 mph pro- vide windbreaks during the work- day and cover walls and materials at the end of the day to prevent wetting and freezing.
    d. Maintain masonry above freezing for 16 hours using auxiliary heat or insulated blankets.
    e. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
3. Air Temperature 25 degrees F to 2 degrees F:
    a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
    b. Maintain mortar temperatures on boards above freezing.
    c. Use salamanders or other heat sources on both sides of walls under construction.
    d. Use windbreaks when wind is in excess of 15 mph.
    e. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
4. Air Temperature 20 degrees F and Below:
    a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
    b. Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F.
    c. Minimum temp. of units when laid: 20 degrees F. Do not lay units having frozen moisture.
    d. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.

F. Protection Requirements For Completed Masonry and Masonry Not Being Worked On:
1. Minimum air temperature 40 degrees F to 32 degrees F:
    a. Refer to paragraph 3.14-B.
2. Mimimuim air temperature 32 degrees F to 25 degrees F:
    a. Refer to paragraph 3.14-B.
3. Mimimum air temperature 25 degrees F to 20 degrees F:
    a. Completely cover masonry with insulating blankets or equal protection for 24 hours, 48 hours for grouted masonry.
    b. Refer to paragraph 3.14-B.
4. Minimum air temperature 20 degrees F and below:

a. Maintain masonry temperature above 32 degrees F for 24 hours by:
   1) Enclosure and supplementary heat
   2) Electric heating blankets
   3) Infrared lamps
   4) Or ther methods acceptable to the Architect/Engineer.
b. Refer to paragraph 3.14-B.

END OF SECTION 04 2001

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SECTION 04 2731

ENGINEERED UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Reinforced Unit Masonry work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Concrete block.
C. Mortar and grout.
D. Integral water repellent admixture.
E. Reinforcement and anchorage.
    1. Installation only of reinforcing steel within all masonry.
F. Installation only of metal flashings.
G. Masonry lintels.
H. Installation only of precast architectural concrete units integral with masonry walls.
I. Accessories.
J. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 2000 - Reinforcing: Reinforcing steel for grouted masonry.
B. Section 04 2001 - Masonry Veneer.
C. Section 05 5000 - Metal Fabrications: Loose steel lintels.
D. Section 07 1900 - Exterior Water Repellents and Graffiti Resistant Sealers: Exterior and Interior masonry sealer.
E. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashings.
F. Section 07 8400 - Firestopping: Firestopping at penetrations of masonry work.
G. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.
H. Section 09 9123 - Interior Painting: Painting of masonry work.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2020a.
C. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.
D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.
E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
F. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.
G. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).
H. ASTM C331/C331M - Standard Specification for Lightweight Aggregates for Concrete Masonry Units; 2017.

I. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2021.
J. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2022.
K. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
L. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021b.
M. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2022a.
N. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
O. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
P. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
Q. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
R. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
S. ASTM C652 - Standard Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale); 2022.
T. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.
U. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2020.
V. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.
W. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2022.
X. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.
Y. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry; 2021.
Z. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
AA. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars; 2018, with Amendment (2020).
BB. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
CC. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
DD. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
EE. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

1. See Section 01 3000 - Administrative Requirements, for meeting procedures.
2. Coordinate with Section 07 2500 - Weather Barriers for compatibility with Flashing Materials.

1.05 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar and grout, and integral water-repellent admixtures .
B. Shop Drawings: Indicate bar sizes, spacings, reinforcement quantities, bending and cutting schedules, reinforcement supporting and spacing devices, and accessories.
C. Samples: Submit four samples of each type of masonry unit to illustrate color, texture, and extremes of color range.
D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
E. Design Data: Indicate required mortar strength, unit assembly strength in each plane, and supporting test data.
F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
G. Manufacturer's and Installer's Qualifications.

H. Test Reports: Test reports for each type of building block used are to be submitted to the Architect/Engineer for review. Testing and reports are to be completed by an independent laboratory. Verify that test reports show:
   1. Compressive strength.
   2. 24-hour cold water absorption.
   3. Saturation coefficient.
   4. Initial rate of absorption (suction).

1.06 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
   1. Maintain one copy of each document on project site.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.
E. Single-Source Responsibility for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
F. Single-Source Responsibility for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

1.07 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 4300 - Quality Assurance.
B. Clay Masonry: Test each type of clay masonry in accordance with ASTM C67/C67M.
C. Concrete Masonry: Test each type, class, and grade of concrete masonry unit in accordance with ASTM C140/C140M for compliance with requirements of this specification.
D. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
E. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
F. Compressive Strength: Where indicated, test masonry prisms in accordance with ASTM C1314.
   1. Prepare two sets of prisms; test one set at 7 days and the other at 28 days.
   2. Clay masonry prisms: Height-to thickness ration of 5.0.
   3. Concrete masonry prisms: Height-to-thickness ratio of not less than 1.33 and not more than 5.0; apply correction factor per TMS 402/602 for ratio other than 2.0.
G. Flexural Bond Strength: Where indicated, test masonry prisms in accordance with ASTM E518/E518M, with tooled joints downward.
H. Water Permeance of Masonry: Test each type of concrete masonry units in accordance with ASTM E514/E514M for conformance to requirements of this specification.

1.08 REGULATORY REQUIREMENTS

A. Conform to the International Building Code ICC (IBC) for necessary requirements for fire-rated masonry construction.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
   1. Store block off ground to prevent contamination by mud, dust or material likely to cause staining or other defects.
   2. Cover materials when necessary to protect from elements.
   3. Protect reinforcement from elements.
   4. Mortar and Grout Materials:
      a. Keep sand dry and protect from freezing.
      b. Store cement and lime off the ground and protect from moisture. In extreme weather, it should be stored in an enclosed space such as a building or trailer.

1.10 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

1.11 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MASONRY CONTRACTORS

A. All masonry contractors must be prequalified by CM/GC.

2.02 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Sizes: Standard units with nominal face dimensions of:
      a. 16 inches by 8 inches (400 mm by 200 mm) and nominal depth of 8 inches.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and preformed single and double bullnose/chamfer as indicated on drawings or as required to complete the work.
   3. Load-Bearing Units: ASTM C90, normal, or medium or light weight, with aggregate conforming to ASTM C331/C331M.
      a. Hollow block, refer to General Structural Notes on Drawings.
      b. Minimum Unit Strength: 2,800 psi.
      c. Admixtures: Integral water repellent admixture.
      d. Exposed Faces: Standard Face, Honed Face, and Split Face units where scheduled on the drawings. Refer to elevations for detail and notation or as directed by Architect.
      e. Colors:
         1) Standard grey color.
   4. Accepted Manufacturers:
      a. Amcor, Inc., Salt Lake City, UT: www.amcormasonry.com.
      b. Richfield Block Co., Richfield, UT.
      c. Sunroc, Orem, UT / St. George, UT: www.sunroc.net.
      d. Substitutions: See section 01 6000 - Product requirements.

2.03 MORTAR AND GROUT MATERIALS

A. Refer to General Structural Notes on Drawings.
B. Mortar: Type S.
C. Masonry Cement: ASTM C91/C91M .
    1. Colored Mortar: Premixed cement as required to match Architect's color sample.
D. Portland Cement: ASTM C150/C150M, Type I/II; color as required to produce approved color sample.
E. Hydrated Lime: ASTM C207,
F. Mortar Aggregate: ASTM C144.
G. Grout Aggregate: ASTM C404.
H. Water: Clean and potable.
I. Accelerating Admixture: Nonchloride type for use in cold weather.

2.04 ADMIXTURES

A. Water-Repellent Admixture System: Water repellent compound designed to reduce capillarity. For all masonry units, mortar and grout.
    1. Performance Requirements: Masonry units, mortar, and grout shall meet the following requirements:
        a. Water Permeance of Masonry: Use water-repellent admixtures capable of providing masonry assembly performance of no visible dampness on backs of three wall specimens after 72 hours of testing when evaluated using ASTM E514/E514M.
        b. Flexural Bond Strength: ASTM C1072 minimum 10 percent increase compared to reference specimen.
        c. Compressive Strength of Masonry Prisms: ASTM C1314, maximum 5 percent decrease.
        d. Compressive Strength of Masonry Mortar: ASTM C109/C109M, minimum 80 percent measure compared to reference specimen.
        e. Drying Shrinkage of Concrete Masonry Units: Maximum 5 percent increase in shrinkage.
        f. Drying Shrinkage of Masonry Mortar and Grout: ASTM C1148 maximum 5 percent increase in shrinkage when compared to reference specimen.
    2. Acceptable Products:
        a. GCP Applied Technologies, Product - Dry-Block: www.gcpat.com/en-us.
        b. BASF, Product - Rheopel: www.basf-admixtures.com.
        c. Euclid Chemical Co., Product - Eucon Blocktite: www.euclidchemical.com.
        d. Substitutions: See Section 01 6000 - Product Requirements.

2.05 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
    1. Blok-Lok Limited: www.blok-lok.com.
    2. Hohmann & Barnard, Inc: www.h-b.com.
    3. WIRE-BOND: www.wirebond.com.
    4. Halfen Anchoring Systems: www.halfenusa.com.
B. Reinforcing Steel: Type specified in Section 03 2000; size as indicated on drawings; uncoated finish.

2.06 FLASHINGS

A. Metal Flashing:

1. Installation only of 24 gauge, 0.028 inch (0.7 mm) thick, Pre-Finished Galvanized Steel, provided by Section 07 6200 - Sheet Metal Flashing and Trim.
    a. Sealants and Accessories: As recommended by flashing manufacturer for complete installation.

B. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on one side to a sheet of polymer fabric.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. WIRE-BOND: www.wirebond.com.
    c. York Manufacturing, Inc; Multi-Flash SS: www.yorkmfg.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

C. Stainless Steel/Polymer Fabric Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on inward facing side to a sheet of polymer fabric that has a clear adhesive with a removable release liner.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. WIRE-BOND: www.wirebond.com.
    c. York Manufacturing, Inc; York 304: www.yorkmfg.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

D. Stainless Steel/Polymer Fabric Drainage Plane Flashing: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded between one sheet of polymer fabric and one sheet of non-woven drainage material.
1. Manufacturers:
    a. STS Coatings, Inc: www.stscoatings.com.
    b. York Manufacturing, Inc; Flash-Vent SS: www.yorkmfg.com.
    c. Substitutions: See Section 01 6000 - Product Requirements.

E. Stainless Steel/Polymer Fabric Drainage Plane Flashing - Self-Adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner on one side and a sheet of non-woven drainage material bonded to the other side.
1. Manufacturers:
    a. York Manufacturing, Inc; Flash-Vent SA: www.yorkmfg.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

F. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. Mortar Net Solutions; CompleteFlash: www.mortarnet.com.
    c. York Manufacturing, Inc: www.yorkmfg.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

G. Termination Bars: Stainless steel; compatible with membrane and adhesives.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. Mortar Net Solutions; Termination Bars: www.mortarnet.com.
    c. York Manufacturing, Inc: www.yorkmfg.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

H. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
1. Manufacturers:
    a. Hohmann & Barnard, Inc: www.h-b.com.
    b. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com.
    c. York Manufacturing, Inc: www.yorkmfg.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

2.07 ACCESSORIES

A. Weeps:
   1. Type: Molded PVC grilles, insect resistant.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. Advanced Building Products, Inc: www.advancedbuildingproducts.com.
      b. CavClear, a Division of Archovations Inc: www.cavclear.com.
      c. Hohmann & Barnard, Inc: www.h-b.com.
      d. Mortar Net Solutions: www.mortarnet.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

B. Cavity Vents:
   1. Type: Preformed aluminum vents with sloping louvers.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers:
      a. Advanced Building Products, Inc: www.advancedbuildingproducts.com.
      b. CavClear, a Division of Archovations Inc: www.cavclear.com.
      c. Hohmann & Barnard, Inc: www.h-b.com.
      d. Mortar Net Solutions: www.mortarnet.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.

C. Drainage Fabric: Polyester or polypropylene mesh bonded to a water and vapor-permeable fabric.

2.08 LINTELS

A. Masonry Lintels: Refer to Structural Drawings.

2.09 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Engineered Masonry; Type S.
   2. Mortar Strength: Refer to Structural Drawings.
   3. Acceptable Manufacturers:
      a. Spec Mix: www.specmix.com.
      b. Quick Crete Products Corporation: www.quickcrete.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Mortar Colorant: Shall be only pure mineral oxide and in no case, exceed 10 percent of the weight of the cement.
   2. Color shall be as selected by the Architect from manufacturer's full line.
   3. Materials shall be chemically inert, finely ground, lime-proof pigment.

C. Use only mortar containing integral water repellent mortar admixture at the manufacturer's recommended addition rate and mixed according to the manufacturer's recommendations.

2.10 MORTAR MIXING

A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
   1. Add integral water repellent admixture during mixing in conformance with the admixture label instructions and the recommendations of the manufacturer.

B. Maintain sand uniformly damp immediately before the mixing process.

C. Add mortar color and admixtures in accordance with manufacturer's instructions. Provide uniformity of mix and coloration.
D. Do not use anti-freeze compounds to lower the freezing point of mortar.
E. Retempering of mortar after initial mix is not allowed.

2.11 GROUT MIXES

A. Mix Design: 2,800 psi (19 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; provide premixed type in accordance with ASTM C 94/C 94M.
   1. Use fine grout for spaces with smallest horizontal dimension of 2 inches or less.
   2. Use coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
B. Use only grout containing integral water-repellent mortar admixture at the manufacturer's recommended addition rate and mixed according to the manufacturer's recommendations.

2.12 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.
B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.
   1. Add integral water repellent admixture during mixing in conformance with the admixture label instructions and the recommendations of the manufacturer.
D. Do not use anti-freeze compounds to lower the freezing point of grout.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.
B. Verify that related items provided under other sections are properly sized and located.
C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
B. Clean reinforcement of loose rust.
C. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COURSING

A. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

3.04 PLACING AND BONDING

A. Lay hollow masonry units with face shell bedding on head and bed joints.
B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
C. Remove excess mortar as work progresses.
D. Tool all joints with an appropriate sized tool when joints are thumb-print hard.
E. All joints which are concealed by other construction materials and finishes shall be "tooled" (no exceptions).
F. Interlock intersections and external corners, except for units laid in stack bond.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
I. Cut mortar joints flush where wall tile is scheduled, resilient base is scheduled, or bitumen dampproofing is applied.

3.05 REINFORCEMENT AND ANCHORAGE

A. Reinforcement Bars: Secure at locations indicated and to avoid displacement during grouting. Minimum spacing between bars or to masonry surfaces shall be one bar diameter.
   1. Welding of splices is not permitted.
B. Reinforced Hollow Unit Masonry: Keep vertical cores to be grouted clear of mortar, including bed area of first course.
   1. Bond Beams: At bond beams or other locations for horizontally reinforced masonry, provide special masonry units or saw to accommodate reinforcement.

3.06 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 1 inch, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.
B. Extend metal flashings through exterior face of masonry and terminate in an angled drip with hemmed edge. Install joint sealer below drip edge to prevent moisture migration under flashing.
C. Lap end joints of flashings at least 6 inches minimum and seal watertight with flashing sealant/adhesive.

3.07 GROUTING

A. Perform all grouting by means of low-lift technique. Do not employ high-lift grouting.
B. Low-Lift Grouting:
   1. Limit height of pours to 48 inches.
   2. Limit height of masonry to 16 inches above each pour.

3.08 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.
B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
C. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.
D. Form expansion joint as detailed and as located on Drawings.
E. This Contractor shall coordinate locations of joints with structural columns, masonry layout, and suggested joint layout on the drawings, including those that extend to upper floor levels.
   1. Maximum spacing shall be 30 feet (9.1 m) on center, unless approved by the Architect, and preferred spacing of 24 feet (7.3 m) to 28 feet (8.5 m) on center.

3.09 BUILT-IN WORK

A. Build into new masonry, all bolts, bearing plates, anchors, nailing blocks, inserts, lintels, etc. indicated on the contract drawings, as furnished by the structural and miscellaneous steel subcontractor specified in Sections 05 1200 and 05 5000.
B. As work progresses, install built-in metal door frames, lintels, glazed frames, lintels, fabricated metal frames, lintels, anchor bolts, lintels, plates, lintels, and lintels and other items to be built into the work and furnished under other sections.
C. Install built-in items plumb, level, and true to line.
D. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
    1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
E. Do not build into masonry construction organic materials that are subject to deterioration.

3.10 TOLERANCES

A. Maximum Variation from Alignment of Columns: 1/4 inch.
B. Maximum Variation from Unit to Adjacent Unit: 1/16 inch.
C. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.
D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
E. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.
F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.11 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.12 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4300 - Quality Assurance.
B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.
C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
D. Mortar Tests: Test each type of mortar in accordance with recommended procedures in ASTM C780, testing with same frequency as masonry samples.
E. Test and evaluate grout in accordance with ASTM C1019 procedures.
    1. Test with same frequency as specified for masonry units.
F. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C1314 and for flexural bond strength in accordance with ASTM C1072 or ASTM E518/E518M; perform tests and evaluate results.

3.13 CLEANING

A. Remove excess mortar and mortar smears as work progresses.
B. Replace defective mortar. Match adjacent work.
C. Follow block manufacturer's recommendations for cleaning.

D. Thoroughly wet surface of masonry on which no green efflorescence appears.
E. Immediately rinse with clear water.
F. Do small sections at a time.
G. Work from top to bottom.
H. Use non-metallic tools in cleaning operations.
I. Protect all sash, metal lintels and other corrodible parts when masonry is cleaned with acid solution.
J. Remove white or green efflorescence in accordance with block manufacturer's recommendations.
K. Adjust pressure of washers so as not to "pock", sandblast or otherwise damage faces of masonry units. All units damaged in such manner shall be removed and replaced by the masonry contractor at no expense to the Owner.

3.14 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.
B. Protection of Masonry Method:
    1. Wall Covering:
        a. During erection, and after completion, cover top of all walls with strong waterproof membrane.
        b. Extend cover minimum of 24 inches (610 mm) down both sides.
        c. Hold cover securely in place and maintain throughout construction until all walls are covered with roofing membrane and/or cap flashings.
C. Staining:
    1. Prevent grout or mortar from staining the face of masonry to be left exposed or painted:
        a. Immediately remove grout or mortar in contact with face of such masonry.
        b. Protect all sills, ledges and projections from droppings of mortar, protect door jambs and corners from damage during construction.
D. Cold Weather Protection:
    1. Preparation:
        a. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
        b. Remove all frozen or damaged masonry.
    2. When brick suction exceeds recommendations, sprinkle with heated water:
        a. When units are above 32 degrees F, heat water above 70 degrees F.
        b. When units are below 32 degrees F, heat water above 130 degrees F.
    3. Use dry masonry units.
    4. Do not use wet or frozen units.
E. Construction Requirements While Work is Progressing:
    1. Air Temperature 40 degrees F to 32 degrees F:
        a. Heat sand or mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
        b. Cover walls and materials to prevent wetting and freezing. Covers should be plastic or canvas.
    2. Air Temperature 32 degrees F to 25 degrees F:
        a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
        b. Maintain temperatures of mortar on boards above freezing.
        c. With wind velocities over 15 mph, provide windbreaks during the workday and cover walls and materials at the end of the day to prevent wetting and freezing.

d. Maintain masonry above freezing for 16 hours using auxiliary heat or insulated blankets.
e. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.

3. Air Temperature 25 degrees F to 2 degrees F:
   a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
   b. Maintain mortar temperatures on boards above freezing.
   c. Use salamanders or other heat sources on both sides of walls under construction.
   d. Use windbreaks when wind is in excess of 15 mph.
   e. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.
4. Air Temperature 20 degrees F and Below:
   a. Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.
   b. Provide enclosures and auxiliary heat to maintain air temperature above 32 degrees F.
   c. Minimum temp. of units when laid: Per manufacturer's requirements.
   d. Heat grout materials to 90 degrees F to produce in-place grout temperature of 70 degrees F at end of work day.

F. Protection Requirements for Completed Masonry and Masonry Not Being Worked On:
1. Minimum air temperature 40 degrees F to 32 degrees F:
   a. Refer to paragraph 3.14-B.
2. Mimimum air temperature 32 degrees F to 25 degrees F:
   a. Refer to paragraph 3.14-B.
3. Minimum air temperature 25 degrees F to 20 degrees F:
   a. Completely cover masonry with insulating blankets or equal protection for 24 hours, 48 hours for grouted masonry.
   b. Refer to paragraph 3.14-B.
4. Minimum air temperature 20 degrees F and below:
   a. Maintain masonry temperature above 32 degrees F for 24 hours by:
      1) Enclosure and supplementary heat,
      2) Electric heating blankets,
      3) Infrared lamps,
      4) Or other methods acceptable to the Architect/Engineer.
   b. Refer to paragraph 3.14-B.

END OF SECTION 04 2731

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Structural Steel Framing work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Wide flange steel beams and bearing plates complete with all bolts, nut, washers, headed studs for roof and floor structures. See details on structural drawings.
C. Steel tube columns with base and cap plates, rods, bolts, nuts and washers for roof, floor and canopy structures. See details on drawings.
D. All miscellaneous steel channels, tubes, angles, plates, bent plates, rods, nuts, bolts, washers, and headed stud anchors required for roof, floor, stair, exterior canopy, and miscellaneous wall support and framing. See details on drawings.
    1. Hot dip galvanized at exterior conditions.
E. Anchor rods incorporated in structure as shown on drawings.
F. Structural steel framing members.
G. Structural steel support members.
H. Base plates and shear stud connectors and expansion joint plates.
I. Grouting under base plates.
J. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joist Framing.
B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.
C. Section 05 4000 - Cold-Formed Metal Framing.
D. Section 05 5000 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2017.
B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.
C. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
D. AISC 207 - Certification Standard for Steel Fabrication and Erection, and Manufacturing of Metal Components; 2016.
E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
H. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

K. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.
M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
O. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2016.
P. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.
Q. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.
R. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2018.
S. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
T. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
U. ASTM F959/F959M - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners, Inch and Metric Series; 2017a.
V. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2021.
W. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
X. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
Y. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
Z. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
AA. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.
BB. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
CC. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
DD. SSPC-SP 3 - Power Tool Cleaning; 2018.
EE. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings:
    1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
    2. Connections.
    3. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
C. Verify conditions at site affecting work of this Section and obtain accurate field dimensions. Report discrepancies between drawings and field dimensions to the Architect prior to commencing work.
D. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.
E. Mill Test Reports: Indicate structural strength, destructive test analysis and non-destructive test analysis.

F. Materials Test Reports: Submit independent test results or engineered performance analysis of structural thermal-break pad performance in bearing or slip-critical connections where shear and moment loads are applied.
G. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
H. Designer's Qualification Statement.
I. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC 201
J. Responsibility: The Contractor shall, alone, be responsible for the correctness of all shop drawings and for all shop and field fabrication. The review or comments on any drawings shall not relieve the Contractor of any responsibility for the correctness of the details. The Architect's review covers general design of details only and if any corrections are made which would cause members not to fit or would not give sufficient strength, the Contractor shall call the Architect's attention to it at once in writing so that corrections can be made. If the Contractor fails to do this, the sole responsibility rests upon him.
K. Omission of any material from the Contractor's shop drawings that is shown on the working drawings or called for in the specification, shall not relieve the Contractor from furnishing such material, even though the Architect/Engineer reviewed the Contractor's shop drawings.

1.05 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) Steel Construction Manual.
B. Maintain one copy of each document on site.
C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.
D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and no more than 12 months before start of scheduled welding work.
E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172 or AISC 201
F. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.
G. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Utah.
H. Welder, Tacker and Welding Operator Qualifications: Welds shall be made only by welders, tackers, and welding operators who have been previously qualified by tests as prescribed in the Code for Welding in Building Construction, AWS D1.1/D1.1M, latest edition, of the American Welding Society to perform the type of work required. All welding shall be in accordance with AWS D1.1, latest edition, of the American Welding Society to perform the type of work required.

1.06 GUARANTEE

A. The Contractor shall guarantee his work for a period of one (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

2.02 MATERIALS

A. Steel Plates, other Shapes, and other Shapes: ASTM A36/A36M.
B. Steel W Shapes and Tees: ASTM A992/A992M.
C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.
E. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.
F. Pipe: ASTM A53/A53M, Grade B, Finish black.
G. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade A and galvanized in compliance with ASTM A153/A153M Class C.
H. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
    1. Galvanized or zinc coated where used with chemically treated wood plates, coordinate with Section 06 1000.
I. Tension Control Bolts: Twist-off type: ASTM F3125/F3125M.
J. Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563 or ASTM A563M nuts and ASTM F436 Type 1 washers.
K. Load Indicator Washers: Provide washers complying with ASTM F959/F959M at connections requiring high-strength bolts.
L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
M. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
    1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
    2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.
    3. Height Change, Plastic State; when tested according to ASTM C827/C827M:
        a. Maximum: Plus 4 percent.
        b. Minimum: Plus 1 percent.
    4. Manufacturers
        a. W.R. Meadows: www.wrmeadows.com.
        b. L & M Construction chemicals, Inc.: www.lmcc.com.
        c. US Spec: www.uspec.com.
        d. Substitutions: See Section 01 6000 - Product Requirements.
N. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
O. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Water Absorption: 0.5 percent by volume, maximum.
B. Shop fabricate to greatest extent possible.
C. Continuously seal joined members by continuous welds. Grind exposed welds smooth.
D. Fabricate connections for bolt, nut, and washer connectors.

2.04 SHOP PRIMING

A. Shop prime structural steel members, except the following:
    1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
    2. Surfaces to be field welded.
    3. Surfaces to be high-strength bolted with slip-critical connections, if primer does not meet the specified AISC slip coefficient.
B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:
    1. Galvanized Conditions:
        a. SSPC-SP 6 - Commercial Blast Cleaning.
    2. Interior Conditions:

a. SSPC-SP 3 - Power Tool Cleaning.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
D. Stripe paint corners, crevices, bolts, welds, and sharp edges.
E. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 6.
B. Shop prime structural steel members (unless noted to be galvanized). Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.
C. Galvanize structural steel members, where indicated on drawings and specified to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.

2.06 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts, testing at least 10 percent of bolts at each connection.
B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:
   1. Radiographic testing performed in accordance with ASTM E94/E94M.
   2. Ultrasonic testing performed in accordance with ASTM E164.
   3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
   4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.
B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.
C. Field weld components and shear studs indicated on shop drawings.
D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) Specification for Structural Joints Using High-Strength Bolts.
E. Do not field cut or alter structural members without approval of Architect and Structural Engineer.
F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.03 GROUTING AND DRY-PACKING

A. Provide grouting and dry-packing of base plates, leveling plates, and all other like work indicated or required, except where specified for work of other trades. Use non-shrink grout for base plates, leveling plates, and steel columns.
B. Proportions and Mixing:
   1. Non-Shrink Grout: Shall be mixed with water to dry-pack or grout consistency as required.

C. Placing and Finishing: Place by forcing and rodding to completely fill all voids, for complete uniform bearing under plates. Finish exposed surfaces neatly with smooth finish and cure with damp burlap at least three (3) days.
D. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.

3.05 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4300 - Quality Assurance.
B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.
C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:
    1. Radiographic testing performed in accordance with ASTM E94/E94M.
    2. Ultrasonic testing performed in accordance with ASTM E164.
    3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
    4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 1200

SECTION 05 2100

STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Steel Joist Framing work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Open web steel joists with bridging, attached seats and anchors.
C. Loose bearing members, such as plates or angles, and anchor bolts for site placement.
D. Supplementary framing for floor and roof openings greater than 12 inches.
E. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of anchors for casting into concrete.
B. Section 05 1200 - Structural Steel Framing: Grouting base plates and bearing plates.
C. Section 05 3100 - Steel Decking: Bearing plates and angles.
D. Section 05 3100 - Steel Decking: Support framing for openings less than 18 inches in decking.
E. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
E. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
F. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.
G. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.
H. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2018.
I. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.
J. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.
K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2021.
L. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
N. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

P. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.
Q. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.
R. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
S. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
T. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.
C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
D. Designer's Qualification Statement.
E. Manufacturer's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC 201.
F. Fabricator's Qualification Statement.
G. Erector's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.
B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.
C. Design and Installation Requirements: Refer to Structural Drawings.
D. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.
E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.
F. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172 or AISC 201.
G. Erector Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI Technical Digest No. 9 requirements.

1.07 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Include guarantee on form in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:
    1. Canam Group Inc: www.canam-construction.com.
    2. Nucor-Vulcraft Group: www.vulcraft.com.
    3. CMC Joist: www.cmcjoist.com.
    4. Valley Joist, Inc.: www.valleyjoist.com.

5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Open Web Joists: SJI Type K Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: 2 1/2 inches.
   3. Minimum End Bearing on Concrete or Masonry Supports: 4 inches.
   4. Finish: Shop primed.

B. Open Web Joists: SJI 100 Type LH Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standards.
   3. Minimum End Bearing on Masonry or Concrete Supports: Comply with referenced SJI standards.
   4. Finish: Shop primed.

C. Anchor Bolts, Nuts and Washers: ASTM A307 hot-dip galvanized per ASTM A153/A153M Class C.

D. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

E. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Frame special sized openings in joist web framing as detailed.

B. Space stud shear connectors on top of top chords as shown on Structural Drawings.

2.04 FINISH

A. Shop prime joists.
   1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:
   1. Interior Conditions:
      a. SSPC-SP 3 - Power Tool Cleaning.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

D. Stripe paint corners, crevices, bolts, welds, and sharp edges.

E. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

F. Prepare surfaces to be finished in accordance with SSPC-SP 3.

2.05 SOURCE QUALITY CONTROL

A. Provide shop testing of steel components as follows:
   1. As required by SJI Standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 ERECTION

A. Erect joists with correct bearing on supports.
B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.
C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.
D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.
E. Position and field weld joist chord extensions and wall attachments as detailed.
F. Install supplementary framing for floor and roof openings greater than 12 inches.
G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.
H. Do not field cut or alter structural members without approval of joist manufacturer.
I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed, except surfaces specified not to be primed.
J. After the erection is complete, all structural steel is to be reviewed by the Architect and/or Structural Engineer.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.
B. Maximum Offset From True Alignment: 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4300 - Quality Assurance.
B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC Specification for Structural Joints Using High-Strength Bolts, testing at least 10 percent of bolts at each connection.
C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds usingone of the following:
    1. Radiographic testing performed in accordance with ASTM E94/E94M.
    2. Ultrasonic testing performed in accordance with ASTM E164.
    3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
    4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 2100

SECTION 05 3100

STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Steel Decking work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Roof deck.
C. Supplementary framing for openings up to and including 12 inches.
D. Stud shear connectors.
E. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 18 inches and shear stud connectors.
B. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.
C. Section 05 5000 - Metal Fabrications: Steel angle concrete stops at deck edges.
D. Division 22 - Plumbing: Reinforcement pans with drain hub assemblies.
E. Division 26 - Electrical: Electrical, telephone, data floor outlets, sleeves, gaskets, raceway, and covers.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.
C. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018.
F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
G. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.
H. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
I. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
J. SSPC-SP 3 - Power Tool Cleaning; 2018.
K. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.
C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.
D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Submit manufacturer's installation instructions.
F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
G. Designer's Qualification Statement.
H. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC 201

1.05 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.
B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

1.06 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Deck:
   1. Canam Steel Corporation: https://www.canam-construction.com.
   2. Nucor-Vulcraft Group: www.vulcraft.com.
   3. New Millennium: www.newmill.com
   4. ASC Steel Deck: www.ascsd.com.
   5. Valley Joist, Inc.: www.valleyjoist.com.
   6. Verco Manufacturing Co.: www.vercodeck.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet:
   1. Ungalvanized Steel Sheet: ASTM A1008/A1008M, Designation SS, Grade 33, Type 1.
   2. Primer: Shop primer over prepared and phosphatized substrate.
   3. Structural Properties:
      a. As indicated on Structural Drawings.

2.03 ACCESSORY MATERIALS

A. Welding Materials: AWS D1.1/D1.1M.
B. Fasteners: Galvanized hardened steel, self tapping.
C. Steel Sheet Metal: 18-gauge, shop primed with screw fastener connections.
D. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.
E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
F. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.
G. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

2.04 FINISH

A. Shop prime steel deck.
   1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.
B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC Specifications as follows:

1. Galvanized Conditions:
    a. SSPC-SP 6 - Commercial Blast Cleaning.
2. Ungalvanized Conditions:
    a. SSPC-SP 3 - Power Tool Cleaning.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness no less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
D. Stripe paint corners, crevices, bolts, welds, and sharp edges.
E. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.
B. On steel supports provide minimum 2-inch bearing and 4-inch lap at splice points.
C. Fasten deck to steel support members as indicated on Structural Drawings.
D. Side Seam Attachments: As indicated on Structural Drawings.
E. Weld deck in accordance with AWS D1.3/D1.3M.
F. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.
G. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.
H. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.
I. After the erection is complete, all structural steel is to be reviewed by the Architect and/or Structural Engineer.

END OF SECTION 05 3100

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SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Metal Fabrication work as indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. All required steel lintels.
C. Support angles or bent plates at wall furring.
D. Miscellaneous steel angles, plates and anchors as required.
E. Shop fabricated steel and aluminum items.
F. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
B. Section 05 1200 - Structural Steel Framing: Structural steel column anchor bolts.
C. Section 05 2100 - Steel Joist Framing: Structural joist bearing plates, including anchorage.
D. Section 05 3100 - Steel Decking: Bearing plates for metal deck bearing, including anchorage.
E. Section 09 9113 - Exterior Painting: Paint finish.
F. Section 09 9123 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.
F. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2020.
G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.
I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2021).
J. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).
K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.
L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
M. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
N. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.
D. Designer's Qualification Statement.
E. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172 or AISC 201.

1.05 QUALITY ASSURANCE

A. Design shall be under direct supervision of a Professional Structural Engineer experienced in design the of this type of Work and licensed in the State in which the Project is located.
B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.2/D1.2M and dated no more than 12 months before start of scheduled welding work.
C. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

1.06 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel W Shapes and Tees: ASTM A992/A992M(50 KSI).
B. Steel Sections: ASTM A36/A36M.
C. Steel All-thread: ASTM A36/A36M
D. Steel Tubing: ASTM A500/A500M Grade B cold-formed structural tubing.
E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.
F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.
B. Fabricate items with joints tightly fitted and secured.
C. Continuously seal joined members by continuous welds.
D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
F. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Lintels: As scheduled on Structural Drawings; galvanized finish.
B. Door Frames for Overhead Door Openings and Wall Openings: Channel and Angle sections; prime paint finish or galvanized finish at exterior conditions.

2.04 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be imbedded in masonry, and items specified for galvanized finish.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
B. Prepare surfaces to be primed in accordance with SSPC-SP 3Power Tool Cleaning.
C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
D. Prime Painting: One coat.
E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.
F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.
   1. Located at exterior conditions.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch.
C. Maximum Misalignment of Adjacent Members: 1/16 inch.
D. Maximum Bow: 1/8 inch in 48 inches.
E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Furnish setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Field weld components as indicatedon shop drawings.
D. Perform field welding in accordance with AWS D1.1/D1.1M.
E. Obtain approval prior to site cutting or making adjustments not scheduled.
F. After erection, prime welds, abrasionsand surfaces not shop primed or galvanized , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
B. Maximum Offset From True Alignment: 1/4 inch.
C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION 05 5000

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SECTION 06 1000

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Rough Carpentry work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Galvanized sheet panels for gypsum board walls.
C. Roofing nailers and parapet caps.
D. Roofing cant strips.
E. Preservative treated wood materials.
F. Fire retardant treated wood materials.
G. Miscellaneous framing and sheathing.
H. Concealed and miscellaneous wood blocking, nailers, and supports.
I. Miscellaneous wood nailers, furring, and grounds.
J. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Setting anchors in concrete.
B. Section 05 1200 - Structural Steel Framing: Prefabricated beams and columns for support of wood framing.
C. Section 05 5000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing and wall sheathing.
D. Section 07 6200 - Sheet Metal Flashing and Trim: Sill flashings.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
B. ASTM D2898 - Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010 (Reapproved 2017).
C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2021.
E. PS 20 - American Softwood Lumber Standard; 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide on all products including technical data on wood preservative materials.
C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

1.06 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Treated Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.03 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
      b. Hoover Treated Wood Products, Inc: www.frtw.com.
      c. Osmose, Inc: www.osmose.com.
      d. Viance, LLC; D-Blaze: www.treatedwood.com.
      e. Substitutions: See Section 01 6000 - Product Requirements.
   2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat exterior rough carpentry items.
      c. Do not use treated wood in direct contact with the ground.

3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. Treat rough carpentry items as indicated .
    c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

2.04 WALL SHEET PANELS

A. Galvanized Sheet Panels: 20 gauge, 48 inch by 96 inch sheets with J3 (joggle offset flush) edge joint per SMACNA, 5th Edition, Table 3-1, ASTM A 653/A 653M with G90 galvanized coating.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.
B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 MISCELLANEOUS FRAMING, BLOCKING, NAILERS, SUPPORTS, AND SHEATHING

A. Provide framing, blocking, and sheathing members as indicated or as required.

3.03 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.
B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.04 CLEANING

A. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.
B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 1000

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SECTION 06 6116

SOLID SURFACING FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Solid Surfacing Fabrication work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Windowsills as shown on the drawings.
C. Sealants related to this section.
D. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Blocking.
B. Division 26 - Electrical: Electrical fixtures.

1.03 REFERENCE STANDARDS

A. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.
B. ASTM D785 - Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials; 2008 (Reapproved 2015).
C. ASTM D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials; 2017.
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
E. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; 2006.
H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
B. Coordination: Coordinate the installation of solid surface fabrications with size, location and installation of window units. Site verify all dimensions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
C. Shop Drawings:
    1. Show location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
        a. Show full-size details, edge details, thermoforming requirements, and attachments.
        b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

D. Samples: Submit 6 inch by 6 inch (150 mm by 150 mm) sample in specified gloss. Cut sample and seam together for representation of inconspicuous seam.
   1. Indicate full range of color and pattern variation.
E. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in North Sanpete School District's name and registered with manufacturer.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Maintenance kit for finishes.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
B. Fabricator/Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver all solid polymer fabrications to site ready for installation. Deliver in protective packing so as to prevent any potential damage to work prior to installation. Do not deliver any materials to site until areas are ready to receive them for installation. Store all materials indoors in a dry area away from extreme temperatures. Store flat materials in vertical racks with edges protected or flat on padded pallets.

1.08 FIELD CONDITIONS

A. Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 degrees F for 48 hours prior to and during installation. After installation, maintain relative humidity and ambient temperature planned for building occupants.

1.09 WARRANTY

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.
B. Provide manufacturer’s warranty against defects in materials.
   1. Warranty shall provide material and labor to repair or replace defective materials.
   2. Warranty Period: Ten years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dupont: www.corian.com.
B. Formica Corporation: www.formica.com.
C. Avonite Surfaces: www.avonitesurfaces.com.
D. Wilsonart International, Inc: www.wilsonartcontract.com.
E. LG hausys; Hi-Macs: www.lghausys.com.
F. Samsung Staron: www.staron.com.
G. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Solid Polymer:

1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.4, having minimum physical and performance properties specified.
2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
3. Finish:
    a. Matte; gloss range of 5 - 20.
    b. Provide surfaces with a uniform finish.
4. Performance Characteristics:
    a. Tensile Strength: 6,000 psi, ASTM D638.
    b. Tensile Elongation: 0.4 percent minimum, ASTM D 638.
    c. Flexural Strength: 10,000 psi, ASTM D790
    d. Hardness: >85, Rockwell "M" Scale - ASTM D785.
    e. Light Resistance: (Xenon Arc) No effect, NEMA LD 3, Method 3.3.
    f. Wear and Cleanability: Passes, ANSI Z124.3 & ANSI Z124.6.
    g. Stain Resistance: Passes, ANSI Z124.3 & Z124.6.
    h. Fungus and Bacteria Resistance: Does not support microbial growth,ASTM G21
    i. High Temperature Resistance: No Change, NEMA LD 3, Method 3.6.
    j. Flammability: Class I and Class A, ASTM E84, NFPA 255, UL 723.
    k. Flame Spread Index: <25.
    l. Smoke Developed Index: <25.

2.03 COMPONENTS

A. Quality Grade: Unless otherwise indicated provide Countertops and Splashes of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Premium Grade.
B. Windowsills: 1/2 inch (13 mm) thick, depth and length as shown on drawings or as indicated by Architect.
    1. Colors: As selected by Architect from Manufacturer's full color line, including premium.
    2. Exposed Edge Treatment: Built up to minimum 1 inch (26 mm) thick; square edge.

2.04 FINISHES

A. Color:
    1. As selected by Architect from Manufacturer's standard color line.
B. Finish:
    1. Matte; gloss range of 5 - 20.
    2. Provide surfaces with a uniform finish.

2.05 ACCESSORIES

A. Joint Adhesive:
    1. Manufacturer's recommended one or two part adhesive kit to create inconspicuous, nonporous joints.
B. Sealant:
    1. Manufacturer's recommended mildew resistant, FDA-compliant, NSF 51 compliant (food zone - any type), UL listed silicone sealant in colors matching components.
C. Conductive Tape:
    1. Manufacturer's recommended aluminum foil tape, with required thickness, for use with cutouts near heat sources.
D. Insulating Felt Tape:
    1. Manufacturer's recommended for use with conductive tape in insulating solid surface material from adjacent heat source.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
B. Windowsills:
    1. Install windowsills full length of window, set securely into place using only concealed fasteners and manufacturer's recommended adhesive.
    2. Windowsills shall be plumb, true and level.
    3. Provide minimum of 1/8 inch (3 mm) expansion gaps on both sides of sill, sealed with manufacturer's recommended sealant.

3.03 REPAIR

A. Repair or replace damaged work which cannot be repaired to Architect's satisfaction.

3.04 CLEANING AND PROTECTION

A. Keep components clean during installation.
B. Remove adhesives, sealants and other stains.

END OF SECTION 06 6116

SECTION 07 1113

BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Bituminous Dampproofing work as in indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Bituminous dampproofing.
   1. Exterior foundations and grade beams.
C. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 31 2323 - Fill.

1.03 REFERENCE STANDARDS

A. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013, with Editorial Revision (2019).
B. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide properties of primer, bitumen, and mastics.
C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.05 QUALITY ASSURANCE

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

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

1.07 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Karnak Corporation: www.karnakcorp.com.
B. Mar-Flex Systems, Inc: www.mar-flex.com.
C. W. R. Meadows, Inc: www.wrmeadows.com.
D. BASF: www.buildingsystems.basf.com.
E. Henry: www.henry.com.
F. Substitutions: See Section 01 6000 - Product Requirements.

2.02 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based; asphalt emulsified with bentonite clay; with fiber reinforcement; asbestos-free.
   1. VOC Content: None.
   2. Products:
      a. W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/.
      b. Henry Company; HE789 - Fibered Asphalt Emulsion Dampproofing: www.henry.com.
      c. BASF; Hydrocide 700/700B: www.buildingsystems.basf.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.
B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.
B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
B. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
C. Apply bitumen with mop.
D. Apply from 2 inches below finish grade elevation down to top of footings.
E. Seal items watertight with mastic that project through dampproofing surface.

END OF SECTION 07 1113

SECTION 07 1900

EXTERIOR WATER REPELLENTS AND GRAFFITI RESISTANT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Water Repellent and Sealer work as is indicated on the drawings and/or specified herein including, but not limited to, the following items.
B. Surfaces to be treated: exterior masonry and precast architectural concrete.
   1. Combination water repellent and anti-graffiti sealer.
C. Surface preparation.
D. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3511 - Exposed Concrete Floor Finishes: Interior Concrete, Sealers.
B. Section 04 2001 - Masonry Veneer.
C. Division 32 - Site Concrete: Exterior horizontal concrete surface sealer.

1.03 REFERENCE STANDARDS

A. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2022a.
B. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 1991 (Reapproved 2022).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect and Owner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.
C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Field Reports: Report whether manufacturer's best practices are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Water Repellent Material: Two gallons of the each type installed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with miminum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of type specified and with minimum three years of documented experience

C. Owner reserves the right to provide continuous independent inspection of surface preparation and application of water repellent.

1.07 MOCK-UPS

A. Prepare representative surface 36 by 36 inches in size using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.
   1. Conduct RILEM test on cured field sample. Allow product to fully cure 5 to 7 days before testing. Adjust application until required repellent performance is achieved.

B. Manufacturer's representative will review technical aspects; surface preparation, application, and workmanship.
C. Obtain Architect's written approval of field sample before start of material application, including approval of aesthetics, color, texture, and appearance.
D. Locate where directed.
E. Mock-up may remain as part of work.

1.08 FIELD CONDITIONS

A. Protect liquid materials from freezing.
B. Do not apply water repellent/sealers when ambient temperature is lower than 50 degrees F or higher than 100 degrees F.
C. Do not apply water repellents/sealers when wind velocity is higher than 15 mph.

1.09 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
B. Store in unopened containers in a cool, dry area. Keep material from freezing in the container; do not store below 35 degrees F (2 degrees C) or above 100 degrees F (38 degrees C).

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Manufacturer shall warrant respective products applied in accordance with manufacturer's specifications for a period of 5 years from date of Substantial Completion, against water intrusion due to material failure. When notified of such conditions, in writing, by the Owner, the manufacturer shall provide materials, and the applicator shall provide the labor to correct said deficiencies promptly and without inconvenience or cost to the Owner.
C. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Silane, Siloxane, Silane-Siloxane Blend, and Siliconate Water Repellents:
   1. BASF Construction Chemicals: www.buildingsystems.basf.com.
   2. Concrete Sealers USA: www.concretesealersusa.com.
   3. Dayton Superior Corporation: www.daytonsuperior.com.
   4. Evonik Corporation: www.evonik.com.
   5. Pecora Corporation: www.pecora.com.
   6. PROSOCO, Inc: www.prosoco.com.
   7. The QUIKRETE Companies: www.quikrete.com.
   8. Rust-Oleum Corporation; OKON S-20 Penetrating Silane-Siloxane Water Repellent Sealer: www.rustoleum.com.

9. Sherwin-Williams Company: www.sherwin-williams.com.
10. Rainguard International: www.rainguard.com.
11. L&M Construction Chemicals, Inc.: www.lmcc.com.
12. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Water Repellent and Graffiti-Resistant Sealer: Combination water repellent and graffiti-resistant sealer, colorless, non-yellowing, non-sacrificial, penetrating, water-vapor-permeable formulated to weatherproof concrete block and other porous masonry materials and protect treated surfaces from repeated graffiti attacks without altering the natural appearance.
   1. Acceptable Products:
      a. PROSOCO; Sure Klean Weather Seal Blok-Guard & Graffiti Control VOC9.
      b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify joint sealants are installed and cured.
C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of water repellent.

3.02 PREPARATION

A. Protection of Adjacent Work:
   1. Protect adjacent landscaping, property, and vehicles from drips and overspray.
   2. Protect adjacent surfaces not intended to receive sealer.
B. Prepare surfaces to be coated as recommended by manufacturer for best results.
C. Do not start work until masonry mortar and concrete substrate is cured a minimum of 60 days.
D. Remove loose particles and foreign matter.
E. Remove oil and foreign substances with a chemical solvent that will not affect sealer.
F. Scrub and rinse surfaces with water and let dry.
G. Allow surfaces to dry completely to degree recommended by sealer manufacturer before starting coating work.

3.03 APPLICATION

A. Apply in accordance with manufacturer's instructions, using procedures and application methods recommended as producing the best results.
B. Apply at rate recommended by manufacturer, continuously over entire surface.
C. Remove sealer from unintended surfaces immediately by a method instructed by water repellent manufacturer.
D. Provide manufacturer's field service representative to inspect preparation and application work continuously during entire application period to ensure that manufacturer's best practices for preparation and application are being followed.

3.04 FINAL CLEANING

A. Clean site of all unused sealer, residues, rinse water, wastes, and effluents in accordance with environmental regulations.
B. Remove and dispose of all materials used to protect surrounding areas and non-masonry surfaces, following completion of the Work of this Section.

C. Repair, restore, or replace to the satisfaction of the Architect, all materials, landscaping, and non-masonry surfaces damaged by exposure to sealer.

END OF SECTION 07 1900

SECTION 07 4100

METAL ROOF PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Metal Roof Panel work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
   1. Standing seam metal roofing system.
   2. Standing seam metal roofing accessories.
   3. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors..

1.02 REFERENCE STANDARDS

A. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure; 2017.
B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
C. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.
D. ICC-ES - International Code Council Evaluation Service; Current.
E. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.
F. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Current Edition, Including All Revisions.
G. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.
H. UL 1897 - Uplift Tests for Roof-Covering Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 RELATED SECTIONS

A. Section 07 6200 - Sheet Metal Flashing and Trim: Coping flashing, rain gutters, and downspouts.

1.04 REFERENCES

A. ASTM A 240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
B. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
C. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
D. ASTM A 875 - Standard Specification for Steel Sheet, Zinc-5 % Aluminum Alloy-Coated by the Hot-Dip Process
E. ASTM B 101 - Standard Specification for Lead-Coated Copper Sheet and Strip for Building Construction.
F. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
G. ASTM B 370 - Standard Specification for Copper Sheet and Strip for Building Construction.

H. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
I. ASTM D 1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
J. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
K. ASTM D 3575 - Standard Test Methods for Flexible Cellular Materials made from Olefin Polymers.
L. ASTM E 84 - Standard Test for Surface Burning Characteristics of Building Materials.
M. ASTM E 283 - Standard Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
N. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
O. ASTM E 1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
P. ASTM E 1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
Q. ASTM E 1680 - Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
R. ASTM E 2140 - Standard Test Method for Water Penetration of Metal Roof Panel Systems by Static Water Pressure Head.
S. AAMA 501.1 - Standard Test Method for Water Penetration of Windows, Curtain Walls and Doors Using Dynamic Pressure.
T. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
U. FM 4470 Approval Standard for Class 1 Panel Roofs.
V. FM 4471 - Class 1 Panel Roof; Factory Mutual Research Corporation.
W. UL 263 - Fire Tests of Building Constructions and Materials.
X. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies.
Y. UL 790 - Standard Test Methods for Fire Tests of Roof Coverings.
Z. UL 1897 - Uplift Test for Roof Covering Systems.
AA. AA. ICC-ES AC166 - Test Procedure for Wind Driven Rain Resistance of Metal Roof Coverings. AB. SMACNA - Architectural Sheet Metal Manual.
BB. AC. National Coil Coating Association (NCCA)
CC. AD. NRCA - The NRCA Roofing and Waterproofing Manual.

1.05 DESIGN / PERFORMANCE REQUIREMENTS

A. Standing Seam Roofing System: R-Mer Shield
    1. Thermal Expansion and Contraction:
        a. Completed metal roofing and flashing system shall be capable of withstanding expansion and contraction of components caused by changes in temperature without buckling, producing excess stress on structure, anchors or fasteners, or reducing performance ability.
        b. Design temperature differential shall be not less then 200 degrees Fahrenheit.
        c. Interface between panel and toprail/clip shall provide for unlimited thermal movement in each direction along the longitudinal direction.
        d. Location of metal roofing rigid connector shall be at roof ridge unless otherwise approved by the manufacturer. Metal ridge connector may require design as per job conditions by specified manufacturer.
    2. Uniform Wind Load Capacity:
        a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.

1) Design Code: ASCE 7, Method 2 for Components and Cladding.
2) Safety Factor: 1.67 after any load reduction or material stress increase.
3) Category III Building with an Importance Factor of 1.
4) Wind Speed: 120 mph.
5) Ultimate Pullout Value: 467 pounds per each of the two fasteners holding the panel anchor to the roof decking or framing system.
6) Exposure Category: C.
7) Roof Pitch: 3 inches per foot.
8) Roof Area Design Uplift Pressure:
   (a) Zone 1 - Field of roof 20.5 psf.
   (b) Zone 2 - Eaves, ridges, hips, and rakes 35.7 psf.
   (c) Zone 3 - Corners 52.8 psf.

b. ASTM E 1592: Capacity shall be determined using pleated airbag method in accordance with ASTM E 1592, testing of sheet metal roof panels. Allowable safe working loads shall be determined by dividing the ultimate test load by the safety factor specified above.

3. Uniform Positive Load Capacity.
   a. Installed roof system shall be capable of resisting the following positive uniform roof loads: Roof Live Load of 20 psf; Roof Snow Load of 150 psf.
   b. Dead Load: Loading of the roof structure, due to tear off of existing, and/or installation of new roofing materials shall not exceed the present loading due to weight of the existing roofing system.
4. ASTM E 1680: Static pressure air infiltration (roof panels):
   a. Pressure Leakage Rate:
      1) 1.57 PSF 0.034 cfm/sq.ft.
      2) 6.24 PSF 0.048 cfm/sq.ft.
      3) 12.0 PSF 0.051 cfm/sq.ft.
      4) 20.0 PSF 0.010 cfm/sq.ft.
5. ASTM E 1646: Static pressure water infiltration (roof panels):
   a. Pressure Result:
      1) 5 Gal. /Hr. per S.F. and Static No Leakage
      2) Pressure of 12.0 Psf for 15 minutes
6. Capacities for gauge, span or loading other than those tested may be determined by interpolation of test results within the range of test data. Extrapolations for conditions outside test range are not acceptable.

1.06 SUBMITTALS

A. Submit under provisions of Section 013000.
B. Product Data: Submit product data, test reports, and certifications in accordance with quality assurance and performance requirements specified herein.
C. Design Loads: Submit manufacturer's minimum design load calculations according to ASCE 7, Method 2 for Components and Cladding. In no case shall the design loads be taken to be less than those specified herein.
D. Dead Load Evaluation: Provide documentation from a licensed structural engineer of a structural evaluation of the roof structure and it's suitability for the new imposed roofing loads.
E. Shop Drawings: Prepared specifically for this project; showing dimensions of metal roofing and accessories, fastening details and connections and interface with other products.
F. Selection Samples: For each finish product specified, two complete sets of samples representing manufacturer's full range of available colors and textures.
G. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and textures.

H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
I. Closeout Submittals:
    1. Provide manufacturer's maintenance instructions that include recommendations for periodic checking and maintenance of installed roof system.
    2. Provide executed copy of manufacturer's warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall have in place a documented, standardized quality control program such as ISO-9001 approval.
B. Manufacturer: Manufacturer shall inspect roofing project a minimum of (2) two times per week to ensure contractor compliance.
    1. Provide weekly inspection report to GC & Architect with photo documentation indicating compliance or issues of correction required to ensure roofing system meets warranty requirements
    2. Inspector shall be a full-time employee of the manufacturer
C. Provide engineering calculations, signed, sealed and dated by a qualified Engineer validating the wind resistance per ASCE7-10 and ANSI-SPRI ES-1. Engineer of record shall be authorized and licensed by the state of Utah and have a minimum of 5 years experience as an approved Engineer for the manufacturers roofing system.
D. Installer Qualifications: Certified and approved installer of the sheet metal roofing manufacturer.

1.08 PRE-INSTALLATION CONFERENCE

A. Convene a pre-roofing conference approximately two weeks before scheduled commencement of roofing system installation and associated work.
B. Require attendance of installers of deck or substrate construction to receive roofing, installers of rooftop units and other work in and around roofing which must precede or follow roofing work including mechanical work, Architect, Owner, roofing system manufacturer's representative.
C. Objectives include:
    1. Review foreseeable methods and procedures related to roofing work, including set up and mobilization areas for stored material and work area.
    2. Tour representative areas of roofing substrates, inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work.
    3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
    4. Review roofing system requirements, Drawings, Specifications and other Contract Documents.
    5. Review and finalize schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
    6. Review required inspection, testing, certifying procedures.
    7. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
    8. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
    1. Store materials above ground, on skids.

2. Protect material with waterproof covering and allow sufficient ventilation to prevent condensation buildup or moisture entrapment on the materials.

1.10 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11 WARRANTY

A. Warranty:
   1. 40 year, no dollar limit, warranty.
   2. Provide installers 2 year warranty covering roofing system installation and water-tightness.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis Of Design: Garland Company, Inc.
   1. Overly Manufacturing.
   2. Merchant & Evans Inc.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 6000.

2.02 STANDING SEAM METAL ROOFING

A. Materials
   1. Width of Standing Seam Panel:
      a. 18-3/4 inches.
   2. Standing Seam: 2-1/16 inch tall mechanically seamed with factory installed hot melt sealant in-seam cap. Panel/Cap is configured with a total of 4 layers of metal surrounding anchor clip and top rail.
   3. Panel Profile: Provided with minimum 1-1/2 inches wide elevated mesa's every 2 inches on center continuous throughout panel. Stiffening ribs shall also be located in flat of panel next to the standing seam legs. Panel profile shall be symmetric in shape.
      a. Slope: Open Purlins or Solid Substrate down to 1/4:12.
   4. Panel material:
      a. Galvanized steel 24 gauge, G90, smooth as per ASTM A 653.
   5. Flashing and flat stock material: Fabricate in profiles indicated on Drawings of same material, thickness, and finish as roof system, unless indicated otherwise.
   6. Accessory Components:
      a. Anchor Clips:
         1) Concealed Standard Anchor Clips: Clips must be extruded aluminum ONE (1) piece clip with projecting legs for additional panel alignment and provision for unlimited thermal movement in each direction along the longitudinal dimension.
         2) Top Rail shall be snap-in-place extruded aluminum retainer. The top rail shall be used as a 6 inch length aligned with each panel clip, or in continuous lengths spanning one or more wind uplift zones, as required by the manufacturer's testing data and project engineering calculations.
            (a) Two piece clips are unacceptable.
            (b) Sealant applied in panel cap must be isolated from clip to insure that no sealant damage occurs from the movement of the panel during expansion and contraction.

(c) Clip must maintain a clearance of a minimum of 1/2 inch between panel and substrate for proper ventilation to help prevent condensation on underside of panel and eliminate the contact of panel fastener head to panel.

b. Gable Anchor Clips:
   1) Extruded Aluminum.
c. Fasteners:
   1) Concealed fasteners: Corrosion resistant steel fasteners (zinc plated, stainless steel or equal) designed to meet structural loading requirements.
   2) Exposed fasteners: Series 410 stainless steel fasteners or 1/8 inch diameter stainless steel waterproof rivets. All exposed fasteners shall be factory painted to match the color of the standing seam panels.
d. Closures: Factory precut closed cell foam meeting ASTM D 1056 or ASTM D 3575, enclosed in metal channel matching panels when used at hip, ridge, rake, and jamb.
e. Provide all miscellaneous accessories for complete installation.

2.03 STANDING SEAM METAL ROOFING ACCESSORIES

A. Underlayment:
   1. 40 mil minimum high temp self adhesive membrane, installed in accordance with manufacturer's requirements.
   2. High temp membrane at a minimum shall be installed at all valley’s, rakes, eaves, ridge & penetrations.
   3. Synthetic non-asphaltic sheet at other than above locations if required by manufacturer
B. Sealant:
   1. Concealed Applications: Non-Curing Butyl Sealant - Schnee-Morehead, Inc. SM5430 Acryl-R, or equal.

2.04 METAL ROOFING ACCESSORIES

A. Soffit: Reduces negative uplift pressures
   1. Profile:
      a. Vented.
   2. Material and Thickness:
      a. inch aluminum
   3. Width of Panel: 12 inches.
   4. Length of Panel: Up to 12 feet.
   5. Color.
      a. Color: Standard color selected by Architect.
B. SS Sheet Stock: High gloss, factory painted aluminum
   1. Material and Thickness:
   2. Color.
      a. Color: Standard color selected by Architect.
C. Snow Guard:
   1. 6005-T5 aircraft grade aluminum.
   2. Color.
      a. Color: Standard color selected by Architect.
D. Coping:
   1. Cover and Splice Plate: Concealed 6 inch splice plates.
      a. 22 gauge steel.
   2. Anchor Chair: 16 gauge G-90 galvanized steel.
   3. ANSI/SPRI ES-1 approved.
   4. FM certified assemblies.

5. Color.
    a. Color: Standard color selected by Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive metal roofing. Notify the Architect in writing of any defective conditions encountered. Starting of work shall constitute acceptance of such conditions.
B. Structural Deck Substrate:
    1. Inspect roof deck to verify deck is clean and smooth, free of depressions, waves, or projections, and properly sloped.
    2. Verify deck is dry and joints are solidly supported and fastened.
C. Structural Framing Substrate:
    1. Verify primary and secondary framing members are installed and fastened, properly aligned and sloped.
    2. Verify damaged shop coatings are repaired with touch up paint.
D. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, reglets are in place, and nailing strips located.
E. Correct defective conditions before beginning work.

3.02 INSTALLATION

A. Install in conformance with the NRCA Roofing and Waterproofing Manual and Manufacturers installation requirements.
B. Form panel shape as indicated on Drawings, accurate in size, square, and free from distortion or defects.
C. Install underlayment and eave protection sheet underlayment as recommended by the Manufacturer.
D. Coordinate with installation of rigid board insulation as specified in Section 07 2100.
E. Install all panels continuous from ridge to eave. Transverse seams are not permitted.
F. Panel lengths that exceed maximum shipping lengths shall be field rolled on equipment owned by the panel manufacturer. Seam sealant must be factory applied.
G. Exposed fasteners, screws and/or roof mastic are unacceptable and will be rejected. System configuration only allows for exposed fasteners at panel overlap, if required, and at trim details in accordance with the Manufacturer's requirements.
H. Where not otherwise indicated conform to SMACNA details including flashings and trim.
I. Install sealants where indicated to clean dry surfaces only without skips or voids..
J. Install metal edge treatment in accordance with the manufacturer's instructions and the approved shop drawings.
K. Install metal roofing accessories in accordance with the manufacturer's instructions and the approved shop drawings.

3.03 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 07 4100

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SECTION 07 5400

THERMOPLASTIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services to fully complete all Thermoplastic Membrane Roofing work as is indicated on the drawings or specified herein including, but not limited to, the following described items.
B. Mechanically attached system with thermoplastic roofing membrane.
   1. Roof insulation of thicknesses required to achieve R-30 rating unless otherwise noted.
   2. 20 year NDL warranty
   3. Clipping of fasteners where exposed to view.
   4. Insulation, flat and tapered.
   5. 1/2" exterior sheathing on roof deck and parapet walls where noted
   6. Flashings.
   7. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Wood nailers and curbs.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Counterflashings, reglets.
C. Section 07 7200 - Roof Accessories: Roof-mounted units; prefabricated curbs.
D. Division 22 - Plumbing: Roof drains.

1.03 REFERENCE STANDARDS

A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
B. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
C. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2017.
D. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2022.
E. ASTM D751 - Standard Test Methods for Coated Fabrics; 2019.
F. ASTM D1149 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment; 2018.
G. ASTM D2136 - Coated Fabrics - Low-Temperature Bend Test; 2002 (Reapproved 2012).
H. ASTM D2137 - Standard Test Methods for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics; 2011.
I. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2021.
J. ASTM D5602/D5602M - Standard Test Method for Static Puncture Resistance of Roofing Membrane Specimens; 2018.
K. ASTM D5635 / D5635M - Standard Test Method for Dynamic Puncture Resistance of Roofing Membrane Specimens; 2011.
L. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin-Based Sheet Roofing; 2021.
M. FM 4450 - Class I Insulated Steel Deck Roofs; 1989.
N. FM 4470 - Examination Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction; 2022.
O. FM DS 1-28 - Wind Design; 2016.
P. NRCA (RM) - The NRCA Roofing Manual; 2022.

Q. NRCA (WM) - The NRCA Waterproofing Manual; 2021.
R. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   2. Review preparation and installation procedures and coordinating and scheduling required with related work.
   3. See 1.06 G Below
B. Coordinate with installation of associated counterflashings installed under other sections.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, fasteners, and cover board.
C. Specimen Warranty: For approval.
D. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.
E. Samples for Verification: Submit two samples 6 x 6 inches (150 x 150 mm) in size illustrating insulation and membrane.
F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions, special procedures, and perimeter conditions requiring special attention.
G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
H. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.
I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
   1. Refer to paragraph 1.10

1.06 QUALITY ASSURANCE

A. Perform work in accordance with NRCA (RM)NRCA Roofing and NRCA (WM)Waterproofing Manual and manufacturer's instructions.
   1. Maintain one copy on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
C. Installer Qualifications: Company specializing in performing the work of this section:
   1. With minimum five years documented experience.
   2. Approved by membrane manufacturer.
D. Moisture Protection: See drawings and details for type, quantity, and location of moisture protection work required. Include all administration, facilities and labor required to furnish the expertise, degree of workmanship, materials and accessories, necessary for the timely and satisfactory integration of the following items into the total building system in compliance with the specifications. The work throughout shall be completed in a manner to assure that no water leakage into the roof system or building results. All details (including metal flashings) relating to the installation of the roof system, shall be approved by the roofing contractor or manufacturer.

E. Contractor's Review: Along with Manufacturer's Data, during submittal process submit written statement signed by contractor and the roofing subcontractor, stating that the architect's drawings and specifications for roofing and flashing have been reviewed with an agent of the manufacturer of the primary roofing materials, and that he is in agreement that the selected systems, layout and design are complete for roofing and flashing and are proper, compatible, and adequate for the applications shown, and that the conditions and details are not in conflict with the roofing manufacturer's roofing and flashing warranty requirements. Show by copy of transmittal
   1. form that copy of statement has been transmitted to roofing manufacturer. (A signed, reviewed copy of the manufacturer's notice of award will satisfy this requirement.)
   2. Drainage and cricket layout is for intent only and may not to be considered appropiate to meet manufacturer's guarantee of system, and also not to be scaled. this shall rest solely on the Contractor to define these slopes.

F. Statement of Application: Upon completion of work, submit a statement signed by contractor and roofing subcontractor, stating that the roofing and membrane flashing comply with these specifications, and that the installation methods comply with the manufacturer's printed instructions and are proper and adequate for the conditions of installation and use.

G. Preinstallation Conference: Conduct Conference at Project Site. Comply with requirements in Division 1 Section "Project Management and Coordination" Review methods and procedures related to roofing system including, but not limited to the following:
   1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing installer, roofing system manufacturer's representative, deck installer, and installers whose work interfaces with or affects roofing including installers of roof accessories and roof-mounted equipment.
   2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
   3. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Examine deck substrate conditions and finishes for compliance with requirements including flatness and fastening.
   5. Review structural loading limitations of roof deck during and after roofing.
   6. Review base flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing system.
   7. Review governing regulations and requirements for insurance and certificates if applicable.
   8. Review temporary protection requirements for roofing system during and after installation.
   9. Review roof observation and repair procedures after roofing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C).

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.
B. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring and temperature is below 40 degrees F.
C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Material Warranty: Provide membrane manufacturer's warranty agreeing to replace material that shows manufacturing defects within 20 years after installation.
C. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
    1. Warranty Term: 20 years - NDL
    2. Warranty shall include Inflationary Coverage.
    3. For repair and replacement include costs of both material and labor with no dollar limitation in warranty.
    4. The maximum wind speed coverage shall be peak gusts of 72 mph (116 km/h) measured at 33 feet (10 meters) above ground level.
    5. Certification is required with bid submittal indicating the manufacturer has reviewed and agreed to such wind coverage.
D. FMG Listing: Provide roofing membrane base finishing, and component materials that comply with requirements in FM 4450 and FM 4470 as part of a membrane roofing system and that are listed in FMG's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.
    1. Fire/Windstorm Classification: Class 1A-105

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Thermoplastic Polyolefin (TPO) Membrane Materials:
    1. Carlisle SynTec; www.carlisle-syntec.com.
    2. Versico Roofing Systems; www.versico.com
    3. Substitutions: See Section 01 6000 - Product Requirements.
B. Polyvinyl Chloride (PVC) Membrane Materials:
    1. Sika Sarnafil, Inc; www.sarnafilus.com.
    2. Duro-Last, Inc; www.duro-last.com.
    3. Substitutions: See Section 01 6000 - Product Requirements.
C. Insulation:
    1. As supplied and warranted by roofing membrane manufacturer.
D. Cover Board and Parapet Wall Sheathing:
    1. USG; Securock: www.usg.com.
    2. Georgia-Pacific; DensDeck: www.gp.com.
    3. Substitutions: See Section 01 6000 - Product Requirements.

2.02 ROOFING - UNBALLASTED APPLICATIONS

A. Thermoplastic Membrane Roofing: One ply membrane, mechanically fastened, over vapor retarder and insulation, and cover board.
B. Roofing Assembly Requirements:
    1. Roof Covering External Fire-Resistance Classification: UL (DIR)UL Class B.

2. Factory Mutual Classification: Class I and windstorm resistance of I-90, in accordance with FM DS 1-28. With gusts of 72 MPH
3. Insulation Thermal Value (R), minimum of 30, provide insulation of thickness required. (LTTR)

C. Acceptable Insulation Types - Constant and Tapered Thickness Application:
1. Minimum 2 layers of polyisocyanurate board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS - TPO

A. TPO Membrane:
1. Material: Reinforced thermoplastic polyolefin (TPO) complying with ASTM D6878/D6878M.
2. Reinforcing: Polyester Scrim.
3. Thickness: 80 mil minimum.
4. Sheet Width: Factory fabricated into largest sheets possible.
5. Color: To be selected by Architect from manufacturer's full color range.
6. Properties:
   a. Thickness Over Scrim: 0.033 inch (0.84 mm) minimum; ASTM D6878/D6878M .
   b. Breaking Strength: 460 lbf (2046 N) minimum; ASTM D751 grab method.
   c. Tearing Strength: 120 lbf (530 N) minimum; ASTM D751.
   d. Brittleness Point: -40 degrees F (-40 degrees C) maximum; ASTM D2137.
   e. Puncture Resistance: 450 lbf (2 kN) minimum; FTM 101C, method 2031.
   f. Ozone Resistance: Pass (no cracks), ASTM D1149, 100 pphm, 168 hrs.

2.04 ROOFING MEMBRANE AND ASSOCIATED MATERIALS - PVC

A. PVC Membrane:
1. Material: Reinforced polyvinyl chloride (PVC) complying with ASTM D4434/D4434M , Type III.
2. Reinforcing: Polyester Scrim.
3. Thickness: 60 mil minimum.
4. Sheet Width: Factory fabricated into largest sheets possible.
5. Color: White.
6. Properties:
   a. Thickness Over Scrim: 0.030 inch (0.76 mm) minimum; ASTM D4434/D4434M .
   b. Breaking Strength: 300 lbf (53 kN) minimum; ASTM D751 grab method.
   c. Seam Strength: Pass at 75 percent, ASTM D751 grab method.
   d. Low Temp Bend: -40 degrees F (-40 degrees C) maximum; ASTM D2136.
   e. Static Puncture Resistance: Pass at 33 lbf (15 kg), ASTM D5602/D5602M.
   f. Dynamic Puncture Resistance: Pass at 14.7 ft-lbf (20 J), ASTM D5635 / D5635M.

B. Seaming Materials: As recommended by membrane manufacturer.
C. Membrane Fasteners: As recommended and approved by membrane manufacturer.
D. Flexible Flashing Material: Same material as membrane.

2.05 PARAPET WALL SHEATHING

A. Either product listed below may be used at Contractor's Option.
B. Parapet Wall Sheathing: Fiber-reinforced gypsum panels, ASTM C1278/C1278M, Type X fire-resistant type, 5/8 inch (16 mm) thick.
1. Products: USG Securock Gypsum-Fiber Roof Board: www.usg.com
2. Substitutions: See Section 01 6000 - Product Requirements.

C. Parapet Wall Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch (16 mm) thick.
1. Products:
   a. Georgia-Pacific DensDeck Prime: www.densdeck.com.

b. Temple-Inland, Inc.; GreenGlass Primed Roof Board: www.templeinland.com.
c. Substitutions: See Section 01 6000 - Product Requirements.

2.06 COVERBOARD

A. Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 1/4 inch (6 mm) / 1/2 inch (12mm) thick.?
   1. Products:
      a. USG Securock; Glass-Mat Roof Board: www.usg.com.
      b. Georgia-Pacific; DensDeck: www.gp.com/build.
      c. Temple-Inland, Inc; GreenGlass Roof Board: www.templeinland.com.
      d. Substitutions: See Section 01 6000 - Product Requirements.
   2. Occurs at Front Canopy only. WHERE IN PROJECT?

2.07 INSULATION

A. Polyisocyanurate Board Insulation: Rigid cellular foam, complying with ASTM C1289, Type II, Class 1, cellulose felt or glass fiber mat both faces; Grade 2 and with the following characteristics:
   1. Compressive Strength: 20 psi (138 kPa)
   2. Board Size: 48 x 96 inch (1220 x 2440 mm).
   3. Thermal Resistance: R-value of 30, aged value shall be based upon 15 year time weighted average LTTR (long term thermal resistance).
   4. Board Edges: Square.
B. Extruded Polystyrene Board Insulation Crickets: ASTM C578, Type IV; 1.5 # Density Extruded polystyrene board with natural skin surfaces; with the following characteristics:
   1. Board Size: 48 x 96 inch (1220 x 2440 mm).
   2. Thermal Resistance: R-value, aged value shall be based upon 15 year time weighted average LTTR (long term thermal resistance).
   3. Board Edges: Square.

2.08 ACCESSORIES

A. Roofing Expansion Joint Flashing: Same material as membrane or as recommended by roofing manufacturer..
B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.
C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches (150 mm) wide; self adhering.
D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.
E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.
F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.
G. Insulation Adhesive: As recommended by insulation manufacturer.
H. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions.
B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.
D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
F. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

3.02 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.
B. Verify deck is supported and secure.
C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
D. Verify deck surfaces are dry and free of snow or ice.
E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and nailing strips are in place.

3.03 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation:
    1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.
B. Lay subsequent layers of insulation with joints staggered minimum 6 inch (150 mm) from joints of preceding layer.
C. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.
D. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
E. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches (450 mm).
F. Do not apply more insulation than can be covered with membrane in same day.

3.04 COVER BOARD APPLICATION

A. Refer to roof system manufacturer's written instructions for proper installation techniques.
B. Install approved fasteners with plates into the roof boards, flush with the surface. Fasteners should be installed in strict compliance with the roof system manufacturer’s installation recommendations and FMG Loss Prevention Data Sheet 1-29. Proper fastener spacing is essential to achieve wind-uplift performance.
C. Locate edge joints on, and parallel to, deck ribs. Stagger end joints of adjacent lengths of roof boards. Butt board edges and ends loosely in typical installations. Long, uninterrupted runs (greater than 200 feet) of roof boards may require slight gaping due to thermal expansion.

3.05 PARAPET WALL SHEATHING APPLICATION

A. Refer to roof system manufacturer's written instructions for proper installation techniques.
B. Use appropriate corrosion-resistant fasteners as defined by roof system manufacturer.
C. Fasten a maximum 8 inches (200 mm) on center around the perimeter and 8 inches (200 mm) on center on framing members in the field of the panel. Minimum fastener penetration in steel framing is 3/8 inch (10 mm).

3.06 MEMBRANE APPLICATION

A. Apply membrane according to manufacturer's instructions.
B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.
D. Overlap edges and ends and seal seams by heat welding, minimum 4 inches (100 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
E. Mechanical Attachment: Apply membrane and mechanical attachment devices in accordance with manufacturer's instructions.
F. At intersections with vertical surfaces:
    1. Extend membrane over cant strips and up a minimum of 4 inches (100 mm) onto vertical surfaces.
    2. Fully adhere flexible flashing over membrane and up to counterflashing height and at parapet wall up, across top and down minimum of 2 inches (50 mm) on opposite face.
G. At gravel stops, extend membrane under gravel stop and to the outside face of the wall.
    1. Install in accordance with NRCA details and manufacturer's instructions.
H. Around roof penetrations, seal flanges and flashings with flexible flashing.
    1. Install in accordance with NRCA details and manufacturer's instructions.
I. Install roofing expansion joints . Make joints watertight.
    1. Install in accordance with NRCA details and manufacturer's instructions.
J. Coordinate installation of roof drains and sumps and related flashings.
K. Coordinate installation of screws required for roofing and installation so as not to damage any interior mechanical, plumbing, electrical, etc. If damage does occur, Contractor shall repair and/or replace work as acceptable to the Architect at no additional cost to the Owner.
L. Refer to details on drawings and manufacturer's standard details.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for general requirements for field quality control and inspection.
B. Require site attendance of roofing and insulation material manufacturers ONCE during installation of the Work.
C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.
    1. Notify Architect or Owner 48 hours in advance of date and time of inspection.

3.08 CLEANING

A. Remove bituminous markings from finished surfaces.
B. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.
C. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 PROTECTION

A. Protect installed roofing and flashings from construction operations.
B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION 07 5400

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Sheet Metal Flashing and Trim work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Fabricated sheet metal items, including copings, drip edges, flashings, counterflashings, gutters, downspouts, and other items shown on Drawings.
C. Sealants for joints within sheet metal fabrications.
D. Reglets and accessories.
E. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors

1.02 RELATED REQUIREMENTS

A. Section 04 2001 - Masonry Veneer: Flashings in masonry.
B. Section 06 1000 - Rough Carpentry: Wood nailers for sheet metal work.
C. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.
D. Division 23 - HVAC: Flashing sleeves and collars for mechanical items protruding through roofing membrane.
E. Division 26 - Electrical: Flashing sleeves and collars for electrical items protruding through roofing membrane.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
B. AAMA 621 - Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates; 2002.
C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).
F. CDA A4050 - Copper in Architecture - Handbook; current edition.
G. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
C. Samples: Submit two samples 12 inches by 12 inches in size illustrating metal finish color.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
B. Maintain one copy of each document on site.
C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
B. Prevent contact with materials that could cause discoloration or staining.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Finish Warranty: On steel manufacturer’s standard form, in which manufacturer agrees to repair or replace fabricated items that evidence deterioration of finish within 20 years from date of Substantial Completion.
C. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sheet Metal Flashing and Trim Manufacturers:
    1. Drexel Metals: www.drexelmetals.com.
    2. Peterson Aluminum Corporation; Pac-Clad: www.pac-clad.com.
    3. Firestone Metal Products; Una-Clad: www.firestonemetal.com.
    4. York Manufacturing, Inc; York: www.yorkmfg.com.
    5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gauge, 0.028 inch thick base metal, shop pre-coated with PVDF coating.
    1. Reverse Side: Manufacturer's standard polyester wash coat of 0.3 to 0.4 mil dry film thickness.
    2. Coping Top: Tapered.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
B. Form pieces in longest possible lengths.
C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams. At wall copings use standing seam joints.
E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.
F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
G. All flashings to be installed with continuous 18 gauge galvanized steel hold downs per SMACNA Architectural Sheet Metal Manual, current edition.

2.04 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.
B. Downspouts: Profile as indicated on Drawings.
C. Gutters and Downspouts: Size indicated.
D. Accessories: Profiled to suit gutters and downspouts.
    1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
    2. Gutter Supports: Brackets.
    3. Downspout Supports: Brackets.
E. Downspout Boots: Steel.
F. Seal metal joints.

2.05 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.
B. Primer: Zinc chromate type.
C. Protective Backing Paint: Zinc molybdate alkyd.
D. Concealed Sealants: Non-curing butyl sealant.
E. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
    1. Products:
        a. Franklin International, Inc.; Titebond WeatherMaster Metal Roof Sealant: www.titebond.com.
        b. Substitutions: See Section 01 6000 - Product Requirements.
F. Plastic Cement: ASTM D4586/D4586M, Type I, asbestos-free.
G. Reglets: Surface-mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.
B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Conform to drawing details and SMACNA (ASMM) Architectural Sheet Metal Manual.
B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
D. Apply plastic cement compound between metal flashings and felt flashings.
E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
F. Seal metal joints watertight.
G. Secure gutters and downspouts in place with concealed fasteners.
H. Slope gutters 1/4 inch per 10 feet, minimum.

I. Connect downspouts to downspout boots, and grout connection watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4300 - Quality Assurance for field inspection requirements.
B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION 07 6200

SECTION 07 8400

FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Firestopping work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Firestopping systems.
C. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.
D. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.
B. Division 23 - HVAC: Firestopping of mechanical work.
C. Division 26 - Electrical: Firestopping of electrical work.

1.03 REFERENCE STANDARDS

A. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).
B. ITS (DIR) - Directory of Listed Products; current edition.
C. FM 4991 - Firestop Contractors; 2013.
D. FM (AG) - FM Approval Guide; current edition.
E. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
F. Certificate from authority having jurisdiction indicating approval of materials used.
G. Manufacturer's qualification statement.
H. Installer Qualification: Submit qualification statements for installing mechanics.

1.05 QUALITY ASSURANCE

A. The Work of this Section shall be accomplished by a single source contractor or by those contractors who, by their contract, are penetrating rated construction with their work. Regardless of responsibility, the General Contractor shall be responsible to assure and verify that all products, systems, etc. used under this Section are appropriate and meet the intent of this specification and is accomplished by factory trained workmen.
B. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
    1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

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

D. Installer Qualifications: Company specializing in performing the work of this section and:
1. Trained by manufacturer.
2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
3. Verification of minimum three years documented experience installing work of this type.
4. Verification of at least five satisfactorily completed projects of comparable size and type.
5. Licensed by local authorities having jurisdiction (AHJ).

1.06 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

B. Provide ventilation in areas where solvent-cured materials are being installed.

1.07 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
1. Hilti, Inc: www.us.hilti.com.

B. Firestopping Manufacturers:
1. 3M Fire Protection Products: www.3m.com/firestop.
2. A/D Fire Protection Systems Inc: www.adfire.com.
3. Nelson FireStop Products: www.nelsonfirestop.com.
4. Specified Technologies Inc: www.stifirestop.com.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero (0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. All UL Systems listed are based on one manufacturer's proprietary product as a basis of design. Other approved manufacturers may bid the project, and shall provide corresponding UL Systems for their individual products.

2.04 FIRESTOPPING FOR WALL-TO-WALL JOINTS

A. Concrete and Concrete Masonry Walls and Floors:

1. Top of Wall Joints at Concrete/Concrete Masonry Wall to Concrete Over Metal Deck Floor:
    a. 2-Hour Construction: UL System HW-D-0181; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
    b. 2-Hour Construction: UL System HW-D-1037; Hilti CFS-SP WB Firestop Joint Spray and CP 672.
2. Concrete/Concrete Masonry Wall to Wall Joint Systems with Movement Capabilities (Dynamic):
    a. 2-Hour Construction: UL System WW-D-0017; HIlti CFS-SP WB Firestop Joint Spray and CP 672.
    b. 2-Hour Construction: UL System WW-D-0032; Hilti CP 606 Flexible Firestop Sealant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
B. Remove incompatible materials that could adversely affect bond.
C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
C. Install labeling required by code.

3.04 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.05 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 8400

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SECTION 07 9200

JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Joint Sealant work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
   1. This section is intended to not only provide information for the caulking contractor, but also the contractors listed below, who are by this specification required to caulk their own work:
      a. Section 07 5400 - Roofing
      b. Section 07 6200 - Sheet Metal Flashing and Trim
      c. Section 07 9513 - Expansion Joint Cover Assemblies
      d. Section 08 4313 - Aluminum-Framed Storefronts
      e. Section 09 9113 - Exterior Painting
      f. Section 09 9123 - Interior Painting
      g. Division 22 - Plumbing.
      h. If not listed above, the work will be caulked under this section.

B. Non-sag gunnable joint sealants.
C. Self-leveling pourable joint sealants.
D. Silicone joint sealants.
E. Urethane joint sealants.
F. Latex joint sealants.
G. Joint backings and accessories.
H. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 07 2700 - Air Barriers: Sealants required in conjunction with air barriers.
B. Section 07 9513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.
C. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.
D. Section 08 8000 - Glazing: Glazing sealants and accessories.
E. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.
F. Section 09 3000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).
B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.
F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

1.04 DEFINITIONS

A. Sealant Types and Classifications:
   1. Type:
      a. Type S: Single-component sealant.
      b. Type M: Multi-component sealant.
   2. Grade:
      a. Grade P: Pourable or self-leveling sealant used for horizontal traffic joints.
      b. Grade NS: Non-sag or gunnable sealant used for vertical and non-traffic joints.
   3. Classes: Represent movement capability in percent of joint width.
      a. Class 100/50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand of at least 100 percent increase and decrease of at least 50 percent of joint width as measured at time of application.
      b. Class 50: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 50 percent of joint width as measured at time of application.
      c. Class 25: Sealant that, when tested for adhesion or cohesion under cyclic movement shall withstand increase and decrease of at least 25 percent of joint width as measured at time of application.
      d. Class 12: Sealant that, when tested for adhesion and cohesion under cyclic movement shall withstand increase and decrease of at least 12 percent of joint width as measured at time of application.
   4. Use:
      a. T (Traffic): Sealant designed for use in joints in pedestrian and vehicular traffic areas such as walkways, plazas, decks and parking garages.
      b. NT (Non-Traffic): Sealant designed for use in joints in non-traffic areas.
      c. I (Immersion): Sealant that meets bond requirements when tested by immersion (Immersion rated sealant applications require primer).
      d. M (Mortar): Sealant that meets bond requirements when tested on mortar specimens.
      e. G (Glass): Sealant that meets bond requirements when tested on glass specimens.
      f. A (Aluminum): Sealant that meets bond requirements when tested on aluminum specimens.
      g. O (Other): Sealant that meets bond requirements when tested on substrates other than standard substrates, being glass, aluminum, mortar.

B. Silicone: Any member of family of polymeric products whose molecular backbone is made up of alternating silicon and oxygen atoms and which has pendant hydrocarbon groups attached to silicon atoms. Used primarily as a sealant. Offers excellent resistance to water and large variations in temperature (minus 100 degrees F to plus 600 degrees F) (minus 73.3 degrees C to plus 316 degrees C).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other sections referencing this section.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
D. Manufacturer's Installation Instructions: Indicate special procedures, surface preparation, and perimeter conditions requiring special attention.
E. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
F. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

1.07 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.
D. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

1.08 MOCK-UP

A. Provide mock-up of sealant joints in conjunction with window and wall under provisions of Section 01 4300.
B. Construct mock-up with specified sealant types and with other components noted.
C. Locate where directed.
D. Mock-up may remain as part of the Work.

1.09 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.10 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a One (1) year period after Date of Substantial Completion.
C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.
D. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants (Grade - NS): Permits application in joints on vertical surfaces without sagging or slumping.

1. Dow Corning Corporation: www.dowcorning.com/construction.
2. Pecora Corporation: www.pecora.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.
4. Sika Corporation: www.usa-sika.com.
5. Tremco Commercial Sealants and Waterproofing: www.tremcosealants.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-leveling Sealants (Grade - P): Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.
1. Dow Corning Corporation: www.dowcorning.com/construction.
2. Pecora Corporation: www.pecora.com.
3. Sherwin-Williams Company: www.sherwin-williams.com.
4. Sika Corporation: www.usa-sika.com.
5. Tremco Commercial Sealants and Waterproofing: www.tremcosealants.com.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
B. Interior Wet Areas: Bathrooms, restrooms, kitchens, and food service areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
C. Sound-Rated Assemblies: Walls and ceilings identified as 'STC-rated', 'sound-rated', or 'acoustical', and any interior wall with insulation.

2.03 SELF-LEVELING SEALANTS

A. Type [6]- Self-Leveling Polyurethane Sealant (paintable): ASTM C920, Grade P, Uses: T, M, NT, G, O, A, and I; Type: multi-component explicitly approved by manufacturer for traffic exposure; and continous water immersion.
1. Applications: Use for:
a. Control and Expansion Joints in sidewalks and vehicular paving.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.
5. Manufacturers:
a. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com.
b. Substitutions: See Section 01 6000 - Product Requirements.

2.04 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
2. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
C. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.
D. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
   1. Examine substrate(s) with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   2. Installer to proceed with installation only after unsatisfactory conditions have been corrected and/or that installation of sealant constitutes acceptance from the installer of acceptable substrate conditions.
B. Verify that backing materials are compatible with sealants.
C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Perform installation in accordance with ASTM C1193.
C. Perform acoustical sealant application work in accordance with ASTM C919.
D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.
E. Install bond breaker backing tape where backer rod cannot be used.
F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION 07 9200

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SECTION 07 9513

EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Expansion Joint Cover Assembly work as is indicated on the drawings and/or specified herein.
B. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Placement of joint cover assembly frames in formwork.
B. Section 07 6200 - Sheet Metal Flashing and Trim: Custom fabricated control and expansion joint devices.
C. Section 09 2116 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
C. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.
C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, and anchorage locations .
D. Samples: Submit two samples 12 inch long, illustrating profile, dimension, color, and finish selected.
E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

1.05 GUARANTEE

A. The Contractor shall guarantee his work for a period of one (1) year} from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.
B. Manufacturer's warranty against material and manufacturing defects for a period of not less than 3 years when installed in accordance with manufacturer’s recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer
    1. Balco, Inc: www.balcousa.com.
B. Other approved manufacturers, subject to compliance with requirements:
    1. Inpro: www.inprocorp.com.

2. MM Systems Corp: www.mmsystemscorp.com.
3. Nystrom, Inc: www.nystrom.com.

2.02 EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. Type A - Exterior Wall to Roof:
   1. Cover: Mill finish aluminum.
   2. Base: Mill finish aluminum.
   3. Movement: 100 percent.
   4. Width: 2-inch gap.
   5. Acceptable product: 9WC-2 manufactured by Balco, Inc.

B. Type B - Exterior Wall to Wall:
   1. Cover: Santoprene.
   2. Base: Mill finish aluminum.
   3. Movement: 100 percent.
   4. Width: 2-inch gap.
   5. Acceptable Product: FCVS-2 manufactured by Balco, Inc.

C. Type C - Interior Wall to Wall:
   1. Material: Silicone Compression/Extension Seal.
   2. Color: As selected by Architect from manufacturer's full available colors.
   3. Movement: 100 percent.
   4. Width: 2-inch gap.
   5. Acceptable Product: CE-200SX manufactured by Balco, Inc.

2.03 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Joint Cover Styles: As indicated above and on drawings.
   4. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   5. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

B. Floor Joint Covers: Coordinate with indicated floor coverings.
   1. If floor covering is not indicated, obtain instructions from Architect before proceeding.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper and T5 temper
   1. Extruded Aluminum:
      a. ASTM B221, alloy 6063-T5 for extrusions
      b. ASTM B209, alloy 6061-T6 for plate
      c. ASTM B209, alloy 5052-H32 for sheet
      d. Exposed Finish Outdoors: Natural anodized.
      e. Exposed Finish at Floors: Mill finish.
      f. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Fasteners and Accessories: As recommended by cover manufacturer for a complete installation.

C. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.

D. Threaded Fasteners: As recommended by manufacturer.

E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 EXPANSION JOINT COVER INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.
B. Align work plumb and level, flush with adjacent surfaces.
C. Rigidly anchor to substrate to prevent misalignment.

3.03 PROTECTION

A. Protect installation from damage by work of others.
B. At completion of the installation, clean exposed surfaces with non-solvent cleaner.
C. Provide reinforced cloth tape to protect finish surface.

END OF SECTION 07 9513

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SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Hollow Metal Door and Frame work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Non-fire-rated hollow metal doors and frames.
C. Fire-rated hollow metal doors and frames.
D. Interior fire resistive rated metal frames.
    1. Applications:
        a. Doors with transoms.
E. Thermally insulated hollow metal doors with frames.
F. Accessories, matching panels.
G. Door hardware.
    1. Provide hardware and installation for work associated with this section as scheduled by Section 08 7100.
H. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware.
B. Section 09 9113 - Exterior Painting: Field painting.
C. Section 09 9123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.
B. ASCE: American Society of Civil Engineers.
C. HMMA: Hollow Metal Manufacturers Association.
D. NAAMM: National Association of Architectural Metal Manufacturers.
E. NFPA: National Fire Protection Association.
F. SDI: Steel Door Institute.
G. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.
C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.
D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.
E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
J. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
L. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames; 2016.
M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
N. ITS (DIR) - Directory of Listed Products; current edition.
O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
Q. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.
R. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2019.
U. UL (DIR) - Online Certifications Directory; Current Edition.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
F. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.08 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
   2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
   3. De La Fontaine Inc: www.delafontaine.com.
   4. Republic Doors, an Allegion brand: www.republicdoor.com.
   5. Steelcraft, an Allegion brand: www.allegion.com.
   6. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Hardware Preparations, Selections, and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
   6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

Level		Model	Full MSG No.
1	Standard Duty	1	20
		2	
2	Heavy Duty	1	18
		2	
3	Extra Heavy Duty	1	16
		2	
		3	
4	Maximum Duty	1	14
		2	

A. Door Finishes, all doors: Factory primed and field finished.
B. Exterior Doors: Thermally insulated.
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 4 - Maximum-duty.
      b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model 1 - Full Flush.
      d. Door Face Metal Thickness: 14 gauge, 0.067 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Thickness: 1-3/4 inches, nominal.
   4. Top Closures for Outswinging Doors: Flush with top of faces and edges.
   5. Door Face Sheets: Flush.
   6. Weatherstripping: Refer to Section 08 7100.
   7. Door Finish: Factory primed and field finished.
C. Fire-Rated Doors:
   1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
      a. Level 2 - Heavy-duty.
      b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      c. Model: 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").

a. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
b. Provide units listed and labeled by UL (DIR) or ITS (DIR).
c. Attach fire rating label to each fire rated unit.

3. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
4. Door Thickness: 1-3/4 inches, nominal.
5. Door Face Sheets: Flush.
6. Door Finish: Factory primed and field finished.

1.02 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Same as hollow metal door.
C. General:
1. Comply with the requirements of grade specified for corresponding door.
a. ANSI/SDI A250.8 Level 3 Doors: 14 gauge, 0.067 inch, minimum frames.
b. ANSI/SDI A250.8 Level 4 Doors: 12 gauge, 0.093, minimum frames.
2. Provide frames with a minimum of six wall anchors and two adjustable base anchors of manufacturer’s standard design.
3. Comply with recommended practice for hardware placement amd reinforcement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
D. Exterior Door Frames: Full profile/continuously welded type.
1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A60/ZF180 coating.
2. Frame Metal Thickness: 12 gauge, 0.093 inch, minimum.
3. Weatherstripping: Separate, see Section 08 7100.
E. Interior Door Frames, Fire-Rated: Fully welded type, ground smooth, fully prepared and reinforced for hardware installation, seamless with joints filled.
1. Fire Rating: Same as door, labeled.
2. Some transoms have hollow metal panels.
3. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
4. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

1.03 FINISHES

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

1.04 ACCESSORIES

A. Astragals for Double Doors: Specified in Section 08 7100.
B. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
C. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
D. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
E. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

2.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Verify that finished walls are in plane to ensure proper door alignment.

2.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
    1. Epoxy paint or self-adhered waterproof membrane may also be used.

2.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
B. Install fire-rated units in accordance with NFPA 80.
C. Coordinate frame anchor placement with wall construction.
D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
E. Door Hardware: Provide hardware and installation for work associated with this section as scheduled by Section 08 7100.
    1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
F. Coordinate installation of electrical connections to electrical hardware items.
G. Touch up damaged factory finishes.

2.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

2.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

2.06 SCHEDULE

A. Refer to Door Schedule on the drawings.

END OF SECTION 08 1113

SECTION 08 3323
ROLLING STEEL DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rolling steel insulated doors.

B. Rolling steel fire doors.

1.2 RELATED SECTIONS

A. Section 05 5000 - Metal Fabrications: Support framing and framed opening.

B. Division 26 - Raceway and Boxes: Conduit from electric circuit to door operator and from door operator to control station.

C. Division 26 - Wiring Connections: Power to disconnect.

1.3 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

B. ANSI/DASMA 203 - American National Standards Institute Specifications for non-rated fire rolling doors published by Door & Access Systems Manufacturers Association International.

C. ASTM A 123 - Zinc hot-dipped galvanized] coatings on iron and steel products.

D. ASTM A 229 - Steel wire, oil-tempered for mechanical springs.

E. ASTM A 653 - Steel sheet, zinc-coated galvanized by the hot-dipped process, commercial quality.

F. ASTM E 330 - Structural performance of exterior windows, curtain walls, and doors by uniform static air pressure difference.

G. ASTM E 413 - Classification for Rating Sound Insulation

1.4 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.

D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

E. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking, adjustment and lubrication of components.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.

B. Installer Qualifications: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and an authorized Wayne Dalton installer.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging with seals and labels intact until ready for installation.

B. Store materials off the ground in a dry, warm, ventilated weathertight location.

1.7 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.8 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

A. Provide Rolling Steel Service doors and Rolling Steel Fire doors with limited 2 Year Warranty on defects in materials and workmanship on the door; excludes the counterbalance spring and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Base Product Manufacturer: Wayne Dalton; 2501 S. State Highway 121 Business, Suite 200, Lewisville, TX 75067: www.wayne-dalton.com.

B. Other Manufacturers: Subject to compliance with all of the requirements of this section, products by one of the following will be acceptable:
   1. The Cookson Company: www.cooksondoor.com.
   2. Cornell Iron Works, Inc.: www.cornelliron.com.
   3. Overhead Door Corp.: www.overheaddoor.com.
   4. Substitutions: See Section 016000 – Product Requirements.

C. Wayne Dalton Model 800C Insulated Rolling Service Doors:
   1. Description:
      a. Sizes: As scheduled on the drawings.

   2. Curtain: composed of interlocking roll-formed slats.
      a. Slat Profiles/Material:
         1) No. 34 Flat-faced slat. The area between the #34 exterior slat and the back slat filled with polyurethane insulation, R-value of 7.7 (U = 0.15).
            (a) 22-gauge galvanized steel with 24-gauge back.
      b. Insulated Vision Lites: Provide with 5 inch by 3/4 inch uniformly spaced openings, with 1/16 inch clear plastic.
      c. Ends of alternate slats fitted with metal endlocks/windlocks.

   3. Bottom Bar: Consists of two equal angles, 0.12 inch minimum thickness, to stiffen curtain, with astragal. Angle shall be:
      a. Steel.

   4. Guides:
      a. Roll-formed steel channel bolted to three structural angle guide angle assembly forming a slot to retain curtains in guides. Structural grade, three angle assembly fabricated of:
         1) Steel, Z guide.
      b. Provide with integral windlock bars and removable bottom bar stops.

   5. Brackets: Design to enclose ends of coil and provide support for counterbalance pipe at each end. Fabricate of steel plates, with permanently sealed ball bearings. Thickness shall be:
      a. 3/16 inch or 1/4 inch minimum, as required for door size.

   6. Counterbalance: Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inch per foot of door span. Curtain to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs will be used to anchor springs to tension shaft and pipe.

   7. Hood: Hood to enclose curtain coil and counterbalance mechanism. Hood fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Fabricate of:
      a. Minimum 24-gauge galvanized steel.

   8. Finish: Shop coat of rust inhibitive primer on non-galvanized surfaces and operating mechanisms. Guides and bracket plates will be coated with a flat black prime paint.
      a. Galvanized Steel:
         1) Standard finish as selected by architect.

9. Operation: Door will be operated by means of:
   a. Motor operation with electrical sensing edge attached to bottom bar to stop and reverse door when it contacts an object during the closing cycle.

10. Weatherstripping: Doors will include bottom astragal, optional surface guide weatherstrip, and internal hood baffle.
    a. Provide with lintel brush weatherstrip.

11. Air Infiltration Package: IECC 2012/2015) listed product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft2
    a. Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 3 inch lintel rubber seal, internal hood baffle and bottom astragal.

12. Locking:
    a. Electric-motor operation doors provided with lock through the operator gearing.

13. Windload: Windload minimum psf per DASMA 102-2012 and as required by local codes.

14. Mounting:
    a. Masonry jambs.

2.2 ROLLING STEEL FIRE DOORS

A. Wayne Dalton FireStar 700 Rolling Steel Fire Door
   1. Description:
      a. Sizes: As scheduled on the drawings.
      b. Fire Labeled: Yes

   2. Curtain: composed of interlocking roll-formed slats.
      a. Slat Profiles/Material:
         1) No. 17 Flat-faced slat.
            (a) 22-gauge steel.

      b. Ends of alternate slats fitted with metal endlocks.

   3. Bottom Bar: Consists of two equal angles, 0.12 inch minimum thickness, to stiffen curtain. Angle shall be:
      a. Steel.

   4. Guides:
      a. Three structural angle guide assembly fabricated of:
         1) Steel.

   5. Brackets: Design to enclose ends of coil and provide support for counterbalance pipe at each end. Fabricate of steel plates, with permanently sealed ball bearings. Thickness shall be:
      a. 3/16 inch or 1/4 inch minimum, as required.

   6. Counterbalance: Curtain to be coiled on a pipe of sufficient size to carry door load with deflection not to exceed 0.033 inch per foot of door span. Curtain to

be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs will be used to anchor springs to tension shaft and pipe.

7. Hood: Hood to enclose curtain coil and counterbalance mechanism. Hood fabricated of sheet metal, flanged at top for attachment to header and flanged at bottom to provide longitudinal stiffness. Provide all FM hoods with a steel hood baffle. Fabricate of:
   a. Minimum 24-gauge galvanized steel.

8. Finish: Shop coat of rust inhibitive primer on non-galvanized surfaces and operating mechanisms. Guides and bracket plates will be coated with a flat black prime paint.
   a. Galvanized Steel:
      1) Brown baked on primer.

9. Operation: Door will be operated by means of:
   a. Chain hoist.

10. Governor: If required by the size for chain hoist or motor driven doors, provide a viscous governor to regulate the rate of descent of door in a quiet manner. Use an engagement type that is not engaged during normal door operation, but after cable release, will retard the speed during automatic door closure to under 24 inches per second and not less than 6 inches per second per NFPA 80.

11. Label: Provide rolling fire doors certified with the following listing.
   a. UL 3-Hour Class A Label for installation on masonry or steel jamb walls (face mounted). Door may be welded to the face of steel jambs.

12. Mounting:
   a. Steel jambs,

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install rolling fire doors in accordance with the manufacturer’s instructions and in accordance with the requirements of the National Fire Protection Association Standard 80 (NFPA 80).

C. Install door complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturers instructions, and as specified herein.

D. Fit, align and adjust rolling door assemblies level and plumb for smooth operation.

E. Upon completion of final installation, lubricate, test and adjust doors to operate easily, free from warp, twist or distortion and fitting for entire perimeter.

3.4 TESTING

A. Drop-test rolling steel fire doors in accordance with NFPA 80 and witnessed, attesting to their successful operation at the time of installation.

3.5 MAINTENANCE

A. Per NFPA 80, paragraph 15-2 4.3: All horizontal or vertical sliding and rolling fire doors shall be inspected and tested annually to check for proper operation and full closure. Resetting of the release mechanism shall be done in accordance with the manufacturers instructions. A written record shall be maintained by the building owner and made available to the authority having jurisdiction.

3.6 ADJUSTING

A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.

B. Adjust hardware and operating assemblies for smooth and noiseless operation.

3.7 CLEANING

A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.

B. Remove labels and visible markings.

C. Touch-up, repair or replace damaged products before Substantial Completion.

3.8 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 08 4313

ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Aluminum Framed Storefront work as is indicated on the drawings or specified herein including, but not limited to, the following described items.
B. Aluminum-framed windows.
   1. Exterior.
C. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.
B. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.
D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2021.
E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2020.
F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
L. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).
M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).
N. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
O. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
P. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.
E. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.
F. Warranty: Submit manufacturer warranty and ensure forms have been completed in South Sanpete School District 's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.
C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.
B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.08 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide five-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
D. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Manufacturer:
    1. Kawneer North America: www.kawneer.com.
        a. Exterior Storefront System: Trifab VG 451T; Thermal System.

B. Other Manufacturers: Subject to compliance with all of the requirements of this section, products by one of the following will be acceptable:
   1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com.
   2. Oldcastle Building Envelope: www.oldcastlebe.com.
   3. Tubelite, Inc: www.tubeliteinc.com.
   4. EFCO Corp: www.efcocorp.com.
   5. Arcadia: www.arcadiainc.com.
   6. Manko Window System, Inc.: www.mankowindows.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. This Contractor/Manufacturer, along with Section 08 8000, shall certify that the specified storefront/glazing assembly meets or exceeds the Utah Energy Code standards (based on ICC (IECC)) as a part of submittal approval.
   1. Minimum Storefront Assembly Overall Design U-Value: 0.50.
   2. Minimum Storefront Assembly Overall Design Solar Heat Gain Coefficient: 0.48.

B. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   1. Design Wind Loads: Comply with requirements of ICC (IBC)
   2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

C. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.

D. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, measured at specified differential pressure across assembly in accordance with ASTM E283.

E. Condensation Resistance Factor: Measure in accordance with AAMA 1503 with 1 inch (25 mm) insulating glass installed.

F. Water Leakage: None, when measured in accordance with ASTM E331 at specified pressure differential.

G. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

H. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line withinside pane of glass and heel bead of glazing compound.

I. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12-hour period without causing detrimental effect to system components, anchorages, and other building elements.

2.03 EXTERIOR STOREFRONT SYSTEM

A. Aluminum-Framed Storefront: Factory fabricated, factory finished, tubular aluminum framing members, thermally broken with interior section insulated from exterior, drainage holes, internal weep drainage system, related flashings, anchorage and attachment devices.
   1. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.
   2. Unitized, shop assembly.
   3. Glazing Position: Front Set.
   4. Glazing Stops: Flush. Type for 1 inch (25 mm) insulating glazing.
   5. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
   6. Horizontal Sill Dimensions: 4 inches high by 4 1/2 inches deep.

7. Water Leakage Test Pressure Differential: 8.00 lbf/sq ft.
8. Air Infiltration Test Pressure Differential: 6.24 psf.
9. Condensation Resistance Factor: 35 (thermally broken) minimum.
10. Finish: Anodized Dark Bronze.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Framing members for interior applications need not be thermally broken.
   2. Glazing stops: Flush. Type for 1 inch (exterior) and 1/4 inch (interior) glazing.
   3. Structurally Reinforced Members: Extruded aluminum with internal reinforcement of structural steel member.

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M); 6063-T6 alloy and temper.
B. Sheet Aluminum: ASTM B209/B209M.
C. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
D. Fasteners: Stainless steel, where exposed.
E. Perimeter Anchors: Aluminum. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
F. Exposed Flashings: Aluminum sheet, 20 gauge, 0.032 inch minimum thickness; finish to match framing members.
G. Perimeter Sealant: As recommended by manufacturer for project specific conditions.
H. Glazing Gaskets: Extruded EPDM rubber. Type to suit application to achieve weather, moisture, and air infiltration requirements.
I. Glazing Accessories: See Section 08 8000.
J. Thermal Barrier: Thermal break with a 1/4 inch (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.
K. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.06 FINISHES

A. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 clear anodic coating not less than 0.7 mils thick.
B. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 integrally colored anodic coating not less than 0.7 mils thick.
C. High Performance Organic Coating: AAMA 2604; multiple coats, thermally cured fluoropolymer system.
D. Superior Performing Organic Coatings System: Manufacturer's standard multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent polyvinylidene fluoride (PVDF) resin, and at least 80 percent of aluminum extrusion and panel surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
E. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch.
   1. Manufacturers:
      a. PPG; Duranar: www.ppgmetalcoatings.com.
      b. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
F. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
B. Prepare components to receive anchor devices. Fabricate anchors.
C. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
    1. Epoxy paint or self adhered waterproof membrane may also be used.
D. Arrange fasteners and attachments to conceal from view.
E. Reinforce interior horizontal head rail to receive roller window shade brackets and attachments.
F. Reinforce components internally for door hardware and door operators.
G. Reinforce framing members for imposed loads.
H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
    1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.
B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.
B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
C. Provide alignment attachments and shims to permanently fasten system to building structure.
D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
E. Provide thermal isolation where components penetrate or disrupt building insulation.
F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
J. Set thresholds in bed of sealant and secure.
K. Install glass using glazing method required to achieve performance criteria; see Section 08 8000.
L. Install perimeter sealant in accordance with manufacturer's written instructions.
M. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent testing and inspection requirements.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

3.06 PROTECTION

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

END OF SECTION 08 4313

SECTION 08 7100

DOOR HARDWARE AND SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Door Hardware work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.

B. Commercial door hardware for the following:
   1. Swinging doors.
   2. Fire-rated swinging doors.
   3. Other doors to the extent indicated.
   4. Cylinders for doors specified in other Sections.
   5. Electrified door hardware.

C. Do not include sales tax. Refer to Section 00 0104 – Notice to Contractors.

1.2 RELATED SECTIONS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Division 26 – Electrical: Connections to electrical power system and for low-voltage wiring work.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.4 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets, if requested.
   1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

C. Qualification Data: For Installer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for locks, latches, and closers as requested.

E. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

F. Warranty: Special warranty specified in this Section.

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

1. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
2. Content: Include the following information:
   a. Identification number, location, hand, fire rating, and material of each door and frame.
   b. Type, style, function, size, quantity, and finish of each door hardware item.
   c. Complete designations of every item required for each door or opening including name and manufacturer.
   d. Fastenings and other pertinent information.
   e. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   f. Explanation of abbreviations, symbols, and codes contained in schedule.
   g. Mounting locations for door hardware.
   h. Door and frame sizes and materials.
   i. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
   j. List of related door devices specified in other Sections for each door and frame.

3. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
   1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's Security Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
   1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
   2. Preliminary key system schematic diagram.
   3. Requirements for key control system.
   4. Address for delivery of keys.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

1.7 COORDINATION

A. Coordinate layout and installation of recessed hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Coordinate with aluminum entrance door supplier for door hardware installation.

D. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system.

E. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.8 WARRANTY

A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of operators and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

   2. Warranty Period: Three (3) years from date of Substantial Completion, except as follows:
      a. Exit Devices: Two (2) years from date of Substantial Completion.
      b. Manual Closers: Ten (10) years from date of Substantial Completion.

B. The Contractor shall guarantee his work for a period of 1 year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six (6) months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Products:
      a. Finish: Shall be US26D, unless otherwise noted.
      b. Manufacture Standard:
         1) Butts: Hager, McKinney, Stanley, Ives*
         2) Locksets: Best, Schlage*

3) Cylinders: Best* (Owner's Standard)
4) Closers: LCN* (Owner's Standard)
5) Exit Devices: Von Duprin* (Owner's Standard)
6) Trim: BBW, Rockwood, Hager, Ives*
7) Weatherstrip: Pemko, Hager, National Guard*
8) Continuous Hinges: HagerRoton, Markar, Ives*
9) Magnetic Door Holders: ABH* Rixson,
10) Rem Mullion: Von Duprin*

B. Substitution requests will be made in accordance with Section 01 6000 – Product Requirements and must meet the performance and manufacturing criteria of this specification section.

2.2 SCHEDULED HARDWARE

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of finish hardware are indicated in the "Hardware Schedule" at the end of this Section. Products are identified by using hardware designation numbers of the following:
   1. Manufacturer's Product Designations: The product designation and name of one manufacturer are listed for each hardware type required for the purpose of establishing minimum requirements. Provide either the product designated or, where more than one manufacturer is specified under the Article "Manufacturers" in Part 2 for each hardware type, the comparable product of one of the other manufacturers that complies with requirements.
   2. ANSI/BHMA designations used elsewhere in this Section or in schedules to describe hardware items or to define quality or function are derived from the following standards. Provide products complying with these standards and requirements specified elsewhere in this Section.

      a. Butts and Hinges: ANSI A156.1.
      b. Bored and Preassembled Locks and Latches: ANSI/BHMA A156.2.
      c. Exit Devices: ANSI A156.3.
      d. Door Controls - Closers: ANSI A156.4.
      e. Auxiliary Locks and Associated Products: ANSI/BHMA A156.5.
      f. Architectural Door Trim: ANSI A156.6.
      g. Template Hinge Dimensions: ANSI A156.7.
      h. Door Controls - Overhead Holders: ANSI A156.8.
      i. Mortise Locks and Latches: ANSI A156.13.
      j. Closer Holder Release Devices: ANSI A156.15.
      k. Auxiliary Hardware: ANSI A156.16.
      l. Self-Closing Hinges and Pivots: ANSI A156.17.
      m. Materials and Finishes: ANSI A156.18.

2.3 MATERIALS AND FABRICATION

A. Base Metals: Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

B. Fasteners: Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

C. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

D. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.4 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: As indicated in hardware sets.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Stainless steel with stainless-steel pin.
   2. Interior Hinges: Steel with steel pin.
   3. Hinges for Fire-Rated Assemblies: Steel with steel pin.

E. Hinge Options: Where indicated in door hardware sets or on Drawings:
   1. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
   2. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging doors.
   3. Corners: Square.

F. Fasteners: Comply with the following:

   1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
   2. Wood Screws: For wood doors and frames.
   3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

2.5 CONTINUOUS HINGES

A. Hinges shall be a geared continuous hinge utilizing a single gear section for the door leaf and a separate gear section for the frame side of the door. The door leaf and jamb leaf shall fully mortised where scheduled, and full surface where scheduled. Geared hinges are to be certified to ANSI 156.25, Grade 2 and UL 10C tested and approved for 90 minutes.

2.6 LOCKS, LATCHES, AND BOLTS

A. Strikes: Provide manufacturer's standard wrought box strike for each latch or lock bolt, with curved lip extended to protect frame, finished to match hardware set, unless otherwise indicated.

B. Lock Throw: Provide 5/8-inch (16-mm) minimum throw of latch on pairs of doors. Comply with UL requirements for throw of bolts and latch bolts on rated fire openings.

C. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (300-mm-) long rod for doors up to 84 inches (2100 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2100 mm) in height.

D. Cylindrical Locks - ANSI A156.2 Series 4000, Grade 1 Strength and Operational requirements. Meets A117.1 Accessibility Codes. Latch bolts shall be steel with minimum ½" throw, deadlocking on keyed and exterior functions. ¾" throw anti-friction latchbolt on pairs of fire doors. Locksets to be tested to exceed 3,000,000 cycles. Lock case shall be steel. Lock shall incorporate one piece spring cage and spindle. Provide 5/8" minimum throw of latch and deadbolt used on pairs of doors. Locks must be compatible with owner's standard cores. Provide Seven Year Warranty.

2.7 KEYING REQUIREMENTS

A. Furnish temporary keyed cores for the construction period, and remove these when directed. The construction cores remain property of the supplier and shall be returned to the supplier when they are removed. Contractor shall install the permanent cores in the presence of the owner's representative.

B. Key Cylinders: Small format interchangeable core, utility patented, 7-pin solid brass construction.

C. Cylinders/Cores: Schlage Primus Cylinders.

2.8 KEY CONTROL CABINET

A. BHMA A156.5; 20 gage metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.

B. Wall mounted cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.9 CLOSERS

A. Accessibility Requirements: Where handles, pulls, latches, locks and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural Transportations Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
   1. Comply with the following maximum opening-force requirements:
      a. Interior, Non-fire-rated Hinged Doors: 5 lbf applied perpendicular to door.

b. Fire Doors: Minimum opening force allowable by Authorities Having Jurisdiction (AHJ).

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15lbf to open door to minimum required width.

C. Cylinder: Shall be of high strength cast iron construction. All door exterior closers shall be tested to ANSI/BHMA A156.4 test requirements by a BHMA certified independent testing laboratory. A written certification showing successful completion of a minimum of 10,000,000 cycles for all exterior door closers must be provided. Cylinder shall have been manufactured and in the marketplace for a minimum of 10 years

D. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory sized closers, adjustable to meet field conditions and requirements for opening force.

E. Surface Closers: BHMA A156.4 Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
1. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body. Double heat-treated pinion shaft, single piece forged piston, chrome silicon steel spring.
2. XL cylinder body to have 1½" piston diameter with ¾" journal double heat treated shaft, (.1421" teeth thickness,) 5/8" full complement bearings, chrome silicon steel spring.
3. Cylinder body to have "FAST" power adjust speed dial to show spring size power.
4. Closers to have forged steel main arm and forearm for REG, EDA and CUSH type arms
5. ISO 2000 certified. Units stamped with date-of-manufacture code.
6. Independent lab-tested 10,000,000 cycles.
7. Thru-bolts at wood doors unless doors are provided with closer blocking. Non-sized, non-handed, and adjustable. Place closer inside building, stairs, and rooms.
8. Plates, brackets and special templating when needed for interface with particular header, door and wall conditions and neighboring hardware.
9. Opening pressure: Exterior doors 8.5 lb., interior doors 5 lb., labeled fire doors 15 lb.
10. Separate adjusting valves for closing speed, latching speed and backcheck, fourth valve for delayed action where scheduled.
11. Extra-duty arms (EDA) at exterior doors scheduled with parallel arm units.
12. Exterior doors do not require seasonal adjustments in temperatures from 120 degrees F to -30 degrees F, furnish data on request.
13. Non-flaming fluid will not fuel door or floor covering fires.
14. Pressure relief values are not allowed.

2.10 EXIT DEVICES/PANIC HARDWARE

A. General features: BHMA A156.3, Grade 1.

B. Accessibility Requirements: Where handles, pulls, latches, locks and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural Transportations Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15lbf to release the latch. Locks shall not require use of a key, tool of special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to AHJ for panic protection, based on testing according to UL 305.
   1. Independent lab-tested 10,000,000 cycles.
   2. Push-through touch pad design. No exposed touch bar fasteners, no exposed cavities when operated. Return stroke fluid dampeners and rubber bottoming dampeners, plus anti-rattle devices.
   3. No exposed screws to show through glass doors.
   4. Non-handed basic device design with center case interchangeable with all functions, no extra parts required to effect change of function.

E. Specific features:
   1. Non-Fire Rated Devices: As scheduled in hardware sets.
   2. Lever Trim: Vandal resistant, forged brass or bronze escutcheon min .130” thickness, match lockset lever design.
   3. Fire-Labeled Devices: UL label indicating “Fire Exit Hardware”. Vertical rod devices less bottom rod (LBR) unless otherwise scheduled.
   4. Electrically Operated Devices: Single manufacturer source for electric latch retraction devices, electrically controlled trim, power transfers, power supplies, monitoring switches and controls.
   5. Furnish all exit devices with deadlocking latchbolts.
   6. End caps shall be sloped and of heavy-duty metal alloy construction and provide horizontal adjustment to provide flush alignment with device cover plate. When device end cap is installed, no raised edges will protrude. End cap shall be cast metal or forged aluminum and have a minimum thickness of (.250"). Plastic or metal stamping will not be acceptable.
   7. Provide all shim kits and filler plates to allow flush mounting of exit devices on all types of doors used in this project.
   8. Removable Mullions: Removable with single turn of building key. Securely reinstalled without need for key.

2.11 TRIM AND STOPS

A. Kick plates, mop plates, and armor plates, shall be .050 gauge with 32D finish. Kick plates to be 10” high, mop plates to be 5” high. All plates shall be two (2) inches less full width of door.

B. Push plates, pull plates, door pulls, and miscellaneous door trim shall be shown in the hardware schedule.

C. Doorstops shall be furnished for all doors to prevent damage to doors or hardware from striking adjacent walls or fixtures. Wall stops are preferred. Floor stops are used only where noted in hardware schedule. Where conditions prohibit the use wall type stops, furnish overhead stops either surface mounted or concealed as noted in hardware sets.

2.12 WEATHERSTRIPPING AND SEALS

A. General: Provide continuous weatherstripping on exterior doors and smoke, light, or sound seals on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.13 THRESHOLDS

A. General: Except as otherwise indicated, provide standard metal threshold unit of type, size, and profile as shown or scheduled.

2.14 ELECTRICAL HARDWARE

A. Furnish wiring diagrams to electrical contractor for use in installing electrical hardware products.

B. Electrical contractor to run all wiring and make all final connections for electrified hardware. Hardware supplier shall be responsible to furnish all wiring diagrams to operate electrified hardware. Access control material and electrified hardware to interface at junction boxes.

2.15 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and locksets (or push-pull units if no latch or lock sets).

B. Provide finishes that match those established by BHMA or, if none established, match the Architect's sample.

C. 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.

D. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

3.3 INSTALLATION

A. Pre-installation conference shall be conducted prior to installation of hardware at Project site. Meet with the, Owner, Contractor, installer, and manufacturers representatives. A separate pre-installation conference shall be conducted prior to the installation of electronic security hardware with the electrical contractor Review catalogs, brochures, templates, installation instructions, and the approved hardware schedule. Survey installation procedures and workmanship, with special emphasis on unusual conditions, as to ensure correct technique of installation, and coordination with other work. Notify participants at least ten, 10 working days before conference.

B. Hardware Installers must have a minimum of five (5) years experience in installation of hardware. Provide verification of installer's qualification to Consultant for approval. All installers to attend review meetings with the hardware distributor.

C. Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

D. Install head seal prior to installation of "PA"-parallel arm mounted door closers and push side mounted door stops/holders. Trim, cut and notch thresholds and saddles neatly to minimally fit the profile of the door frame. Install thresholds and saddles in a bed of caulking completely sealing the underside from water and air penetration.

E. Counter sink through bolt of door pull under push plate during installation.

F. Mounting Heights: Mount door hardware units at heights indicated, as follows, unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

G. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

H. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.7 DOOR HARDWARE SETS

A. The following schedule of hardware sets shall be considered a guide and the supplier is cautioned to refer to general conditions, special conditions, and the full requirements of this section. It shall be the hardware supplier's responsibility to furnish all required hardware.

B. Where items of hardware are not definitely or correctly specified and are required for completion of the Work, a written statement of such omission, error, conflict, or other discrepancy shall be sent to the Architect, prior to date specified for receipt of bids, for clarification by addendum.

C. Adjustments to the Contract Sum will not be allowed for omissions or items of hardware not clarified prior to bid opening.

DOOR HARDWARE SCHEDULE

HW SET: 01
DOOR NUMBER: (Includes but is not limited to the following doors)
E001A E001B E001D 102B E002A E002C
E002D 103C

ALL HARDWARE BY DOOR MANUFACTURER

HW SET: 02
DOOR NUMBER: (Includes but is not limited to the following doors)
103A

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	98L 996L 4'	626	VON
1	EA	RIM CYL HOUSING	20-079	626	SCH
1	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
1	EA	SURFACE CLOSER	4040XP HEDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR STOP	FS448	626	IVE
1	SET	SEALS	700SA (DO NOT CUT AROUND CLOSER BRACKET)	AL	NGP
1	EA	DOOR SWEEP	C627A	AL	NGP
1	EA	THRESHOLD	425HD	AL	NGP
1	EA	RAIN DRIP	144AA	AA	ZER

HW SET: 03
DOOR NUMBER: (Includes but is not limited to the following doors)
102A 103B

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	PANIC HARDWARE	98L 996L 3'	626	VON
1	EA	RIM CYL HOUSING	20-079	626	SCH
1	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
1	EA	SURFACE CLOSER	4040XP HEDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	700SA (DO NOT CUT AROUND CLOSER BRACKET)	AL	NGP
1	EA	DOOR SWEEP	C627A	AL	NGP
1	EA	THRESHOLD	425HD	AL	NGP
1	EA	RAIN DRIP (@DOOR 103B)	144AA	AA	ZER

HW SET: 04
DOOR NUMBER: (Includes but is not limited to the following doors)
101A

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	STOREROOM LOCK	ND80BDC RHO	626	SCH
1	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
1	EA	SURFACE CLOSER	4040XP HEDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	700SA (DO NOT CUT AROUND CLOSER BRACKET)	AL	NGP
1	EA	DOOR SWEEP	C627A	AL	NGP
1	EA	THRESHOLD	425HD	AL	NGP
1	EA	RAIN DRIP	144AA	AA	ZER

HW SET: 05
DOOR NUMBER: (Includes but is not limited to the following doors)
E001C E002B

EACH TO HAVE:

1	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
1	EA	RIM CYL HOUSING	20-079	626	SCH
1	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
1	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	MAGNETIC HOLD-OPEN	SEM 7850	AL	LCN
1	SET	SEALS	160S	AL	NGP

INTERFACE WITH FIRE LIFE SAFETY SYSTEM FOR IMMEDIATE RELEASE OF MAG HOLDERS IF ENGAGED IN THE EVENT OF A FIRE.

HW SET: 06
DOOR NUMBER: (Includes but is not limited to the following doors)
104A

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	SET	AUTO FLUSH BOLT	FB42	630	IVE
1	EA	CLASSROOM LOCK	ND70BDC RHO	626	SCH
1	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
1	EA	COORDINATOR	COR X FL X BRACKETS AS REQ'D	628	IVE
1	SET	ASTRAGAL	9605A 84"	CL	NGP
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	WALL STOP	WS407CCV	630	IVE
1	SET	SEALS	160S	AL	NGP

HW SET: 07
DOOR NUMBER: (Includes but is not limited to the following doors)
E003A **E011B**

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	MULLION	EXISTING REM MULLION		
2	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
2	EA	RIM CYL HOUSING	20-079	626	SCH
2	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	160S	AL	NGP

HW SET: 08
DOOR NUMBER: (Includes but is not limited to the following doors)
E011A

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	224HD	628	IVE
1	EA	MULLION	KR4954	689	VON
2	EA	FIRE EXIT HARDWARE	98L-F 996L	626	VON
2	EA	RIM CYL HOUSING	20-079	626	SCH
2	EA	CYLINDER CORE	PRIMUS CYLINDER(S)	626	SCH
2	EA	SURFACE CLOSER	4040XP EDA TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	SET	SEALS	160S	AL	NGP

END OF SECTION

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Glazing work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Insulating glass units.
C. Glazing compounds and accessories.
D. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for other than glazing purposes.
B. Section 08 4313 - Aluminum-Framed Storefronts: Exterior units to be glazed.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.
B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
E. ASTM C1036 - Standard Specification for Flat Glass; 2021.
F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.
G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.
I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.
J. GANA (GM) - GANA Glazing Manual; 2008.
K. GANA (SM) - GANA Sealant Manual; 2008.
L. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. ICC (IECC) - International Energy Conservation Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

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

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

D. Samples: Submit two samples 12 by 12 inch in sizeof glass units, showing coloration and design.
E. Manufacturer's Certificate: Certify that glass and glazing products meets or exceeds specified requirements.
    1. Refer to Sections 08 4313 and 08 4413 for assembly thermal performance compliance and certification.
F. This Contractor/Manufacturer along with Section 08 4313, shall comply with current edition of ICC (IECC) and submit (Component Modeling Approach) CMA Label Certificate that lists the performance for all aluminum framed fenestration systems for the project as a part of submittal approval. www.nfrc.org/CMA/

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM) and GANA (SM) for glazing installation methods. Maintain one copy on site.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 50 degrees F.
B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPES

A. Type G1 - Sealed Insulating Glass Units: Vision glazing, low-E.
    1. Between-lite space filled with air.
    2. Winter Thermal Resistance (U-Value): 0.29.
    3. Total Solar Heat Gain Coefficient: 0.23.
    4. Total Visible Light Transmittance: 54 percent.
    5. Basis of Design: PPG Industries, Inc: www.ppgideascapes.com.
    6. Outboard Lite: Heat-strengthened float glass, 1/4 inch (6 mm) thick.
        a. Coating: PPG Solarban 90 on #2 surface, no coating on #3 surface.
        b. Tint: Starphire (ultra clear).
    7. Inboard Lite: Annealed float glass, 1/4 inch (6 mm) thick.
        a. Tint: Starphire (ultra clear).
    8. Total Thickness: 1 inch (25 mm).
B. Safety Glazing:
    1. Applications: Unless specifically indicated on the drawings, glazing shall comply with ICC (International Building Code 2021 for locations of tempered glazing.)
    2. Use fully tempered float glass.
    3. Design Pressure: Calculated in accordance with ASCE 7.
    4. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

5. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/200 of their lengths under specified design load.
6. Glass thicknesses listed are minimum.

C. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
1. In conjunction with vapor retarder and joint sealer materials described in other sections.
2. To utilize the inner pane of multiple pane insulating glass units for the continuity of the vapor retarder and air barrier seal.
3. To maintain a continuous vapor retarder and air barrier throughout the glazed assembly from glass pane to heel bead of glazing sealant.

D. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

E. Refer to Sections 08 4313 for Assembly Thermal Performance Compliance and Certification.

2.02 GLASS MATERIALS

A. Float Glass Manufacturers:
1. AGC Flat Glass North America, Inc: www.na.agc-flatglass.com.
2. Guardian Industries Corp: www.sunguardglass.com.
3. Pilkington North America Inc: www.pilkington.com/na.
4. PPG Industries, Inc: www.ppgideascapes.com.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.
6. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
7. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality-Q3, color and performance characteristics as indicated.

2.03 SEALED INSULATING GLASS UNITS

A. Manufacturers:
1. Any of the manufacturers specified for float glass.
2. Fabricator certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.
3. Cardinal Glass Industries: www.cardinalcorp.com.
4. Guardian Industries Corp: www.sunguardglass.com.
5. Viracon, Apogee Enterprises, Inc: www.viracon.com.
6. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Sealed Insulating Glass Units: Types as indicated.
1. Locations: Exterior, except as otherwise indicated.
2. Durability: Certified by an independent testing agency to comply with ASTM E2190.
3. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
4. Metal Edge Spacers: Aluminum, bent and soldered corners.
5. Spacer Color: Black.
6. Edge Seal: Glass to elastomer with supplementary silicone sealant.
7. Color: Black.
8. Purge interpane space with dry air, hermetically sealed.

2.04 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color, non-skinning.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25;grey color as selected by architect.
C. Manufacturers:
    1. Bostik Inc: www.bostik-us.com.
    2. Dow Corning Corporation: www.dowcorning.com/construction.
    3. Momentive Performance Materials, Inc, exclusive licensee of General Electric: www.siliconefor building.com.
    4. Pecora Corporation: www.pecora.com.
    5. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.05 GLAZING ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option I. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.
C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compoundwith integral resilient spacer rod applicable to application indicated; 10 to 15 cured Shore A durometer hardness; coiled on release paper; black color.
    1. Manufacturers:
        a. Pecora Corporation: www.pecora.com.
        b. Tremco Global Sealants: www.tremcosealants.com.
        c. Saint-Gobain Performance Plastics: www.plastics.saint-gobain.com.
        d. Substitutions: Refer to Section 01 6000 - Product Requirements.
D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option I; grey color as selected by Architect.
E. Glazing Clips: Manufacturer's standard type.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

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

3.04 INSTALLATION - EXTERIOR WET/DRY GLAZING METHOD (PREFORMED TAPE AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.
B. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
C. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
D. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
E. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
F. Install removable stops, with spacer strips inserted between glazing and applied stops 1/8 inch below sight lines.
    1. Place glazing tape on glazing pane of unit with tape flush with sight line.
G. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
H. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
B. Remove non-permanent labels immediately after glazing installation is complete.
C. Clean glass and adjacent surfaces after sealants are fully cured.
D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION 08 8000

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SECTION 09 0561

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Floor Preparation work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
   1. Resilient flooring (VCT).
B. Removal of existing floor coverings.
C. Preparation of existing concrete floor slabs for installation of floor coverings.
D. Testing of concrete floor slabs for moisture and alkalinity (pH).
E. Patching compound.
F. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 4300 - Quality Assurance: Additional requirements relating to testing agencies and testing.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.
B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 2020.
C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.
B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.
C. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's qualification statement.
   2. Manufacturer's statement of compatibility with types of flooring applied over remedial product.
   3. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
   4. Manufacturer's installation instructions.

5. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

D. Testing Agency's Report:
1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Recommendations for remediation of unsatisfactory surfaces.
6. Product data for recommended remedial coating.
7. Include certification of accuracy by authorized official of testing agency.
8. Submit report to Architect.
9. Submit report not more than two business days after conclusion of testing.

E. Adhesive Bond and Compatibility Test Report.

1.06 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing may be performed by an independent testing agency employed and paid by Owner.
1. If required, Contractor shall schedule testing.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.
B. Deliver materials in manufacturer’s packaging; include installation instructions.
C. Keep materials from freezing.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.
B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

1.09 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
   2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.
   3. Products:
      a. ARDEX Engineered Cements; ARDEX Feather Finish: www.ardexamericas.com.
      b. Floor Seal Technology, Inc; Color Match Patch: www.floorseal.com.
      c. H.B. Fuller Construction Products, Inc; TEC Feather Edge Skim Coat: www.tecspecialty.com.
      d. USG Corporation; Durock Brand Advanced Skim Coat Floor Patch: www.usg.com.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for concrete slab relative humidity moisture up to 95 percent; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Thickness: As required for application and in accordance with manufacturer's installation instructions.
   2. Use product recommended by testing agency.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Follow recommendations of testing agency.

B. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.
   8. Adhesive bond and compatibility test.
   9. Protection.

3.02 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
C. Test in accordance with ASTM F1869 and as follows.
D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.
E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.
F. Report: Report the information required by the test method.

3.03 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.
    1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.
    2. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.
    3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.
C. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.04 PH TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
B. Note: This procedure is the equivalent of that described in ASTM F710; repeated here for the Contractor's convenience.
C. Use a wide range pH paper, its associated chart, and distilled or deionized water.
D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch (25 mm) in diameter. Allow the puddle to set for approximately 60 seconds, then dip the pH paper into the water, remove it, and compare immediately to chart to determine pH reading.
E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of limits, perform remediation if any test value is over 10.

3.05 PREPARATION

A. See individual floor covering section(s) for additional requirements.
B. Comply with requirements and recommendations of floor covering manufacturer.
C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
D. Do not fill expansion joints, isolation joints, or other moving joints.

3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.07 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION 09 0561

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SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Acoustical Ceiling work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Suspended metal grid ceiling system.
C. Acoustical panels.
D. Accessories.
E. Do not include sales tax, refer to Section 00 0102 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Division 28 - Fire Detection and Alarm: Fire alarm components in ceiling system.
C. Division 21 - Fire Suppression Sprinkler Systems: Sprinkler heads in ceiling system.
D. Division 23 - Air Outlets and Inlets: Air diffusion devices in ceiling.
E. Division 26 - Interior Lighting: Light fixtures in ceiling system.
F. Division 27 - Public Address Systems: Speakers in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.
B. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.
C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.
D. ASTM C635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
C. Product Data: Provide data on suspension system components and acoustical units.
D. Samples: Submit two samples 12 x 12 inch (300 x 300 mm) in size illustrating material and finish of acoustical units.
E. Samples: Submit two samples each, 12 inches long, of suspension system main runner, cross runner, and perimeter molding.
F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: 2 unopened cartons of each type of acoustical ceiling panel.

1.06 QUALITY ASSURANCE

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

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees Fahrenheit, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

1.08 GUARANTEE

A. The Contractor shall guarantee his work for a period of 1 year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Manufacturers:
   1. CertainTeed Corporation: www.certainteed.com.
   2. Substitutions: See Section 01 6000 - Product Requirements.
B. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: As specified in Section 01 6116.
C. Acoustical Tile Type 1: Mineral Fiber, ASTM E 1264 Type III, with the following characteristics:
   1. Size: 24 x 48 inches (600 x 1200 mm).
   2. Thickness: 3/4 inches.
   3. Composition: Water felted.
   4. Light Reflectance: 0.83 to 0.85 percent, determined as specified in ASTM E1264.
   5. NRC: 0.70, determined as specified in ASTM E 1264.
   6. Ceiling Attenuation Class (CAC): 35 to 40, determined as specified in ASTM E1264.
   7. Edge: Square.
   8. Surface Color: White.
   9. Surface Pattern: Fissured.
   10. Product: HHF-497 HNRC Fine Fissured High NRC by CertainTeed (Match Existing).
   11. Suspension System: Exposed grid Type 1 (Match Existing)

2.02 SUSPENSION SYSTEM(S)

A. Manufacturers:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. Chicago Metallic Corporation: www.chicagometallic.com.
   4. USG: www.usg.com.
   5. Substitutions: See Section 01 6000 - Product Requirements.
B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
C. Exposed Steel Suspension System - Type 1: Formed steel, commercial quality cold rolled; heavy-duty and non-rated (Verify with existing system).
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.

3. Finish: White or Black painted (to match ceiling tiles).
4. Product: Donn DX by USG.
5. Product: Classic Stab System by CertainTeed.
6. Product: Prelude XL by Armstrong.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide 7/8 x 7/8 inch (22 mm) wall molding with seismic clip for mounting at same elevation as face of grid.
      a. Product: ACM7 Seismic Clip manufactured by USG.
      b. Product: BERC2 Seismic Clip manufactured by Armstrong.
C. Touch-up Paint: Type and color to match acoustical and grid units.
D. Suspension and Lateral Bracing Wire: #12 gauge SWG galvanized steel wire.
E. Escutcheon Ring for Pipe Penetrations: 2 inch escutcheon ring with built-in hole cutter.
   1. Color: White.
   2. Manufacturers:
      a. Premier Mounts; Product - "HCER": www.premiermounts.com.
F. Steel Stud System (vertical seismic struts):
   1. Shall be type, gauge, and size as shown on drawings.
   2. Manufacturers:
      a. Dietrich Metal Framing: www.dietrichindustries.com.
      b. Cemco Steel: www.cemcosteel.com.
      c. Scafco Corporation: www.scafco.com.
      d. The Steel Network Inc: www.SteelNetwork.com.
      e. Telling Industries: www.tellingindustries.com.
      f. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.
   1. Hangar wires shall be supported from steel joist structure. Spacing of wires for all suspended grid system ceilings shall not exceed 4 feet o.c. each way. Splayed hangers may be provided. Hanger wires shall be installed with a minimum of 3 turns around itself, both top and bottom. Hanging wires greater than 15 degrees out of plumb shall be splayed by bracing, counter-splaying or trapeze supports.
B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
C. Locate system on room axis according to reflected plan, avoid tiles less than 6 inches when cut.
D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   1. Additional lateral force support bracing wires as required for ceiling system, light fixtures, partition head loads, mechanical air terminals, etc., shall comply to IBC Standard, Section 47-18 and the latest CISCA Standards. In case of conflict, adhere to most stringent requirements as accepted by the Architect and without extra cost to the Owner.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.
   3. Overlap and rivet corners.

L. Form expansion joints as detailed on drawings or as directed by Architect. Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

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

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

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

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

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

G. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

H. Where round obstructions and bullnose concrete block corners occur, provide preformed closures to match perimeter molding.

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

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 SCHEDULE - REFER TO DRAWINGS

END OF SECTION 09 5100

SECTION 09 6500

RESILIENT FLOORING VCT / MCT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Resilient Flooring work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Resilient tile flooring, VCT.
C. Resilient base.
D. Installation accessories.
E. Floor finishing accessories.
F. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM E662 - Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials; 2021a, with Editorial Revision.
B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).
C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.
D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
E. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.
F. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.
I. NFPA 258 - Recommended Practice for Determining Smoke Generation of Solid Materials; 2001.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Shop Drawings: Indicate locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts. Provide details of special patterns.
D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
E. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.

F. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
I. Manufacturer's Field Reports: Manufacturer's field reports specified herein.
J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: 2 cartons or 5 percent of each type and color.
    3. Extra Wall Base: 50 linear feet of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
    1. Whenever possible, provide each type of resilient flooring as provided by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.
B. Installer Qualifications: Company specializing in installing specified flooring with minimum three yearsdocumented experienceand approved by flooring manufacturer.
C. Regulatory Requirements:
    1. Fire Performance Characteristics: Provide resilient linoleum tile flooring with the following fire performance characteristics as determined by testing products in accordance with ASTM method indicated below by a certified testing laboratory or another testing and inspecting agency acceptable to authorities having jurisdiction:
    2. Critical Radiant Flux: Class 1 Rating per NFPA 253 (ASTM E648) (0.45 watts/cm² or greater).
    3. Smoke Density: Less than 450 per NFPA 258 (ASTM E662).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
B. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
C. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
D. Storage and Protection: Store materials protected from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
    1. Material should be stored in areas that are fully enclosed, weathertight with the permanent HVAC system set at a uniform temperature of at least 68 degrees F (20 degrees C) for 48 hrs. prior to, during and after installation.
    2. Move resilient flooring and installation accessories into spaces where they will be installed at least 48 hours before installation, unless longer conditioning periods are required by manufacturer.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

B. Substrate Conditions: Use the methods described below to determine the dryness and pH as required to ensure initial and long-term success. Testing to be done by an Independent Testing Agency, refer to Section 01 4000.
   1. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.
      a. This test method covers the quantitative determination of percent relative humidity in concrete slabs for field or laboratory tests.
      b. The relative humidity measured from the center of the concrete slab should not exceed 75 percent. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
      c. Report the following information:
         1) Name and address of the structure.
         2) Date and time measurements were made. Name, title, and affiliation of worker performing the measurements.
         3) Locations and depths of probe holes within the structure.
         4) Relative humidity in each probe hole, to the nearest percent relative humidity.
         5) Temperature in each probe hole, to the nearest degree Celsius (Fahrenheit).
         6) Ambient air temperature, to the nearest degree Celsius (Fahrenheit) and relative humidity (to the nearest percent relative humidity) above each probe hole.
         7) Make, model, and last calibration date of the instrument used to make the measurements.
         8) Report any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.
   2. ASTM F1869 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride:
      a. This test method covers the quantitative determination of the rate of moisture vapor emitted from below-grade, on-grade, and above-grade (suspended) concrete floors.
      b. The moisture vapor emissions rate should not exceed 5.0 lbs per 1,000 square feet within a 24-hour period. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
      c. Number of Tests and Locations:
         1) Perform three tests for the first 1000 ft2 (100 m2) and at least one additional test for each additional 1000 ft2 (100m2). Select test locations to provide information about moisture distribution across the entire concrete floor slab, especially areas of potential high moisture. For slabs on-grade and below-grade, include a test location within 1 m (3 ft) of each exterior wall.
         2) The General Contractor shall be responsible for conducting one calcium chloride test for every 1,000 square feet (minimum 3 tests) to ensure concrete moisture emissions do not exceed 5.0 lbs per 1,000 square feet within a 24-hour period. If the test results exceed the limitations, the installation must not proceed until the problem has been corrected.
         3) Report the following information:
            (a) Name and address of the structure.
            (b) Date and time measurements were made.
            (c) Name, title, and affiliation of worker performing the measurements.
            (d) Diagram of the area showing the locations of tests within the structure.
            (e) Results of each test conducted
         4) Report any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.

3. Contingency for High Moisture Readings: If at the time of testing the moisture readings are in excess of 5.0 lbs the General Contractor will initiate testing using petrographic analysis to determine if the Water Cement Ratio and sufficient hydration has taken place. If the Specifications were not followed in their entirety, water/cement ratio (as specified), and or the concrete surface has been inadequately hydrated the Contractor responsible for the placement of the cement shall be responsible for the costs associated with the petrographic analysis and subsequent remediation requirements.
4. Concrete pH Test: Perform pH tests on concrete floors regardless of the age or grade level. If the pH is greater than 10, it must be neutralized prior to beginning the installation.

C. Environmental Requirements/Conditions: In accordance with manufacturer's recommendations, areas to receive flooring should be clean, fully enclosed and weathertight with the permanent HVAC system operational and set at a minimum of 68 degrees F (20 degrees C) for a minimum of 7 days prior to, during, and 7 days after the installation. The flooring material should be conditioned in the same manner for at least 48 hours prior to the installation. Maximum temperature should not exceed 100 degrees F after installation. Areas to receive flooring shall be adequately lighted to allow for proper inspection of the substrate, installation and final inspection.

D. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

E. Finishing Operations: Install resilient flooring after finishing operations, including painting and ceiling operations, have been completed.

1.08 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
   1. Warranty Period: Five (5) year limited warranty commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SHEET FLOORING

2.02 TILE FLOORING

A. Vinyl Composition Tile - VCT: Homogeneous, with color extending throughout thickness
   1. Manufacturers:
      a. Armstrong Flooring, Inc: www.armstrongflooring.com.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Substitutions: See Section 01 6000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Size: 12 by 12 inch.
   5. Thickness: 0.125 inch.
   6. Pattern: None.

2.03 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Roppe Corporation; Contours Profiled Wall Base System: www.roppe.com.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Height: 4 inch.
   4. Thickness: 0.125 inch.
   5. Finish: Satin.
   6. Length: Roll.
   7. Color: 187 Blue by Roppe (match existing).
   8. Accessories: Premolded external corners, internal corners, and end stops.

2.04 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
C. Resilient Transition Strips:
   1. VCT to Concrete: SSR-XX-B manufactured by Johnsonite, Inc.
D. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Adjacent Surfaces Protection: Protect adjacent work areas and finish surfaces from damage during product installation.
B. Surface Preparation: Prepare floor substrate to be smooth, rigid, flat, permanently dry, clean and free of foreign materials such as dust, paint, grease, oils, solvent, curing and hardening compounds, sealers, asphalt and old adhesive residue.
C. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
D. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
E. Prohibit traffic until filler is fully cured.
F. Clean substrate.
G. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.
B. Install in accordance with manufacturer's written instructions.
C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.
2. Fit joints and butt seams tightly.
3. Set flooring in place, press with heavy roller to attain full adhesion.

D. Loose-Laid Installation: Set flooring in place in accordance with manufacturer's instructions.
E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
   1. Resilient Strips: Attach to substrate using adhesive.
G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
H. Install flooring in recessed floor access covers, maintaining floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half of a tile at perimeter
B. Lay tiles square with room axis, unless otherwise indicated CL Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures.
   1. Discard broken, cracked, chipped, or deformed tiles.
C. Lay field color tiles in basket-weave pattern with grain direction alternating in adjacent tiles.
D. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures, including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
E. Extend tiles into toe spaces, door reveals, closets, and similar openings.
F. Maintain reference markers, holes, and openings that are in place or marked for future cuffing by repeating on finish flooring as marked on subfloor. Use chalk or other non-permanent, non-staining marking device.
G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to comply with tile manufacturer's written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times
H. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
I. Roll resilient flooring using 100 lbs roller as required by resilient flooring manufacturer.
J. Do not install resilient flooring over expansion joints. Use expansion joint covers manufactured for use with resilient flooring. Refer to Section 07 9513 for expansion joint covers.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
C. Install base on solid backing. Bond tightly to wall and floor surfaces.
D. Scribe and fit to door frames and other interruptions.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.
B. Clean resilient flooring in accordance with manufacturer's instructions.
C. Tile Flooring:
   1. Sweep and/or dust all floors.

2. Scrub floor using “Stride” neutral cleaner. Rinse floor thoroughly.
3. Do not perform initial maintenance for a minimum of 5 days after installation has been completed. This is to allow the adhesive the proper time to set.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.
B. Protect installed product and finish surfaces from damage during construction. Remove and dispose of protective covering at time of Substantial Completion.

3.08 SCHEDULE - REFER TO DRAWINGS

END OF SECTION 09 6500

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SECTION 09 9113

EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Exterior Painting work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
   1. Field application of paints and on the following surfaces as applicable
      a. Steel.
      b. Galvanized metal.

B. Surface preparation of substrates as required for acceptance of painting, including high pressure washing, abrasive blasting, cleaning, small crack repair, patching, and caulking..

C. Field application of paints.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. The term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
   2. Finish top, bottom, and side edges of exterior doors the same as exposed faces.
   3. Exposed surfaces of steel lintels and ledge angles.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Non-metallic roofing and flashing.
   6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, zinc, and lead.
      a. Unless indicated.
   7. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
   8. Glass.

F. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Shop-primed items.

B. Section 07 1900 - Exterior Water Repellents and Graffiti Resistant Sealers

C. Section 09 9123 - Interior Painting.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523, a matte flat finish.

C. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.

D. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.

E. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
F. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
G. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
D. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2016.
F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.
G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
H. SSPC-SP 2 - Hand Tool Cleaning; 2018.
I. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
    2. MPI product number (e.g. MPI #47).
    3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
    4. Manufacturer's installation instructions.
    5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
    1. Where sheen is specified, submit samples in only that sheen.
    2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
    3. Allow 30 days for approval process, after receipt of complete samples by Architect.
    4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.
D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
E. Manufacturer's Instructions: Indicate special surface preparation procedures.
F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.
    2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
    3. Label each container with color and type in addition to the manufacturer's label.

1.06 QUALITY ASSURANCE

A. This Contractor shall have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work. Contractor shall provide a list of the last three comparable jobs including, name and location, project manager, start/completion dates and value of painting work.
B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.
C. All surfaces requiring painting/coating shall be inspected by the Painting/Coating Manufacturer's Product Representative who shall notify the Architect and General Contractor in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate. The Manufacturer's Product Representative shall provide a written certification of all surfaces and conditions for paint or coating system application as well as on site supervision, inspection and approval of the application.
D. The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator/supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.
E. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
F. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.09 GUARANTEE

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.
B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
   2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
   3. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
   4. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
C. Basis of Design Products: Subject to compliance with requirements, provide company products indicated from one of the following:
   1. Sherwin-Williams.
   2. Benjamin Moore.
   3. PPG Architectural Finishes, Inc: (Devoe Paints).
D. Other Manufacturers:
   1. Other manufacturers shall be allowed to submit as a proposed substitute **before bid time, no submittal time substitutions will be considered**. Proposed substitutes shall be prepared to furnish published literature verifying that the proposed substitution meets all requirements of the Specifications and is suitable for the intended use. The Owner and Architect will evaluate any proposed substitutions and will make the final determination as to whether or not the product is acceptable to them for this project. The Owner and Architect shall have the option of waiving minor technical variations of other manufacturers as a part of reviewing and awarding contract.
   2. Refer to Section 01 6000 - Product Requirements.
E. Primer Sealers: Same manufacturer as top coats.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. VOC Content: Utah Administrative Code R307-361 Products shall comply with VOC limits of authorities having jurisdiction and, for interior and exterior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
   1) Flat Paints and Coatings: 50 g/L.
   2) Non flat Paints and Coatings: 100 g/L.
   3) Dry-Fog Coatings: 150 g/L.
   4) Primers, Sealers, and Undercoaters: 100 g/L.
   5) Industrial maintenance Coatings Applied to Ferrous Metals: 250 g/L.
   6) Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7) Pretreatment Wash Primers: 420 g/L.
   8) Floor Coatings Foot Traffic: 100 g/L.
   9) Floor Coatings High Performance: 250 g/L.
   10) Shellacs, Clear: 730 g/L.
   11) Shellacs, Pigmented: 550 g/L.
   12) Wood Coatings: 275 g/L

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Chemical Content: The following compounds are prohibited:
   1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
   2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

E. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

F. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
   3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.03 PAINT SYSTEMS - EXTERIOR

A. Exterior Ferrous Metal: Semi-Gloss Finish
   HM Doors, Frames and Miscellaneous Metals
   1. Primer:
      a. Product: S/W Pro industrial Pro-Cryl Universal Metal Primer
      b. Product: PPG 90-19XX Pitt-Tech Interior/Exterior Acrylic Primer Finish DTM Industrial Enamel
      c. Product: BM Corotech Waterborne Bonding Primer V175
   2. 1st coat:
      a. Product: S/W Pro Industrial Acrylic Semi-gloss
      b. Product: PPG 90-1610 Pitt-Tech Plus EP DTM Acrylic Semi-Gloss Finish
      c. Product: BM 331 Corotech DTM
   3. 2nd coat:
      a. Product: S/W Pro Industrial Acrylic Semi-gloss
      b. Product: PPG 90-1610 Pitt Tech Plus DTM Acrylic Semi-Gloss Finish
      c. Product: BM 331 Corotech DTM

1.02 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

2.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.
B. Obtain written certification from Manufacturer's Product Representative that surfaces are ready to receive Work.
C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
D. Test shop-applied primer for compatibility with subsequent cover materials.

2.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or repair existing paints or finishes that exhibit surface defects.
D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
E. Seal surfaces that might cause bleed through or staining of topcoat.
F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
G. Concrete:
    1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
H. Galvanized Surfaces:
    1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
    2. Prepare surface according to SSPC-SP 2.
I. Ferrous Metal:
    1. Solvent clean according to SSPC-SP 1.
    2. All dirt, fabrication and cutting oils, accumulated salts, rust, and mill must be removed prior to application of finish materials.
    3. Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical or chemical methods as recommended as best practice by primer manufacturer.
    4. Shop-Primed Steel Surfaces to be Finish Painted: Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat. Re-prime entire shop-primed item.
    5. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
J. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

2.03 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
B. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
C. Do not apply finishes over dirt, rust, scale, grease, moisture, scuffed surfaces, or other conditions detrimental to formation of a durable coating film;
D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
E. Apply each coat to uniform appearance.
F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.
H. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.
    1. Brush Application: Use brushes best suited for the type of material applied; use brush of appropriate size for the surface or item being painted; produce results free of visible brush marks.
    2. Roller Application: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
    3. Spray Application: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
I. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
    1. Number of coats and film thickness required are the same regardless of application method.
    2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
    3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.
    4. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
J. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
    1. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
    2. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
    3. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
    4. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
    5. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
    6. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.

7. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
8. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.

2.04 FIELD QUALITY CONTROL

A. See Section 01 4300 - Quality Assurance, for general requirements for field inspection.
B. All surfaces, preparation and paint applications shall be inspected.
C. Manufacturer's Product Representative to provide field inspection and written certification of product application.
D. Painted exterior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Manufacturer's Product Representative and/or Architect:
   1. Brush/roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
   2. Evidence of poor coverage at rivet heads, plated edges, lap joints, crevices, pockets, corners and re-entrant angles.
   3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
   4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
   5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
E. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces:
   1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches (1000 mm).
   2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches (1000 mm).
   3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
   4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
F. Painted surfaces rejected by the Manufacturer's Product Representative and/or Architect shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs and sags shall be removed by a scraper or by sanding prior to application of paint.

2.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from site.

2.06 PROTECTION

A. Protect finishes until completion of project.
B. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.
C. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 9113

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SECTION 09 9123

INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Interior Painting work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Surface preparation of substrates as required for acceptance of painting, including high pressure washing, abrasive blasting, cleaning, small crack repair, patching, and caulking.
C. Field application of paints.
D. Materials for backpriming woodwork.
E. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
    1. If a surface, material, or item is not specifically mentioned, paint in the same manner as similar surfaces, materials, or items, regardless of whether colors are indicated or not.
    2. Finish surfaces behind movable equipment and furnishings the same as similar exposed surfaces.
    3. Finish surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.
    4. Finish semi-exposed structure, miscellaneous pipes, conduit, ducts, etc. visible through finished ceiling elements.
    5. Finish back sides of access panels and removable and hinged covers to match exposed surfaces.
    6. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
    7. Access ladders.
    8. Prime surfaces to receive wall coverings.
F. Do Not Paint or Finish the Following Items:
    1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
    2. Items indicated to receive other finishes.
    3. Tile backer board.
    4. Items indicated to remain unfinished.
    5. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
    6. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
        a. Unless indicated.
    7. Marble, granite, slate, and other natural stones.
    8. Floors, unless specifically indicated.
    9. Ceramic and other tiles.
    10. Brick, architectural concrete, cast stone, integrally colored plaster, and stucco.
    11. Glass.
    12. Concrete masonry units in utility, mechanical, and electrical spaces.
    13. Acoustical materials, unless specifically indicated.
    14. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.
B. Division 21 - Identification for Fire Suppression Piping and Equipment: Color coding scheme for items to be painted under this section.
C. Division 22 - Identification for Plumbing Piping and Equipment: Color coding scheme for items to be painted under this section.
D. Division 23 - Identification for HVAC Piping and Equipment: Color coding scheme for items to be painted under this section.
E. Division 26 - Identification for Electrical Systems: Color coding scheme for items to be painted under this section.
F. Section: 32 1723 - Pavement Markings: Painted pavement markings.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.
B. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523, a matte flat finish.
C. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, a high-side sheen flat, velvet-like finish.
D. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523, an eggshell finish.
E. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523, a satin-like finish.
F. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523, a semi-gloss finish.
G. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523, a gloss finish.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2019.
C. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).
D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
F. SSPC-SP 2 - Hand Tool Cleaning; 2018.
G. SSPC-SP 3 - Power Tool Cleaning; 2018.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used, with the following information for each:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
    2. Cross-reference to specified paint system(s) product is to be used in; include description of each system. Use same designations indicated on Drawings and in schedules.
    3. Manufacturer's installation instructions.
    4. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
    5. Product characteristics.

6. Primer requirements and finish specification.
7. Storage and handling requirements and recommendations.
8. Application methods.
9. Cautions.

C. Selection Samples: Submit a complete set of color chips that represent the full range (including premium) of manufacturer's color samples available.
   1. Allow 30 days for approval process, after receipt of complete samples by Architect.
   2. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, wood doors, and casework, have been approved.
   3. Where sheen is specified, submit samples in only that sheen.
   4. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
   5. Within a reasonable amount of time after all color related submittals have been reviewed and accepted, the Architect will issue the "Color Schedule" for the project which will include all required paint color selections for the Contractors use.

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 (200 mm) square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

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

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

1.06 MAINTENANCE MATERIAL SUBMITTALS

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

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

1.07 QUALITY ASSURANCE

A. This Contractor shall have a minimum of five (5) years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work. Contractor shall provide a list of the last three comparable jobs including, name and location, project manager, start/completion dates and value of painting work.

B. Material Safety Data Sheets: At project site maintain file of MSDS sheets for each product used; become familiar with and follow manufacturer's stated application and safety requirements.

C. All surfaces requiring painting/coating shall be inspected by the Painting/Coating Manufacturer's Product Representative who shall notify the Architect and General Contractor in writing of any defects or problems, prior to commencing painting work, or after the prime coat shows defects in the substrate. The Manufacturer's Product Representative shall provide a written certification of all surfaces and conditions for paint or coating system application as well as on site supervision, inspection and approval of the application.
D. The painting contractor shall receive written confirmation of the specific surface preparation procedures and primers used for all fabricated steel items from the fabricator/supplier to ascertain appropriate and manufacturer compatible finish coat materials to be used before painting any such work.
E. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.
F. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.08 MOCK-UP

A. See Section 01 4300 - Quality Assurance, for general requirements for mock-up.
B. 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 specified in Part 3.
        a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
        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.
C. Locate where directed by Architect.
D. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Deliver products to Project site in an undamaged condition in manufacturer's original sealed containers, complete with labels and instructions for handling, storing, unpacking, protecting, and installing. Packaging shall bear the manufacturer’s label with the following information:
    1. Product name and type (description).
    2. Batch date.
    3. Color number.
    4. VOC content.
    5. Environmental handling requirements.
    6. Surface preparation requirements.
    7. Application instructions.
B. Paint Materials: Store materials not in use in tightly covered containers in well-ventilated areas at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.
    1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.10 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 degrees F (10 and 35 degrees C).
B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F above the dew point, or to damp or wet surfaces.
D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.11 GUARANTEE

A. This Contractor shall guarantee his work for a period of One (1) years from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated from one of the following:
   1. Sherwin-Williams.
   2. PPG Paints.
   3. Kelly Moore Paint Company, Inc.
B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
C. Substitutions: See Section 01 6000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Material Compatibility:
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
   4. Supply each paint material in quantity required to complete entire project's work from a single production run.
   5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
   6. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.
B. VOC Content: Utah Administrative Code R307-361 Products shall comply with VOC limits of authorities having jurisdiction and, for interior and exterior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
   1. Flat Paints and Coatings: 50 g/L.
   2. Non flat Paints and Coatings: 100 g/L.
   3. Dry-Fog Coatings: 150 g/L.
   4. Primers, Sealers, and Undercoaters: 100 g/L.
   5. Industrial maintenance Coatings Applied to Ferrous Metals: 250 g/L.

6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Wood Coatings: 275 g/L.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.
4. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.
5. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.03 PAINT SYSTEMS - INTERIOR

A. CMU - Walls: Acrylic, eggshell finish
For: Classrooms, offices, etc.
1. Filler:
a. Product: S/W PrepRite Block Filler.
b. Product: PPG 6-7 Speed-hide Int./Ext. Masonry Latex Block Filler
2. 1st coat:
a. Product: S/W ProMar 200 Zero VOC HP Latex Eg-shel B20 Series
b. Product: PPG Speedhide Zero VOC Interior Paint 6-411ZV Series
3. 2nd coat:
a. Product: ProMar 200 Zero VOC HP Latex Eg-shel B20 Series
b. Product: PPG Speedhide Zero VOC Interior Paint 6-411ZV Series

B. CMU - Walls: Epoxy, Semi-Gloss Finish
For: Shops and Wrestling Room
1. Primer:
a. Product: S/W Loxon Block Surfacer
b. Product: PPG 4-100XI Perma Create Concrete Masonry Surfacer/Filler
2. 1st coat:
a. Product: S/W Pro Industrial Pre-catalyzed Water-Based Epoxy
b. Product: PPG Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss (16-510)
3. 2nd coat:
a. Product: S/W Pro Industrial Pre-catalyzed Water-Based Epoxy
b. Product: PPG Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss (16-510)

B. Gypsum - Walls: Acrylic, Eggshell Finish
For: Classrooms, offices, etc.
Gypsum walls under wall coverings, wood panels, galvanized metal panels - (2) coats primer only.
1. Primer:
a. Product: S/W ProMar 200 Zero VOC Interior Latex Primer
b. Product: PPG 6-4900XI Speed-hide Zero VOC Interior High Solids Latex Primer
2. 1st coat:
a. Product: S/W ProMar 200 Zero VOC HP Latex Eg-shel B20 Series
b. Product: PPG Manor Hall Interior Paint 82-410 Series
3. 2nd coat:
a. Product: ProMar 200 Zero VOC HP Latex Eg-shel B20 Series

b. Product: PPG Manor Hall Interior Paint 82-410 Series

B. Ferrous Metal: Epoxy Semi-Gloss Finish

HM doors, frames and miscellaneous metals

1. Primer:
   a. Product: S/W Pro Industrial Pro-Cryl Universal Metal Primer
   b. Product: PPG 4020 Pitt-Tech Interior/Exterior Primer Finish DTM Industrial Enamel
2. 1st Coat:
   a. Product: S/W Pro Industrial Pre-Catalyzed Water-Based Epoxy
   b. Product: PPG Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss (16-510)
3. 2nd Coat:
   a. Product: S/W Pro Industrial Pre-Catalyzed Water-Based Epoxy
   b. Product: PPG Pitt Glaze WB1 Interior Pre-Catalyzed Semi-Gloss (16-510)

B. Exposed Ceilings: Acrylic Dryfall Flat Finish

To Include: Fire Riser Room, Structural Steel, Metal Deck.

1. Primer:
   a. Product: S/W Pro Industrial Pro-Cryl Universal Metal Primer.
   b. Product: PPG 4020 Pitt-Tech Plus Interior/Exterior Primer Finish DTM Industrial Enamel.
2. 1st coat:
   a. Product: S/W Pro Industrial Waterborne Acrylic Dryfall.
   b. Product: PPG 6-725XI Speed-hide Supertech Interior Flat White Dryfall.
3. 2nd coat:
   a. Product: S/W Pro Industrial Waterborne Acrylic Dryfall.
   b. Product: PPG 6-725XI Speed-hide Supertech Interior Flat White Dryfall

1.02 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
B. Patching Material: Latex filler.
C. Fastener Head Cover Material: Latex filler.

1.03 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 EXECUTION

2.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.
B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers. Where acceptability of substrate conditions is in question, apply samples and perform in-situ testing to verify compatibility, adhesion, and film integrity of new paint application.
   1. Report, in writing, conditions that may affect application, appearance, or performance of paint.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
   1. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
F. Test shop-applied primer for compatibility with subsequent cover materials.
G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

2.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
D. Seal surfaces that might cause bleed through or staining of topcoat.
E. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content, alkalinity of surfaces, or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.
   3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
G. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
H. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.
J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. 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:
      a. SSPC-SP 2, "Hand Tool Cleaning."
      b. SSPC-SP 3, "Power Tool Cleaning."
      c. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."

K. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

2.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
    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.
C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
E. Apply 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.
    1. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
    2. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.
G. Sand wood and metal surfaces lightly between coats to achieve required finish.
H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
I. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

2.04 FIELD QUALITY CONTROL

A. See Section 01 4300 - Quality Assurance, for general requirements for field inspection.
B. 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.

2.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from 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.

2.06 PROTECTION

A. Protect finishes until completion of project.
B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION 09 9123

SECTION 09 9724

SEALERS - INTERIOR PRECAST SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools, and services required to fully complete all Interior Sealer Finish work as is indicated on the drawings and/or specified herein including, but not limited to, the following items.
B. Sealer applied to existing interior masonry walls.
C. Low gloss sealer.
D. Surface preparation.
E. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors

1.02 RELATED REQUIREMENTS

A. Section 07 1900 - Exterior Water Repellents and Graffiti Resistant Sealers.
B. Section 07 9200 - Joint Sealants.

1.03 REFERENCE STANDARDS

A. ASTM C779/C779M - Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces; 2010.
B. ASTM C805/C805M - Standard Test Method for Rebound Number of Hardened Concrete; 2008.
C. ASTM C1028 - Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method; 2007e1.
D. ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test; 2009e2.
E. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005.
F. ASTM D5095 - Standard Test Method for Determination of the Nonvolatile Content in Silanes, Siloxanes, and Silane-Siloxane Blends Used in Masonry Water Repellent Treatments; 2007.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a meeting at least one week prior to starting work; require attendance of affected installers; invite Architect andSouth Sanpete School District .

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide product description, details of tests performed, limitations, and chemical composition.
C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention; cautionary procedures required during application.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Field Reports: Report whether manufacturer's best practices are being followed; if not, state corrective recommendations. Email report to Architect the same day as inspection occurs; mail report on manufacturer's letterhead to Architect within 2 days after inspection.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Sealer Material: Two gallons of the type installed.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by the manufacturer.
C. South Sanpete School District reserves the right to provide continuous independent inspection of surface preparation and application of sealer.

1.07 MOCK-UP

A. Masonry Walls: Prepare a representative surface 36 x 36 inch in size of Sealed Masonry Wall using specified materials and preparation and application methods on surfaces identical to those to be coated; approved mock-up constitutes standard for workmanship.
B. Mockup may remain as part of the Work, if undisturbed at time of Substantial Completion at the discretion of the Architect.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's sealed packaging, including application instructions.
B. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer

1.09 FIELD CONDITIONS

A. Maintain ambient temperature of between 50 and 90 degrees F (10 and 32 degrees C) during application and at least 48 hours after application.
B. Precautions shall be taken to avoid damage or contamination of any surfaces near the work zone. Protect completed dye work from moisture or contamination.

1.10 WARRANTY

A. Provide 5 year written guarantee on installation by sealer installer accompanied by written certification from Sealer Manufacturer verifying Manufacturer's installation requirements have been met. Guarantee shall cover defects in workmanship and include statement that sealer installer shall, at no additional expense to Owner and upon written notice from Owner, promptly correct or replace improper work and material that may become apparent within 60 months after date of final completion. Installer shall complete corrective work within 15 days of receipt of Owner's written notice unless other arrangements are made in writing with Owner. Installer's Guarantee shall be in form given in Section 01 7800.
B. Manufacturer shall provide a writteen warranty that warrants respective products applied in accordance with manufacturer's specifications for a period of 5 years from date of Substantial Completion, against water intrusion due to material failure. When notified of such conditions, in writing, by the Owner, the manufacturer shall provide materials, and the applicator shall provide the labor to correct said deficiencies promptly and without inconvenience or cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS - GENERAL

A. Volatile Organic Compound (VOC) Content:
   1. Provide coatings that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
1) Opaque, Flat: 50 g/L, maximum.
2) Opaque, Nonflat: 150 g/L, maximum.
3) Opaque, High Gloss: 250 g/L, maximum.
4) Varnishes: 350 g/L, maximum.
c. Architectural coatings VOC limits of State in which the project is located.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

B. Chemical Content: The following compounds are prohibited:
1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate., dimethyl phthalate, ethylbenzene, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.

C. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

D. Accessory Materials: Materials not specifically indicated but required to achieve the finishes specified; commercial quality.

2.02 INTERIOR MASONRY WALL SEALER

A. Low Sheen Sealer
1. Manufacturers:
a. Okon, Inc.; Product - "OKON S-40": www.okoninc.com.
b. BASF Building Systems; Product - MasterProtect H 185: www.buildingsystems.basf.com.
c. Evonik Industries (formerly Degussa); Product - "Protectosil Aqua-trete SG": www.evonik.com.
d. Sherwin-Williams Company; Loxon 7 Percent Siloxane, with VOC of Zero g/L: www.sherwin-williams.com.
e. Substitutions: See Section 01 6000 - Product Requirements.

B. Material:
1. Sealer material shall be clear, and colorless. When sprayed onto the hardened concrete it should penetrate the surface to become an integral part of the concrete by chemically reacting with the calcium hydroxide (lime and alkali) from the cement to form a non-soluble seal within the pores and capillaries of the concrete, permanently sealing it against ingress of moisture yet allowing the concrete to breathe. It should have a permeability of not more than 0.093 ml/m2/s in accordance with BS1881. Pt5: 1970 Initial Surface Absorption Test (ISAT). There should be no change to the surface characteristics after the application of the Deep Penetrating Sealer.
2. The material shall not be diluted by solvent or any other fluid.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify joint sealants are installed and cured.
C. Verify surfaces to be coated are dry, clean, and free of efflorescence, oil, or other matter detrimental to application of sealer.
    1. Unit Masonry: Below 12 percent.

3.02 PREPARATION

A. Protection of Adjacent Work:
    1. Protect adjacent surfaces not intended to receive sealers.
B. Prepare surfaces to be coated as recommended by manufacturer for best results.
C. Do not start work until masonry mortar substrate or concrete is cured a minimum of 60 days.
D. Remove loose particles and foreign matter.
E. Remove oil and foreign substances with a chemical solvent that will not affect sealer.
F. Scrub and rinse surfaces with water and let dry.
G. Allow surfaces to dry completely to degree recommended by manufacturer before starting coating work.

3.03 SEALER APPLICATION

A. Apply sealer in accordance with manufacturer's instructions, using procedures and application methods recommended for best results.
B. Apply at rate recommended by manufacturer, continuously over entire surface.
C. Remove sealer from unintended surfaces immediately by a method instructed by sealer manufacturer.

3.04 CLEANING AND PROTECTION

A. Collect waste material which may constitute a fire hazard, place in closed metal containers, and remove daily from site.
B. At the end of each workday, remove empty cans, rags, rubbish, and other discarded sealer materials from site.
C. Protect other work against damaged. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.
D. Provide "Wet Paint" signs to protect newly sealed finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
E. At completion of construction activities of other trades, touch up and restore damaged or defaced surfaces.

END OF SECTION 09 9724

SECTION 11 6623

GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Gymnasium Equipment work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Wall mounted protection pads (Wrestling).
C. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 01 2300 - Alternates: Alternate bidding for the work of this Section.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.
B. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
C. PS 1 - Structural Plywood; 2009 (Revised 2019).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
    1. Fire rating certifications.
    2. Manufacturer's installation instructions.
C. Shop Drawings: For custom fabricated equipment indicate, in large scale detail, construction methods; method of attachment or installation; type and gage, hardware, and fittings; plan front elevation; elevations and dimensions; minimum one cross section.
D. Erection Drawings: Detailed dimensional requirements for proper location of equipment.
E. Samples: Submit samples of wall pad coverings in manufacturer's available range of colors and textures.
F. Operating and maintenance data, for each operating equipment item.
G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in South Sanpete School District 's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified with minimum five years of experience, trained and approved by manufacturer.
C. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer. Manufacturer must have local representation.
D. Composite Wood Products: Made without urea formaldehyde.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.
C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.07 COORDINATION

A. Coordinate layout and installation of gymnasium equipment with other construction including power/data outlets and light switches.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
B. Provide Manufacturer's Warranties:
   1. Wall Pads: 5 years.
C. The Contractor shall guarantee this work for a period of One (1) year from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gymnasium Equipment:
   1. ADP Lemco, Inc; _____: www.adplemco.com.
   2. Performance Sports Systems: www.perfsports.com.
   3. Porter Athletic Equipment Company: www.porterathletic.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.
B. Where mounting dimensions or sizes are not indicated, comply with applicable requirements of the following:
   1. National Federation of State High School Associations NFHS (Guide) sports rules.
C. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of Contract Documents.
D. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

2.03 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Extruded Bars, Profiles, and Tubes: ASTM B221.
   2. Cast Aluminum: ASTM B179.
B. Softwood Plywood: APA PS 1, exterior.
C. Particleboard: ANSI A208.1
D. Anchors, Fasteners, Fittings and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units.

2.04 SAFETY PADS (WRESTLING ROOM)

A. Basis-of-Design Product: Subject to compliance with requirements, provide Performance Sports or a comparable product by one of the following:
   1. ADP Lemco Inc.
   2. Performance Sports Systems.
   3. Porter Athletic Equipment Co.

B. Pad Coverings: Provide safety pad fabric covering fabricated from puncture- and tear-resistant, not less than 14-oz./sq. yd PVC-coated polyester or nylon-reinforced PVC fabric treated with fungicide for mildew resistance; with surface-burning characteristics indicated. Must meet NFPA 701.
C. Wall Safety Pads: Padded wall wainscot panels designed to be attached in a continuous row; each panel section consisting of fill laminated to backer board with visible surfaces fully covered by seamless fabric covering, free of sag and wrinkles and firmly attached to back of backer board. Provide cut outs where needed. Trim neat to Architect's approval.
    1. Backer Board: Not less than 3/8-inch thick OSB or plywood.
    2. Fill: Multiple-impact-resistant foam not less than 2" thick.
    3. Size: Each panel section, 24 inches wide by not less than 72" high.
    4. Number of Panel Sections: As shown on drawings.
    5. Installation Method: Concealed mounting Z-clips and 1-inch bottom fabric attachment flange with exposed.
    6. Fabric Covering And Color(s): Minimum 14 oz. vinyl coated polyester fabric. Color as selected by Architect from manufacturer's full range for color(s).
    7. Graphics: As indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.
B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.
C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

3.02 INSTALLATION

A. Install in accordance with Contract Documents and manufacturer's instructions.
B. Install equipment rigid, straight, plumb, and level.
C. Secure equipment with manufacturer's recommended anchoring devices.
D. Separate dissimilar metals to prevent electrolytic corrosion.
E. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, have been completed.
F. Permanently Placed Gymnasium Equipment and Components: Rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated on Shop Drawings; in proper relation to adjacent construction.

3.03 CLEANING

A. Remove masking or protective covering from finished surfaces.
B. Clean equipment in accordance with manufacturer's recommendations.

3.04 DEMONSTRATION

A. Submit operation and maintenance manuals in accordance with Section 01 7800 - Closeout Submittals.

END OF SECTION 11 6623

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SECTION 12 2413

ROLLER WINDOW SHADES - DRAPER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Roller Window Shade work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Motorized, roll-up fabric interior window shades including motor operator, controls, and mounting hardware.
   1. Locations as indicated on Drawings.
C. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Sealants for perimeter of shade system.
B. Section 08 4313 - Aluminum Framed Storefronts: Blocking for support of window shade pocket assemblies.
C. Division 26 - Electrical: Electrical supply, conduit, and wiring for motorized window shades.

1.03 REFERENCE STANDARDS

A. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2019.
B. ASTM D4674 - Standard Practice for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Office Environments; 2002a (Reapproved 2010).
C. ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2015
F. UL (DIR) - Online Certifications Directory; Underwriters Laboratories Inc.; current listings at database.ul.com.
G. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.
B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Manufacturer's data sheets on each product specified, including:
   1. Preparation instructions and recommendations.
   2. Installation and maintenance instructions.
   3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   4. Storage and handling requirements and recommendations.
   5. Mounting details and installation methods.

6. Typical wiring diagrams.

C. Shop Drawings: Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
D. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.
E. Selection Samples: For each finish product specified, two complete sets of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
F. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade fabric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.
G. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
H. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.
C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.
D. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Do not deliver window shades until building is enclosed and construction within spaces where shades will be installed is substantially complete.
B. Deliver shades to project site in manufacturer's original, unopened, undamaged containers with labels intact.
C. Individually mark shades with room number and opening number.
D. Inspect the materials upon delivery to assure that specified products have been received.
E. Store and handle shades to prevent damage to fabrics, finishes and operators prior to installation.

1.08 FIELD CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.09 WARRANTY

A. The Contractor shall guarantee his work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.
B. Manufacturer's Warranty:
   1. Shade Hardware: Ten (10) years
   2. Electronic Control Equipment: Five (5) Years
   3. Fabrics / Shade Cloth: Ten (10) Years
   4. Aluminum and steel coatings: Ten (10) Years
   5. Chain: Ten (10) Years

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis of Design Manufacturer:
   1. Draper, Inc: www.draperinc.com.

B. Other Acceptable Manufacturers:
   1. Shade Techniques, Inc: www.shadetechniques.com.
   2. Mechoshade Systems, Inc.: www.mechoshade.com.
   3. Hunter Douglas Contract: www.hunterdouglascontract.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

2.02 MOTORIZED WINDOW SHADES

A. Hardware:
   1. Mounting Assembly:
      a. 38 mm x 3 mm x length required (1.5 inch x 1/8 inch thick x length required) aluminum mounting plate.
      b. Mounting plates shall be attached to square HDPE plates, size as required.
      c. All shade brackets shall be shipped completely assembled from the factory.
      d. Motor coupling and end assemblies shall be as per the above angle and plate with an adjustable (Alan key) setscrew, to ensure proper leveling of the system.
      e. Multiple shade panels (bands) being driven by a single motor may be coupled to a maximum angle of 90 degrees.
   2. Mounting assembly shall allow for continuous front or back-roll fascia across multiple shades without exposed fasteners.
   3. Shade roller tube shall be removable from mounting assembly without hardware removal.
   4. All non-metal components shall be self-lubricating.
   5. Shade hardware system shall provide for field adjustment or component replacement without removal of brackets, regardless of mounting location.
   6. Shade hardware shall allow for a bottom-up or a sideways roller tube installation and removal without removing brackets.

B. Electrical Shade Motors:
   1. Shade motor located inside the extruded aluminum roller tube with appropriate adaptors to allow for a smooth operation. Lifting capacity with a 30 percent safety ratio and not exceeding 30DB. Shade motor shall be equipped with a disconnect plug at motor lead.
   2. Shade motor shall be an asynchronous unit, start and run, single phase type (125V - 60 Hz, 230V - 50 Hz or 24V), thermally protected, brush-less motor, permanently lubricated bearings and gearbox manufactured from non corrosive metal gears containing a 3 phase planetary gear reducer. Non-metal planetary gear boxes will not be acceptable.
   3. Shade motor shall contain a conical steel disk brake allowing no slippage under high torque.
   4. Shade motor shall be fitted with solid steel adjustable drive extensions, rectangular bar shaped for drive and torque transfer to single or multiple coupled extruded roller tubes.
   5. Motor speed shall range from 12 to 30 RPM and draw 1.1 to 3.4 Amps as selected by the shade manufacturer for proper system operation. Motor lead shall be plenum rated quality.
   6. Shade motor shall be equipped with externally located control wheels which allow exact control of shade limits in raised and lowered positions, preventing over winding of the fabric/shade cloth.
   7. Include all components for proper unit operation.

C. Motor Control System:

1. Keyed Wall Switches, refer to Electrical Drawings.

D. Roller Tube assembly:
   1. Top roller tube of one piece extruded aluminum tube, with 10 micron thick clear anodized coating, at the manufacturers recommended engineered diameter and wall thickness for maximum allowable deflection of L/700; Mill finish tubes will not be acceptable.
   2. The roller tube shall be extruded with provision made for mechanical engagement with the operator and drive assembly.
   3. The extrusion shall have various channels to accept fabric attachment spline. The spline and slot reinforces the tube and retains the fabric and operating system.
   4. The spline will be an extruded vinyl profile, welded to the fabric band or panel, such that removal and re-installation of the fabric panels can occur without removing the roller tube and hardware. Fabric panels must be replaceable on site. Attachment of the fabric to the tube with double sided adhesive tapes, adhesives, staples, or rivets is not acceptable.

E. Hembars:
   1. Aesthetically designed exposed extruded aluminum alloy 6063-T5, custom rectangular shaped, with matching end caps, pre-weighted, to maintain bottom of shade fabric straight and flat. Hembar attached to fabric panel with welded fabric spline.

F. Fasteners:
   1. Non-corrosive to manufacturers recommendations.

G. Aluminum Fascia:
   1. Back/Regular Roll Fascia:
      a. Extruded aluminum alloy 6063-T5, prefinished, 105 mm x 45 mm x 1.6 mm wall thickness (4.13 inch x 1.77 inch x 0.063 inch), custom designed profile to fit onto remoulded end mounting brackets without exposed fasteners.
      b. Fascia shall allow for continuous placement across multiple shades without exposed fasteners.
      c. Fascia shall conceal the mounting hardware, power and control cables, drive mechanism, roller tube, and all fabric rolled on the tube.
   2. Fascia shall not fit snug against side channels to prevent thermal shock to the glazing system.

H. Pockets and Closures:
   1. Shade Pocket: Manufactured from 2.5 mm (0.098 inch) thick aluminum or 1.5 mm (0.059 inch) thick satin coat steel pocket engineered to meet site conditions. Design considerations include, but are not limited to, mounting conditions, wall/ceiling construction, type and quantity of shades in pocket, and shade length, as indicated on the drawings.
   2. aluminum Closure:
      a. Extruded aluminum alloy, 6063-T5, pre-finished, 82 mm wide x 1.5 mm thickness (3.23 inch x 0.059 inch).
      b. Designed for attachment to the corresponding pocket and/or hardware using an extruded aluminum clip and return angle, both made of 6063-T5 aluminum alloy, without exposed fasteners.

2.03 FINISHES

A. Aluminum Finishes:
   1. All exposed aluminum shall be clear anodized oxide finish according to AA-M12C22A31 to match adjacent window framing.
   2. Unexposed aluminum unless otherwise specified: mill finish.

2.04 FABRIC

A. Light-Filtering Fabric:

1. Openness Factor: 1 percent open.
2. Fabric Thickness: 0.027 inches thick.
3. Fabric Weight: 14.6 oz/sq yd.
4. 36 percent fiberglass, 64 percent vinyl on fiberglass.
5. Product: Phifer Sheerweave SW2701.
6. Colors: As selected by Architect from manufacturer's full range.

B. Seaming: Seams in fabric to match vertical mullions.

2.05 FABRICATION

A. Shading system components manufactured and assembled allowing for installation techniques to suit project requirements.
B. Finished assemblies shall be, square, true to size and free from distortion, twist, or other defects that could affect their strength, operation or appearance. Factory applied finish shall be uniform, smooth and without blemishes.
C. The fabric shall be colourfast, retain its shape, not be affected by moisture or heat, and shall be non-flammable. Cut fabric to eliminate glare and reflection from shining surfaces while maintaining exterior view. The top of the fabric is retained in recessed spline of the shade roller and the bottom of the fabric is retained by the selected hem.

PART 3 EXECUTION

3.01 PREPARATION

A. Field verify window dimensions prior to fabrication.
B. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.
C. Coordinate requirements for power supply, conduit, and wiring required for window shade motors and controls.

3.02 INSTALLATION

A. Install work by manufacturer’s skilled tradesmen and installed in strict accordance with manufacturers recommendations.
B. All items installed, plumbed, squared, rigidly coupled and adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane. Fabric shall not travel more than 3 mm (0.125 inch) in either direction within channels after installation.
C. The solar screen fabric shall be pre-measured and manufactured off-site

3.03 ADJUSTING AND CLEANING

A. Adjust shades and operating components as required to ensure smooth and trouble free operation without binding.
B. Adjust shade to hang flat without buckling or distortion.
C. Clean shades and exposed components.
D. Replace work, which cannot be satisfactorily repaired, adjusted, or cleaned

3.04 TESTING AND DEMONSTRATION

A. Test motorized window shades to verify that controls, limit switches, and other operating components are functional. Correct deficiencies.
B. Test manual window shades to verify that operating mechanism, fabric retainer, and other operating components are functional. Correct deficiencies.
C. Demonstrate operation of shades to Owner's designated representatives.

3.05 SCHEDULE - REFER TO DRAWINGS

END OF SECTION 12 2413

SECTION 21 0000

FIRE PROTECTION

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of Section 220000, 230000, 230100, 230501, 230800, 230900, and 251000 shall govern the work in Section 210000, where applicable, and where not in conflict with governing codes and ordinances. Division 1 is a part of this and all other sections of these specifications.

1.2 SCOPE

A. The work required includes the designing, hydraulically calculating pipe sizes, flows, and pressure, furnishing and installation of fire protection systems in accordance with the drawings, specifications, latest standards and codes for complete systems for the building.

B. The work specified in this section shall be installed by none other than an approved fire sprinkler contractor. All fire protection system piping shall be hydraulically calculated. All systems shall be subject to the inspection and approval of the local fire authority or his representative for compliance of applicable standards.

C. **Preferred contractors shall be Kimco Fire Protection, Chaparral Fire Protection, Fire Engineering Co., Paradise Fire Protection Inc. Delta Fire Protection Systems, Fire Services Inc., State Fire DC, Preferred Fire Protection and Firetrol Protection Systems.**

D. All work shall be coordinated with other subcontractors.

E. The sprinkler system shall consist of the required number of sprinkler heads, piping, hangers, drains, test pipes, alarms, valves, gauges, fire department connections, anti-freeze loop, and all other parts to assure a complete system to meet the requirements of the owner's insurance underwriter, local authority having jurisdiction, and in accordance with nationally recognized standards.

F. Codes & Standards:

1. Water Supply: National Fire Code #24 - 2021 International Building Code.
2. Wet Sprinkler System & Combined Systems: N.F.C. #13 and #14 - I.B.C.
3. Alarm Equipment: N.F.C. #70 & 72A
4. Standpipe & Hose Systems: N.F.C. #14 - I.B.C.
5. Supervision: N.F.C. #13 and #14 - I.B.C.
6. Temporary Fire Protection: N.F.C. #14 - I.B.C.
7. Sprinkler Heads: N.F.C. #13
8. Sleeves and Location: N.F.C. #13
9. Excavation and Backfill: 230900 of this specification

G. Work Included Elsewhere:

1. Fire Hydrants - By Site Utilities Contractor
2. Underground Mains: N.F.C. #24
3. Concrete Work - By General Contractor
4. Access Doors - By General Contractor.

5. Painting of sprinkler piping - By Painting Contractor.
6. Color coding or pipe identification - By Mechanical Contractor.
7. Wiring of flow switches and gate valve supervisory switches - By Electrical Contractor.

1.3 WORK BY FIRE PROTECTION CONTRACTOR

A. This contractor shall furnish and install all labor, material, and equipment to make a complete and working fire protection system fully tested and approved in accordance with the drawings, standards of this specification for the new building.

1.4 UNDERGROUND WATER SUPPLY

A. Fire protection contractor shall perform a flow test at or near site prior to final calculations for system. Flow test to be performed in the presence of local fire marshal and Emery School District representative.

B. Connect fire sprinkler mains to connections provided by others as shown on the drawings and install U.L. labeled pipes into building at locations shown. Coordinate testing and flushing of this portion of the main in accordance with N.F.C. #24 and furnish test certificates to the Owner's representative.

C. This contractor will be responsible for coordinating with the site utilities contractor to assure that the underground water supply has been flushed and tested in accordance with NFPA pamphlet #24 prior to the connection of the overhead sprinkler system.

D. Flow Test Information:

Date:	September 23, 2024
Location:	100 West 500 North Manti, Utah
Static Pressure:	68 PSI
Residual Pressure:	22 PSI
Flow Rate:	1933 GPM
Available Flow at 20 psi:	2039 GPM

E. Sprinkler System:

1. This system shall conform to N.F.C. #13 and #14 and I.B.C. Riser may be calculated but shall not be smaller than 6". Sprinkler systems are to be light, ordinary, or extra hazard, as required by NFC-13 and the Utah State Fire Marshall's office.

2. System shall be hydraulically calculated. Sprinkler system shall be light hazard, except for casual ordinary and extra hazard group 1 in storage and service areas. Density for light hazard areas shall be 0.10 gpm per sq. ft. over 1500 sq. ft. Remote area with a maximum head spacing of 225 sq. ft. Service area shall be density of 0.15 over 2000 sq. ft. with maximum spacing of 130 sq. ft.

1.5 QUALIFICATION OF DESIGNER

A. Designer shall be an engineering technician or Senior Engineering Technician (Level III or Level IV), NICET certification for fire sprinkler system design.

1.6 QUALIFICATION OF INSTALLER

A. It is intended that the system be designed and installed by a firm regularly engaged in the design and installation business of Fire Sprinkler contracting. The Owner's representative may require evidence to support the ability of the contractor to perform work in the scope and volume as specified. A contractor who cannot verify such experience may be found not suitable to perform the work.

PART 2 – PRODUCTS

2.1 HANGERS

A. All hangers to be in accordance with NFPA Pamphlet No. 13.

2.2 RISERS

A. Risers shall be at the locations shown and shall include a U.L. approved control valve, double check valve, flow switch, pressure gauges, water motor gong, or electric bell, standard fire department connection, gate valve supervisory switch, test connections, and drains as required.

B. Fire department connection shall be a duplex type with locking Knox caps per ESD standards and local Fire Authority requirements.

2.3 SPRINKLER HEADS

A. Sprinkler heads shall be U.L. approved. "K" factors shall be the same on each system and/or floor. See plans for head types. Extended coverage heads will be allowed per NFPA.

B. Sprinklers shall be of the proper temperature rating. The location of sprinkler head wherever reasonably possible shall be symmetrical and coordinated with the ceiling pattern.

C. Number and location of sprinkler heads shown on the drawings are schematic. The exact number and location of heads shall be determined by the system design, and architectural coordination.

D. Provide dry pendent heads in areas subject to freezing, only where wet piping can be run in heated space. Otherwise, provide antifreeze loops.

E. Provide spare head cabinets in accordance with NFPA No. 13 and equip same with at least ten (10) concealed type heads, three (3) upright white heads, six (6) upright brass heads, and appropriate wrenches.

F. Provide head guards in all areas where heads are subject to physical abuse.

2.4 VALVES

A. All valves and fittings shall be listed by Underwriters Laboratories or approved by Factory Mutual for fire protection duty and shall be installed in accordance with their listing and/or approval. Control valve shall have alarm supervisory switches with two sets of contacts and normally open/normally closed.

B. All indicating valves will be of the listed and/or approved type with an electric tamper switch approved for use with that valve.

C. Water hammer arrestors shall be provided ahead of all automatic valves to eliminate water hammer and shall be installed vertically in an accessible location.

D. Hose valves off standpipes shall be U.L. approved. All valves shall be 2-1/2" with 2-1/2" X 1-1/2" reducer and cap with chains. Valves shall be polished brass and chrome plated.

2.5 PIPING

A. All piping above ground shall be Schedule 40 domestic steel pipe and fittings.

B. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

2.6 PIPING SUPPORT

A. Steel roof deck shall not be used to support loads from fire piping or equipment of any kind, unless specifically noted otherwise.

B. Bracing of miscellaneous items (fire, mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.

C. It is essential that all piping be supported from roof structure at joist within 6” of panel point location and from top or bottom chord of floor or roof joist.

D. Beam clamps shall not be used to hang piping from open web joist, trusses or girders.

2.7 EARTHQUAKE BRACING

A. Install earthquake bracing in accordance with NFPA #13 Standards and Utah State Fire Marshall's Office.

2.8 SLEEVES

A. Sleeves shall be furnished, together with their location and elevations to the construction manager, timely with required schedule or concrete pours. If sleeves are missed by this contractor, he shall be responsible for core drilling thru concrete at his own expense, and he shall be responsible for his cutting and patching. Sleeves shall be of the size, type, and length required by N.F.P.A. codes. See Section 230900 for "Sleeves".

B. Sleeves shall be placed in structural members only where approved by the Owner's representative.

C. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

D. Sleeves thru Finished Surfaces:
For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

1. Sleeves thru Fire-rated Surfaces:
All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes have been placed with a U.L. listed fire safing system. Contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.

2. Sleeves thru Sound Rated Surfaces:
All pipe sleeves and ductwork penetrating sound rated walls or surfaces shall be packed with dense fiberglass, sealed with duct sealer and fitted with metal cover flanges on both sides.

3. Sleeves thru Floors:
Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

E. All penetrations must be sleeved or core drilled/cut. Hammer drill is not an acceptable means.

PART 3 – EXECUTION

3.1 TEMPORARY FIRE PROTECTION DURING COURSE OF CONSTRUCTION

A. This contractor shall provide fire protection as required by N.F.C. #14 - Chapter 8 and shall be coordinated with the local fire department.

3.2 SHOP DRAWINGS

A. Shop drawings, submittals, and hydraulic calculations, as necessary and required, shall be submitted to the Owner's representative for approval prior to incorporating materials or equipment into the work. Shop drawings shall be complete and in accordance with N.F.C. #13, #14, #20, and all applicable standards, submittals, and equipment, valves, flow switches, controls, and other important items shall be complete, showing details, description, and characteristics; hydraulic calculations shall be based on the water system fire flow capacities shown on the drawings and shall show flows, pressures, velocities, pipe size, and equivalent lengths as required for the system.

B. Calculations shall be arranged in an orderly manner with sufficient reference points for the approving authority to review and approve.

C. Testing shall be accomplished by this contractor for all required systems, equipment, and appurtenances, as required by the various standards and codes. The Owner's representative shall witness and sign off each item required. This contractor shall furnish required forms.

3.3 TESTS

A. Install all test pipes and valves as required by NFPA No. 13. Locate inspector's test valves and auxiliary drain valves above ceilings in areas approved by the Architect and provide hose bibb connections. Conduct all tests as required by NFPA Standards and Insurance Services Office and submit copies of completed test forms to the building owner.

B. All fire sprinkler related tests requiring witnessing by local authorities will be the responsibility of this contractor. If tests are not run or do not have the proper witness or documentation, then they will be run late and all damage caused by the system or caused in uncovering the system for such tests will be borne by this contractor.

C. The Utah State Fire Marshall and building owner shall be notified (in writing) at least three days in advance of the following:

1. Hydrostatic test and final inspection of the underground, prior to backfilling.
2. Flushing of underground prior to connection to overhead.
3. Hydrostatic test and final inspection of overhead, prior to the installation of the ceilings.

3.4 GENERAL REQUIREMENTS

A. This contractor shall submit complete drawings, hydraulic calculations, and proper documentation to the local authority having jurisdiction and receive their approval before submitting such material to the Owner's representative for final approval. The contractor will be required to show proof of submittal to the Owner's insurance underwriter and local building authorities before installation may begin.

B. All work of this contractor will be coordinated with other trades to insure minimal changes to the sprinkler system from the designs. Careful coordination of mechanical and electrical ducts, pipe and conduit shall be required. 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, rainwater, and soil lines' supply, return, and exhaust ductwork; water piping; fire protection piping; and pneumatic control piping.

C. Every effort shall be required to ensure that the heads form a symmetrical pattern in the ceiling with the ceiling grid, the lights, and diffusers and grilles and as shown on the Architect's reflected ceiling plan. Offsets shall be made in piping to accommodate ductwork in ceiling. Heads should be symmetrical, and all piping run parallel or perpendicular to building lines. In no case shall sprinkler heads be installed closer than 6" from ceiling grids or closer than approved distances from ceiling obstructions.

D. All sprinkler piping shall be concealed unless approved by the Owner's representative. All lines will be run as high as possible so as to not interfere with future changes to ceiling heights or other mechanical equipment. This contractor will be responsible for all sleeves, core drills, and sealing of penetrations in walls, floors, and structural members to facilitate the installation of the system, however, no holes in, or attachments to structural members will be allowed unless approved by the Owner's representative.

E. All required drains and test pipes will be installed and finished in a workmanlike manner, terminating at a proper location to accommodate the required outflow without damaging the building or landscaping. Drain and test pipe locations shall be approved by the owner's representative.

F. All piping, and heads located in un-heated spaces shall be installed with a glycol loop system. Coordinate location with the owner's representative. Indicating valves with tamper switches shall be installed and wired as required by code. Coordinate with electrical contractor.

G. No piping or valve assemblies shall be run exposed in a finished area without the prior approval of the owner's representative.

H. **All heads located in specialty ceiling systems shall be coordinated with Architect prior to any installation.**

3.5 JOB CLOSEOUT

A. This contractor shall assure that all placards, signs, and instruction manuals are in place, and all tests are run before any consideration for final payment will be considered. This includes maintenance manuals, hydraulic calculations placards, spare head cabinets and the proper number of spare heads, and instruction to on-site personnel.

B. This contractor shall, in addition to the above, furnish the owner one (1) set of mylar reproducibles of the sprinkler system "record drawings" for his project files.

3.6 WATER SUPPLY ANALYSIS & FIRE FLOW INFORMATION (BEGINS ON NEXT PAGE)

END OF SECTION 21 0000

Craig Blue, P.E. Inc.
Fire Suppression
Engineering & Testing

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801-886-3473
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9/23/2024

Richard Judkins
Naylor Wentworth Architects
723 Pacific Avenue Ste 1010
Salt Lake City, UT
801-355-5959 o
801-706-4839
rjudkins@nwlarchitects.com

RE Water Supply Analysis

This report contains the assessment of the water supply available for fire protection at the following site/address:
Manti School District- Shop and Wrestling Addition
100 West 500 North,
Manti Utah

Report was prepared at the direction of:
Richard Judkins
rjudkins@nwlarchitects.com
Naylor Wentworth Architects
723 Pacific Avenue Ste 1010
Salt Lake City, UT

Prepared by:
Craig Blue PE.

Background info:

The purpose of this report is to determine the amount of water supply available at the site noted above. The report shall assist authorities having jurisdiction, in determining fire suppression requirements & issuing of building permits. Comments included in report, that references 2021 International Building/Fire code are based on minimum recommended standards only. The authorities having jurisdiction may require more or less than the reference appendix.

Water hydrants to site are supplied from Mant water system. Hydrants selected were nearest to site.

Flow Test:

The flow test was performed by Craig Blue P.E. and Waylon Blue. Water flow and pressures available at hydrants nearest to site are as follows:

Static Pressure -	75	psi
Residual Pressure-	25	psi
Flowing 4.5" single outlet (16 psi-pitot):	1933	gpm
See flow data sheet for site plan, and hydrants reference elevation.		
Hydrants elev.	5564	ft. elev. Approx
Fire flow calculated for performance	2039	gpm at 20 psi

Fire Flow:

The builidng structure type is type IIB non-combustible. Existing area (504,000 sf) + (9500 sf Wrestling) + (19,500 sf shop) = 533,000 sf. fire area total. With fire sprinklers provided throughout building the fire flow may be reduced to 25% of fire flow. The fire flow with sprinkler reduction demands, (8000 x .25) = 2000 gpm. Flow allows for an unlimited areas noted on IFC table 105.1(2). vs structure type.

Fire Sprinkler System Designs

Fire Sprinkler design should use a 10% reduction in pressures to account for demand variations in area.

10% reduced- Static 68 psi, 22 psi flowing 1933 gpm

Summary & Recommendations:

It is our opinion, that fire flow performance near site is sufficient for structures anticipated.

If there are further questions, please contact me

Craig Blue PE
C.B.P.E. Inc
801-886-3473
Craig@CBluePE.com

CBPE# 2050-35

FLOW TEST DATA SHEET

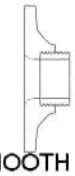
Craig Blue P.E. Inc.
Fire Suppression Engineering & Testing
801-886-3473 Craig@CBluePE.com

CBPE: 2050-35

WATER SYSTEM: Manti City Water
NAME OF PROPERTY: Manti High School - Shop and Wrestling Room Addition
ADDRESS: 100 West 500 North
Manti, UT
DATE: 9/14/24 TIME: 10:00 am TEMPERATURE: +70 F
TYPE OF CITY SYSTEM:
TEST CONDUCTED BY: Craig Blue PE. & Waylon Blue
WITNESSED BY:
NOTES:

OUTLET TYPES:


PLAY PIPE
C=0.97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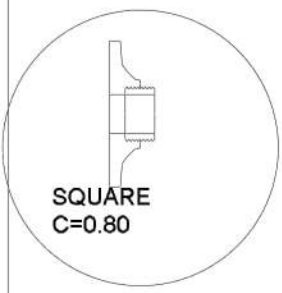
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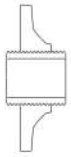


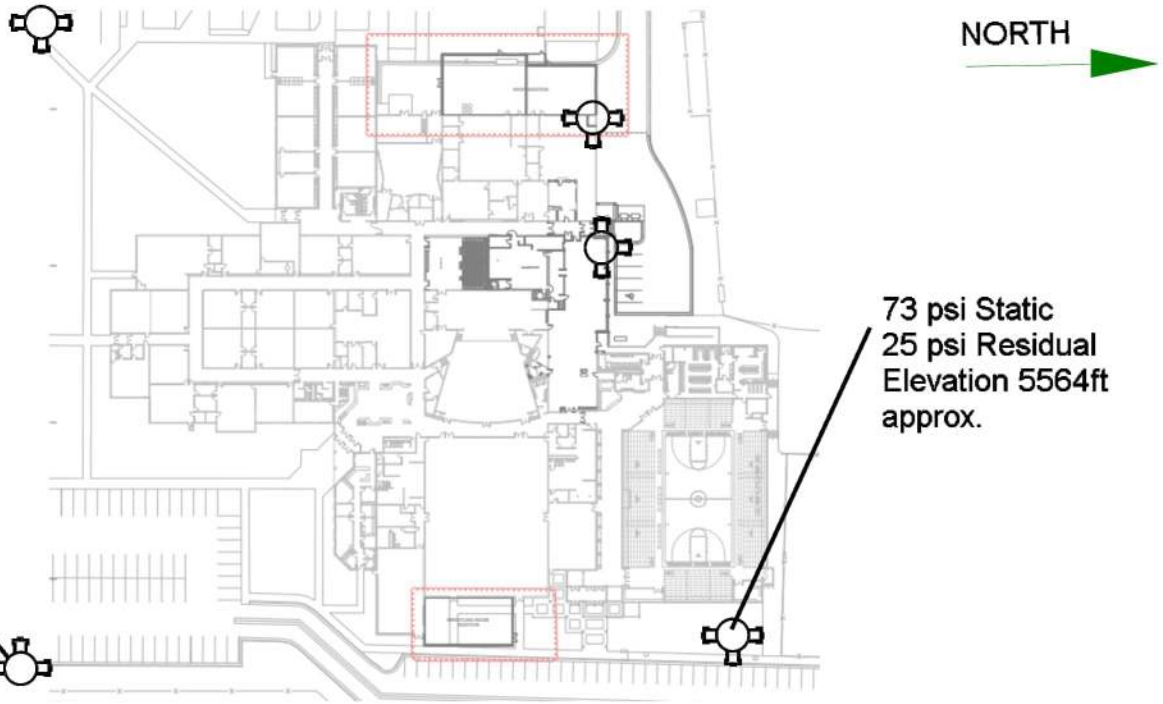
FORMULA Q=29.83 C D^2 P^.5

WHERE Q IS GALLONS PER MINUTE
C IS THE COEFFICIENT OF DISCHARGE
D IS I.D. IN INCHES OF OUTLET (2.469" typ.)
P IS PITOT GAUGE READING (PSI)

	SIZE (IN)	PITOT (PSI)	FLOW (GPM)
OUTLET 1	4.5	16	1933
OUTLET 2	X	X	X
OUTLET 3			
OUTLET 4			
FIRE FLOW: 2039 gpm @ 20psi		TOTAL FLOW:	1933 gpm

STATIC: 73 PSI RESIDUAL: 25 PSI ELEVATION: 5564 FT. hydrant elev.

SKETCH AREA MAP BELOW:



FLOW TEST DATA CHART

Craig Blue P.E. Inc.
Fire Suppression Engineering & Testing
801-886-3473 Craig@CBluePE.com

CBPE: 2050-35

WATER SYSTEM: Manti City Water

NAME OF PROPERTY: Manti High School - Shop and Wrestling Room Addition

ADDRESS: 100 West 500 North
Manti UT

SUPPLY:	73 PSI	25 PSI	1933 GPM	2039 GPM	5564 ft.
	STATIC	RESIDUAL	FLOWING	FIRE FLOW at 20 psi	GRADE ELEV.

DATE OF TEST: 9/14/24

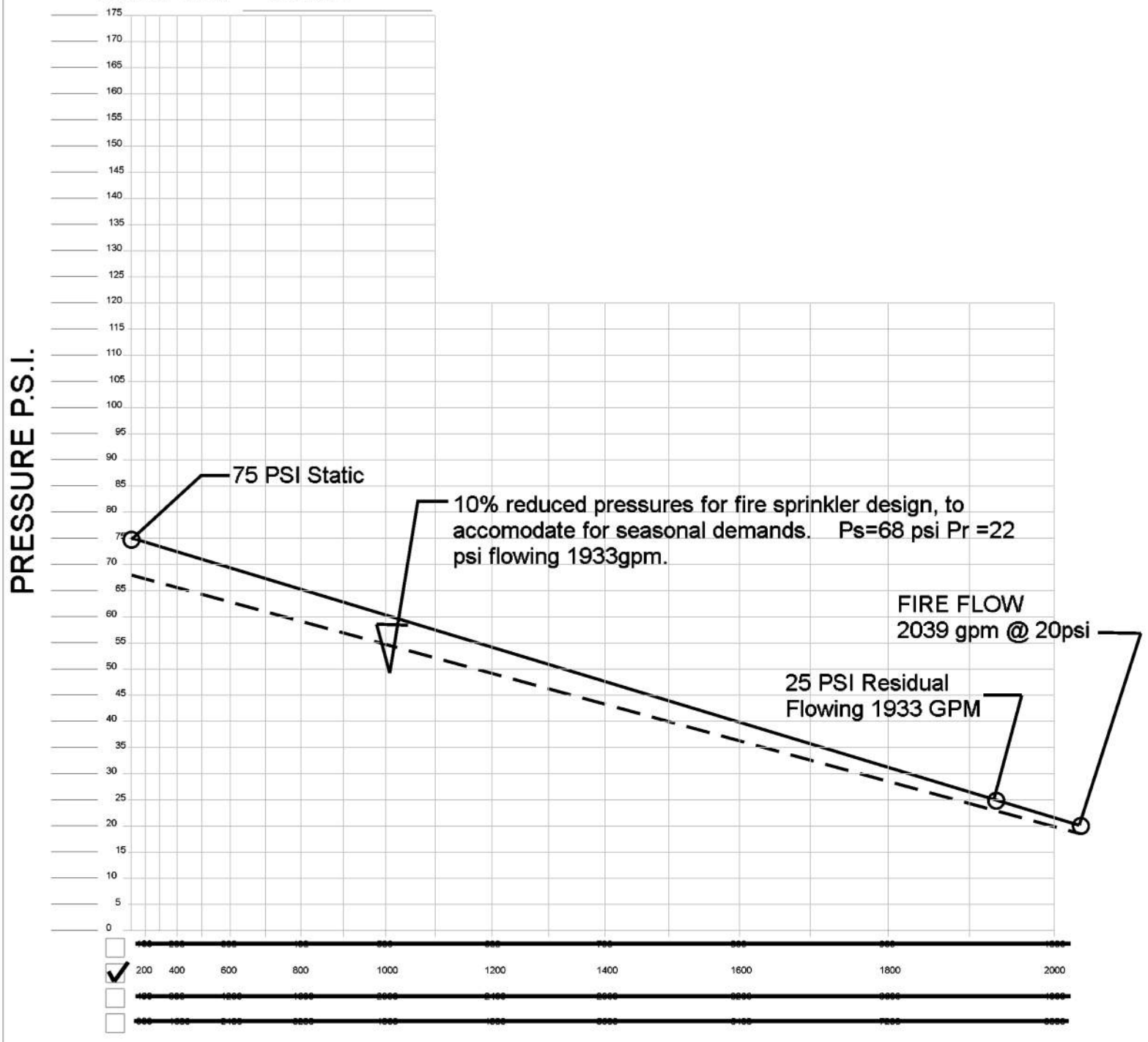


CHART #1

504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3-percent slope), shall be provided with a *stairway* to the roof. *Stairway* access to the roof shall be in accordance with Section 1011.12. Such *stairway* shall be marked at street and floor levels with a sign indicating that the *stairway* continues to the roof. Where roofs are used for landscaped roofs or for other purposes, stairways shall be provided as required for such occupancy classification.

SECTION 505
PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with *approved* address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of $^1/_2$ inch (12.7 mm). Where required by the *fire code official*, address identification shall be provided in additional *approved* locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the *public way*, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with *approved* signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an *approved* size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506
KEY BOXES

506.1 Where required. Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the *fire code official* is authorized to require a key box to be installed in an *approved* location. The key box shall be of an *approved* type *listed* in accordance with UL 1037, and shall contain keys to gain necessary access as required by the *fire code official*.

506.1.1 Locks. An *approved* lock shall be installed on gates or similar barriers where required by the *fire code official*.

506.1.2 Key boxes for nonstandardized fire service elevator keys. Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:

1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and *approved* by the *fire code official*.
2. The front cover shall be permanently labeled with the words "FIRE DEPARTMENT USE ONLY—ELEVATOR KEYS."
3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.
4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.
5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted where authorized by the *fire code official*.
6. In buildings with two or more elevator banks, a single key box shall be permitted to be used where such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).

Exception: A single key box shall be permitted to be located adjacent to a *fire command center* or the nonstandard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.

506.2 Key box maintenance. The operator of the building shall immediately notify the *fire code official* and provide the new key where a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507
FIRE PROTECTION WATER SUPPLIES

507.1 Required water supply. An *approved* water supply capable of supplying the required fire flow for fire protection shall be provided to premises on which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be determined by an *approved* method.

507.4 Water supply test. The *fire code official* shall be notified prior to the water supply test. Water supply tests shall be witnessed by the *fire code official* or *approved* documentation of the test shall be provided to the *fire code official* prior to final approval of the water supply system.

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an *approved* route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the *fire code official*.

Exceptions:

1. For Group R-3 and Group U occupancies, the distance requirement shall be 600 feet (183 m).
2. For buildings equipped throughout with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the distance requirement shall be 600 feet (183 m).

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30 480 mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30 480 mm) where *approved* by the *fire code official*.

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the *fire code official*. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, alterations and servicing shall comply with *approved* standards. Records of tests and required maintenance shall be maintained.

507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with NFPA 25 at the following intervals:

1. Private fire hydrants of all types: Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or *approved*.

507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other *approved* means shall comply with Section 312.

SECTION 508
FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *International Building Code* and in all F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m^2), a *fire command center* for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.7.

508.1.1 Location and access. The location and access to the *fire command center* shall be *approved* by the *fire code official*.

508.1.2 Separation. The *fire command center* shall be separated from the remainder of the building by not less than a 1-hour *fire barrier* constructed in accordance with Section 707 of the *International Building Code* or *horizontal assembly* constructed in accordance with Section 711 of the *International Building Code*, or both.

508.1.3 Size. The *fire command center* shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m^2) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater.

Where a *fire command center* is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m^2), the *fire command center* shall have a minimum size of 96 square feet (9 m^2) with a minimum dimension of 8 feet (2438 mm) where *approved* by the *fire code official*.

508.1.4 Layout approval. A layout of the *fire command center* and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the *fire command center* shall be prohibited.

508.1.6 Required features. The *fire command center* shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. Fire detection and alarm system annunciator.
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: *Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the* International Building Code®.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The *fire code official* is authorized to reduce the *fire-flow* requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full *fire-flow* requirements is impractical.

B103.2 Increases. The *fire code official* is authorized to increase the *fire-flow* requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The *fire-flow calculation area* shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings that are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate *fire-flow calculation areas*.

B104.3 Type IA and Type IB construction. The *fire-flow calculation area* of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: *Fire-flow calculation area* for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum *fire-flow* and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and *townhouses* shall be as specified in Tables B105.1(2) and B105.2.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an *approved automatic sprinkler system*, the water supply shall be capable of providing the greater of:

1. The *automatic sprinkler system* demand, including hose stream allowance.
2. The required *fire flow*.

APPENDIX B—FIRE-FLOW REQUIREMENTS FOR BUILDINGS

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	3
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
—	—	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
—	—	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
—	—	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
—	—	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
—	—	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
—	—	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
—	—	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
—	—	191,401–Greater	138,301–Greater	85,101–Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

8000 x .25 = 2000 gpm with fire sprinkler reduction applied.

TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.
a. The reduced fire flow shall be not less than 1,000 gallons per minute.
b. The reduced fire flow shall be not less than 1,500 gallons per minute.

SECTION B106
REFERENCED STANDARDS

B106.1 General. See Table B106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE B106.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
IBC—21	*International Building Code*	B104.2
IRC—21	*International Residential Code*	Table B105.1(1)
IWUIC—21	*International Wildland-Urban Interface Code*	B103.3
NFPA 1142—17	*Standard on Water Supplies for Suburban and Rural Fire Fighting*	B103.3

SECTION 22 0000

PLUMBING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Piping diagrams are schematic and indicate preferred pipe routing. It is the intent that the installation be complete. Where fixtures are not shown connected to any required services, they shall be connected properly and completely. Connect all fixtures to various services, i.e., hot water, cold water, waste, and vent, etc., as required.

B. The work shall include furnishing of all materials and labor required for the job as described, together with all accessories and trim implied or required to finish the work, and generally as follows:

1. Complete rain removal system, including piping and roof drains.
2. Plumbing fixtures and piping.
3. Compressed air systems
4. Sanitary sewer systems.
5. Natural gas systems
6. Backflow prevention systems.
7. Condensate drain systems.
8. Final connection of building systems to site utilities.

1.2 STANDARDS

A. Plumbing installation shall be done in accordance with the 2021 International Plumbing Code, City Code, and all other governing codes.

B. In the event drawings violate the codes as being locally enforced, the contractor shall base his estimate on the enforced code requirements.

1.3 DISINFECTING

A. After flushing the mains, introduce a water and chlorine solution concentrated to 300 PPM to disinfect the system and oxidize piping contaminates. Retain treated water and chlorine for a period of not less than three hours or more than six hours before final flushing out of system.

B. All valves should be opened periodically during the process and the residual chlorine checked to ensure that at least 50 percent of the initial concentration is present to complete the disinfection. If there is less than 50 percent, the valves should be allowed to drain water until the 50 percent or greater level is obtained. A make-up chlorine solution of a concentration equal to the initial concentration must be added as needed during the withdrawal of the spent solution.

C. A warning sign shall be conspicuously posted at each water outlet and faucet during the disinfecting process to prevent occupants from drinking the water.

D. Flushing: Following disinfection, all treated water shall be flushed from the system through its extremities. Flushing shall continue until samples show that the quality of the water delivered is comparable with the quality of the public water supply and satisfactory to the public health authority having jurisdiction. Flushing shall be repeated if samples taken daily over a period of three days show the water quality is not being maintained. Samples shall be taken only from taps located and installed in such a manner that they will not contribute any contamination. Samples shall not be drawn from hydrants or through unsterilized hose. Test samples shall be certified by a recognized and approved testing laboratory, and a certificate of acceptability shall be submitted.

E. Written certification of the disinfecting process and purity of water samples shall be forwarded to the Owner's representative.

1.4 VERIFICATION OF GRADE

A. The contractor shall verify with the site utilities contractor the connection of water, and waste piping systems to the mains, and shall verify the actual job site elevation and location prior to the installation of the building footings.

PART 2 – PRODUCTS

2.1 CLEANOUTS

A. Approved cleanouts shall be installed in the base of each vertical drainage line, and in the horizontal line at each change in direction. In addition, there shall be cleanouts spaced at a maximum of 50' in all horizontal lines. All cleanouts shall be extended to accessible surfaces. All cleanouts to grade shall be capable of cleaning in both directions.

2.2 WATER HAMMER

A. Provide and install stainless steel bellows type shock absorbers in the ends of all multiple fixture water lines and in piping ahead of snap-acting automatic valves.

B. Absorbers shall be sized and located in compliance with manufacturer's recommendations for the specific application. Absorbers shall be Zurn, Wade, or Smith.

C. Absorbers shall not be installed in inaccessible areas. Extend piping to accessible locations.

2.3 FLASHINGS

A. All pipes passing thru the roof shall be neatly flashed. Flashing shall be provided under Division 7.

2.4 FIXTURE STOPS

A. All stops for plumbing fixtures shall be McDonald 1/4 turn ball valves.

2.5 PLUMBING FIXTURES

A. This contractor shall furnish and install all fixtures shown on the architectural or mechanical drawings or specified hereinafter, clean and adjust all fixtures and replace any damaged fixtures at the contractor's expense.

B. The fixtures shall be all new and complete as shown and described in manufacturer's catalog, and as required for the work, including accessible loose key 1/4 turn ball valve stops above the floor in supplies to all fixtures, and cast brass P-traps, unless otherwise shown. Trim for all fixtures shall be chrome-plated, and all trim shall match in design. Supply faucets shall have renewable seats and barrels. Fixtures shall be Kohler, American Standard, Crane, or approved equal.

C. Approved Fixtures:

Sinks:	Just, Elkay, or approved equal.
Faucets:	Moen, Kohler, American Standard, or approved equal.
Hose bibbs:	Watts, Zurn, JR Smith, Woodford, or approved equal.
Roof drains, downspouts:	Zurn, Watts, AO Smith, or approved equal.

PLUMBING FIXTURES

S-1	Sink: (Shops)	Acorn “Wash-Ware” 3403-ES-2-SQQ-BAT, 3-station, 14-gauge floor mount type 304 stainless steel, ASSE1070 temperature balancing mixing valve with integral check & strainers, Battery operated sensor faucets, Proflo PF8912 cast P-trap, Proflo 210PC tailpiece.
HB-1	Hose Bibb:	Zurn Z-1320CL 3/4" "Ecolotrol" non-freeze anti-syphon wall hydrant with copper casing, nickel bronze face, integral vacuum breaker, locking cylinder & wall clamp. Minimum length from face to valve 12”. Hydrant to be centered in block course.
HB-2	Hose Bibb:	Chicago Faucet No. 952 (No. 998 where connected to exposed piping) 3/4" chrome plated hose bibb with No. 293-6 handle and 3/4" threaded outlet with integral vacuum breaker.
EW-1	Emergency Eyewash: (ADA)	Acorn Model S0440-BF wall mounted ADA Emergency Eyewash with stainless steel bowl, ABS plastic spray heads with covers, inline strainer & ½” stay-open ball valve with push handle, chrome plated brass tailpiece with P-Trap, 11-gauge wall bracket with yellow powder coat finish.
TV-1	Tempering Valve: (EW-1)	Leonard Model TA-300-RF emergency mixing valve, 1/2” inlets and 1/2” outlet, to mix cold water with 120 deg. F. hot water for 85 deg. F. tempered water supply. .5 GPM min. flow and 6 GPM at 20 psi pressure drop. Manifold shall be complete with temperature gauge, inlet check stops, and cold-water bypass.
AO-1	Air Outlet:	1/2" quick disconnect coupling with both male and female portions. Lincoln or equal.
RD-1	Roof Drain:	J.R. Smith #1010-ARC, roof drain cast iron type with flashing collar, C.I. dome, gravel guard, extension, sump receiver, and underdeck clamp. See plans for sizes.

RD-2	Roof Drain: (Secondary)	J. R. Smith #1080-ARC w/2" water dam, duco cast iron body with combined flashing clamp and gravel stop with underdeck clamp, extension, sump receiver, and cast-iron dome. See plans for sizes.
DN-1	Downspout Nozzle:	Smith #1770 brass downspout nozzle. Provide 1/4" mesh aluminized, slip fit bird screen. See plans for sizes.

2.6 LEAD PANS AND WATERPROOF MEMBRANES

A. Furnish a 30" square 4# lead flashing with each roof drain.

B. All floor drains shall be fitted with clamping collar and waterproof membrane.

C. Membrane and lead waterproofing pans for shower stalls and built-up type custodial floor sinks shall be furnished and installed by plumbers so they are 100% watertight. Drains shall have clamping device which clamps drain to pans. There shall be a mastic seal between floor drain bottom and lead or membrane so when clamping device is tightened, there is a complete watertight seal.

D. Care should be taken not to clog weep holes. All pans will be tested by placing test plug in drain and filling with water overnight.

2.7 CONDENSATE DRAIN

A. All refrigerated air conditioning and/or cold storage cases which have cooling coil condensate drip pans with pipe connections shall be piped to the nearest drain by this contractor.

B. Pipe location and routing shall be approved by the owner's representative.

C. Piping shall be the same size as the drain pan connection and shall be trapped to prevent forced air flow thru the pipe.

2.8 VACUUM BREAKERS, DOUBLE CHECK VALVE ASSEMBLIES, & BACKFLOW PREVENTERS

A. Vacuum breakers and backflow preventers shall comply with requirements of the 2021 IPC and all Utah & local Plumbing Codes for the actual installed duty.

B. Vacuum breakers and backflow preventers shall be of the type, style, and arrangement approved by the Code.

C. All vacuum breakers and backflow preventers shall be installed with the necessary isolation valves and test cocks.

D. Backflow preventers shall be located at a maximum of 4' - 0" A.F.F. and shall be accessible for service. Backflow preventers shall have a water filter with a replaceable cartridge.

2.9 GAS PRESSURE REGULATORS

A. Furnish and install, as required, approved type gas pressure regulators in gas piping ahead of appliance and equipment. Regulators located outside of building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with approved cap screen. Approved manufacturers of gas regulators are Fisher and Reliance.

PART 3 – EXECUTION

3.1 PRODUCT HANDLING

A. Protection:

Use all means necessary to protect plumbing materials before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements:

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.

3.2 TESTING

A. Furnish all required personnel and equipment and make all tests required to receive the approval of the Owner and all agencies having jurisdiction.

3.3 CLEANING UP

A. Prior to acceptance of the building, thoroughly clean all exposed portions of the plumbing installation, removing all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item and being careful to avoid all damage to finished surfaces.

3.4 ROOF DRAIN LOCATIONS

A. This contractor shall review the architectural and structural drawings, and shall field verify from actual job site conditions that the roof drains are located at the low points of the roof systems. The locations shown on the plumbing drawings are approximate. All low points on the roof shall have primary and secondary roof drains installed in them unless otherwise noted.

3.5 INSTALLATION OF PRESSURE REDUCING VALVES

A. General: Install one or more pressure reducing valves on the main water line supplying plumbing fixtures.

1. Provide each pressure reducing valve with a gate valve and union on both the inlet and outlet connections.
2. A bypass one pipe size smaller than the main water line provided with a globe valve and union, shall be installed between the inlet and outlet sides of the pressure reducing valve assembly.
3. Pressure gauges shall be installed at the inlet and outlet connections to the pressure reducing valve assembly. Gauges shall have T-handle stops in their connections.

3.6 STRAINER INSTALLATION

A. General: Place strainers ahead of pressure reducing valves, automatic control valves, pumps, and elsewhere as indicated on the drawings or specified.

3.7 BACKFLOW PROTECTION VALVE INSTALLATION

A. General: The entire water distribution system shall be protected against contamination due to backflow from non-potable sources. Each connection to a fixture or an item of equipment shall be protected in accordance with the requirements of the National Plumbing Code.

B. Reduced Pressure Zone Backflow Preventer: Install a reduced pressure zone backflow preventer in the building water supply main to expansion tanks, condenser water systems, and boilers as shown on the drawings and/or as required by the local codes.

3.8 INSTALLATION OF PIPE SLEEVES

A. Basic Requirements: Install pipe sleeves as follows:

1. Pipe sleeves shall be provided for all pipes passing through walls, slabs on grade and floors. Sleeves may be omitted where pipes pass through exterior walls above ground to lawn faucets, wall hydrants and downspout nozzles.
2. Sleeves for pipes passing through exterior walls and slabs on grade which do not have membrane waterproofing shall be of cast-iron or galvanized steel pipe or black steel pipe, Schedule 40.

3. Sleeves for pipes passing through exterior walls, slabs on grade and floors which are provided with membrane waterproofing shall be of threaded galvanized steel pipe fitted with companion flanges and arranged to secure membrane. Companion flanges shall be drilled and tapped in such a manner that bolting is affected from the outer (or upper) face only.
4. Sleeves for pipes passing through potentially wet floors that do not have membrane waterproofing such as in toilet rooms, cafeteria kitchens, serving areas, dishwashing rooms, utility cores, mechanical equipment rooms, and areas that are provided with fire protection sprinkler systems, shall be galvanized steel pipe, shall project 2 inches above the finished floors, and shall be caulked watertight.
5. Sleeves for pipes passing through all other floors and walls shall be constructed of galvanized or black steel pipe, standard weight.

B. Sleeves On New Work: On new work, sleeves shall be built into the walls and floors as the work progresses.

3.9 INSTALLATION OF CLEANOUTS AND FERRULES

A. Riser Connection to Sewer or Drain: Where soil, waste, or roof drainage risers connect to a sewer or drain extending from the building above the lowest floor, the fitting at the base of each stack or downspout shall be a sanitary tee or a combination Y and 1/8 bend with cleanout plug in the end of the run of the main.

B. Test Tees: Each vertical soil, waste, and vent pipe and each downspout and roof drainage pipe which connects to horizontal drain piping below ground shall be fitted with a test tee above the lowest floor or ground. Where accessible, test tee may be installed in the horizontal pipe at the base of the riser.

C. Cover Plates: Where cleanouts or test tees occur on concealed pipes in finished rooms, they shall be provided with a 1/8-inch thick, machine finished, brass cover plate of sufficient diameter to cover the opening in the finished wall or partition. The cleanout plug shall have a solid head, tapped for a 1/4-inch brass screw to secure the cover plate. Where cleanout plugs extend beyond the wall finish, the cover plates shall be of machine finished brass and shall be only of sufficient depth to fit against the wall to cover plug. Cleanout cover plates shall be painted to match adjacent wall finish.

D. Cleanouts Plugs for Threaded Fittings: Cleanout plugs for threaded fittings shall be in accordance with ANSI B16.12. Except for test openings, where size must be sufficient to admit test plug, bushings will be permitted on pipes 5-inches and larger to reduce plug size to 4 inches; cleanout plugs for piping 4 inches and smaller shall be the same size as the pipe.

E. Cleanout Plugs for Copper Drainage Lines: Cleanout plugs on copper drainage lines shall be installed in solder-joint fittings having threaded openings provided for the cleanout, or in solder-joint fittings with threaded adapters.

3.10 WATER PIPING INSTALLATION

A. General: Water piping shall be complete from service connection to all fixtures and equipment outlets. Sizes of pipes shall be as shown or specified.

B. Reaming: Ends of pipes and tubes shall be reamed before being made up.

C. Threaded Joints: Threaded joints shall be made up metal-to-metal, with a noncorrosive lubricant applied to the male thread only. Lampwick or other packing material shall not be used in making up threaded joints.

D. Chromium Plated Piping: Chromium plated piping shall be threaded and made up carefully, and not more than one full turn of thread shall be exposed beyond any fittings.

E. Long Screws and Bushings: Long screws and bushings (other than bushings cast in the sand) shall not be used on water piping.

F. Soldering: Ends of tubing and recesses of fittings to be soldered shall be thoroughly cleaned. Joints shall be assembled without binding. Solder shall penetrate fully and shall fill the joint completely. Joints shall be made using lead-free solder, as specified.

G. Joint Materials: All joint materials shall be free from oil, tar, and greasy substances, and shall be dry when placed in the joint. The material shall be handled with care to prevent contamination.

H. Copper Tubing: All copper tubing shall be free from cuts, dents or other surface damage at the time of final inspection. Damaged tubing shall be removed and replaced with new.

I. Copper Tube Anchoring: Horizontal runs of copper tubing over 50 feet in length shall be anchored to wall or floor construction. Anchors shall be located near the midpoints of the runs so as to force the expansion equally to the ends or in a direction where expansion can take place without excessive strain.

J. Swing Joints, Offsets, and Expansion Joints: Swing joints, offsets, and expansion joints shall be provided where necessary to accommodate expansion of piping, which will be approximately two inches in 100 feet of copper hot water piping.

K. Dielectric Couplings: Where non-ferrous metal piping and zinc-coated metal piping are joined, brass couplings, fittings or unions shall be provided.

L. Reducing Fittings: Where pipe sizes shown or specified differ from the connection sizes of meters, pumps, fixtures, outlets, and the like, reducing fittings shall be installed close to them.

M. Pipe Branches: Branches from water supply mains shall be taken from the top, bottom or side, using crossover fittings where required by structural or operating conditions.

N. Upfeed Hot Water Return: On upfeed hot water distribution systems for which return circulation piping is shown, a 1/2" circulation connection shall be made at a point on each riser just below the highest outlet connection. Provide branch circulation lines with gate valves near the valves on corresponding supply lines.

O. Downfeed Hot Water Supply: Each downfeed main for a hot water supply system shall be graded upward to the first branch connection, which shall be taken from the top of the main. Beyond the first connection the main shall grade downward, and all branch connections shall be taken from the bottom of the main. Connect a 1/2-inch circulating line to the bottom of each downfeed riser. Provide branch circuiting lines with gate valves in locations corresponding to the supply branch valve locations.

P. Grading: Hot water supply and hot water circulating lines shall be accurately and uniformly graded to avoid traps which might impede or destroy circulation. All lines shall be graded so as to facilitate drainage.

Q. Unions: Unions shall be installed near points of connection to each piece of equipment, and elsewhere as required for installation of piping, removal and replacement of regulating and control equipment and the like. Right and left couplings or nipples are prohibited.

R. Water Hammer Arresters: Water hammer arresters shall be provided where indicated on the drawings. Water hammer arresters shall be approved and installed in accordance with the requirements of PDI-WH201 and shall bear the PDI seal of approval.

S. Roughing: Roughing shall be provided for equipment furnished under other sections of the specifications.

T. Where future extensions are indicated on the drawings, roughing shall extend to within the space to be served and shall be valved and capped or plugged.

END OF SECTION 22 0000

SECTION 22 0700

INSULATION

PART 1 – GENERAL

1.1 WORK INCLUDED

A. It is the intent of this section of the specifications that all hot (above 105 deg. F.) and cold (below 55 deg. F) surfaces of all piping and mechanical system components be insulated, unless specifically excluded herein.

B. Systems to be insulated:

1. Supply air ductwork
2. Culinary hot and cold-water piping systems
3. Roof drain piping systems
4. Water, tempering valve and pipe, and waste lines below lavatories and ADA sinks
5. Make-up air unit ductwork (exposed & concealed)
6. Refrigerant suction lines

C. The providing of all materials, supplies, equipment, tools, transportation, and facilities and performing all labor and service necessary to provide the work outlined above and as shown on the working drawings.

PART 2 – PRODUCTS

2.1 COMPLIANCE

A. All insulation shall (as a minimum) conform to the requirements of the building code an have a flame spread rating of less than 25 and smoke developed less than 50.

B. Insulation shall be manufactured by Johns-Manville, Owens-Corning, Knauf, Armstrong, or Certainteed.

2.2 DOMESTIC HOT & COLD-WATER PIPING

A. All piping shall be insulated with 2-piece heavy density pipe insulation having an average thermal resistivity in the range of 4.0 to 4.6 Hr Deg. F. Ft2/BTU per inch of thickness on a flat surface at a mean temperature of 75 deg. F. Thickness of insulation shall be as follows:

MINIMUM PIPE INSULATION THICKNESS IN INCHES FOR PIPE SIZES**

Minimum Pipe Insulation in inches

PIPING SYSTEM TYPES	FLUID TEMP. RANGE, (deg. F)	CONDUCTIVITY (Btu-in./(h-ft^2-deg F))	<1"	1" TO <1 1/2"	1 1/2" TO <4"	4" TO <8"	8" TO >8"
DOMESTIC HOT WATER (120 deg F)	105-140	0.21-0.28	1.0	1.0	1.5	1.5	1.5
DOMESTIC HOT WATER (140 deg F)	141-200	0.25-0.29	1.5	1.5	2.0	2.0	2.0
DOMESTIC COLD WATER	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
REFRIGERANT SUCTION LINE	40-60	0.21-0.27	0.5	0.5	1.0	1.0	1.0
REFRIGERANT LIQUID LINE	105-140	0.21-0.28	1.0	1.0	1.5	1.5	1.5
ROOF DRAIN	<40	0.20-0.26	0.5	1.0	1.0	1.0	1.5
a.	Piping in conditioned partitions may have insulation reduced by 1" to a minimum insulation of 1" if piping diameter is less than 1 1/2" See IECC 2018 403.11. Reduced insulation length must be less than 12 ft.						
b.	For piping exposed to outdoor air, increase thickness by 1/2"						
c.	Direct buried Hot water may have insulation reduced by 1 1/2" to a minimum insulation of 1", see IECC 2018 403.11.						

* Runouts not exceeding 12 feet in length to individual terminal units.
** For piping exposed to outdoor air, increase thickness by 1/2".

B. Pipe insulation shall be covered with an all-service jacket.

C. Duct insulation, pipe Insulation & vapor barrier shall be run continuous thru all wall and floors.

D. Insulated piping in areas exposed to abuse shall have a heavy-duty white PVC cover.

2.3 ROOF DRAIN PIPING

A. Roof drain receivers and roof drain piping (both primary and secondary) except in masonry wall and where buried in the ground, shall be insulated as specified for domestic cold water. Insulation thickness shall be 1".

B. Roof drain piping and fittings running exposed in occupied public areas shall be covered with a white PVC cover.

2.4 REFRIGERANT SUCTION PIPING

A. Refrigerant suction piping shall be insulated with 1-1/2" thick closed cell flexible foam. Insulation exposed to outside shall be finished with two heavy coats of U.V. resistant grey sealer.

2.5 WATER & WASTE PIPING EXPOSED BELOW LAVATORIES AND ADA SINKS

A. Insulate all exposed surfaces with an approved ADA insulation kit as required by sink manufacturer.

2.6 LOW PRESSURE ROUND DUCTS

A. All round metal ducts shall be wrapped with 1" thick fiberglass duct wrap with factory-applied vapor barrier. All joints shall be sealed with mastic and taped to form a neat and complete insulation system.

2.7 MAKEUP AIR UNIT SUPPLY DUCT

A. Wrap makeup air unit exhaust duct with 1" thick fiberglass blanket with FSK barrier.

2.8 DUCTS ABOVE ROOF

A. Ducts above roof shall be covered with 2" thick 3 lb. density rigid duct board secured with duct clips and covered with .016" aluminum sheet as hereinafter specified. Do not line make-up air ductwork.

B. Material shall comply with 2021 IMC Standard 10-1.

PART 3 – EXECUTION

3.1 GENERAL

A. The contractor shall provide a complete installation which is neat in appearance and functional.

B. Remove all excess materials and packaging from job site.

C. All insulation shall be continuous thru wall and ceiling openings and thru sleeves.

D. Insulation on all cold surfaces where vapor barrier jackets are used will be applied with a continuous, unbroken vapor seal. Hangers, supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.

E. Valves and fittings inside the building shall be insulated as specified for the piping systems and covered with high temperature P.V.C. insulation fitting covers.

F. Fittings and valves for pipe size smaller than 4" shall be insulated and finished with Insulating and Finishing Cement to a thickness equal to the adjoining pipe insulation. Fittings and valves for pipe sizes 4" and larger shall be insulated with segments of the molded insulation secured with No. 20 gage galvanized annealed steel wire finished with a smoothing coat of finishing cement. Vapor seal with a layer of glass fabric embedded between two 1/16" coats of vapor seal adhesive. Lap seal outer jacket at least 1" on itself adjoining insulation.

G. All terminations of insulation ends shall be tapered and covered with finishing cement.

H. In exposed areas, all fittings shall be additionally finished with FSK wrap smoothly adhered. Overlap the FSK wrap on itself and adjoining pipe insulation. Overlap to be at least 1" on pipe insulation below 4" and 2" on sizes 4" and above.

I. Insulation inserts and shields for cold surface piping such as roof drain lines and domestic cold-water piping shall be installed at all pipe hangers. Inserts between the pipe and pipe hangers shall consist of calcium silicate block insulation of equal thickness to the adjoining insulation and shall be provided with vapor barrier where required. Insulation inserts shall not be less than the following lengths:

1/2" to 2-1/2" pipe size	6" long
3" to 6" pipe size	9" long
8" to 10" pipe size	12" long

J. Rigid metal shields shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and shall extend up to the centerline of the pipe and length specified for the insulation hanger inserts.

K. Vapor barrier wrap shall be sealed tight and not penetrated by the hanger or shield, and Finishing Cement, pre-sized glass cloth shall be smoothly adhered with Adhesive.

L. Adhesives, mastics, and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.

M. Where insulation pipes pass thru sound or fire-rated walls, floors, or ceilings, the insulation sleeves shall be sound or fire-rated to match rating of surface penetrated.

N. All insulation which runs outside of the building, or inside of the building in areas where the insulation will be exposed to physical abuse, shall be jacketed with a minimum thickness of .016-inch aluminum. The insulation and aluminum shall be secured in place by a continuous friction type joint to provide a positive weatherproof seal along the entire length of the aluminum jacket. Then, an aluminum preformed strap containing a permanently plastic weatherproof sealant shall be centered over each circumferential joint, and secured by tightening on a clip, or by use of separate 1/2-inch-wide stainless-steel banding. All elbows, tube, turns, sweeps, and bends shall be insulated with mitered sections of aluminum-jacketed insulation. Joints shall be sealed with a sealing compound and preformed aluminum bands. Valves shall be covered by prefabricated sections of aluminum-jacketed insulation according to manufacturer's recommendation.

3.2 INSULATION WORKMANSHIP

A. All insulation shall be applied by specialists experienced in the field and shall be neat in appearance. Neatness in appearance shall be equated to proper insulation application procedures, and sloppy workmanship will not be tolerated. Work which is deemed unacceptable shall be condemned, removed, and replaced at the contractor's expense.

B. Protect floors, valve handle, accessories, etc., to keep paste off areas not being insulated.

C. Splitting of longitudinal sections on flexible foam pipe insulation will not be permitted.

3.3 CLEAN-UP

A. The piping shall be cleaned and tested prior to installation of insulation.

B. Fittings shall be cleaned after insulation is installed.

END OF SECTION 22 0700

SECTION 23 0100

GENERAL PROVISIONS

PART 1 – GENERAL PROVISIONS

1.1 GENERAL CONDITIONS

A. The contractor shall carefully read the General Conditions of the Contract and all information to bidders which, with the following specifications for heating, cooling, plumbing, exhaust ventilation, and temperature controls are a part of the Contract.

1.2 BASIC BID

A. Shall include all labor and materials specified in this division. The term "furnish" and/or "install" or similar implication shall mean "furnish and install complete."

1.3 SCOPE OF WORK

A. The work to be done under this section includes the furnishing of all labor, materials, equipment, controls and accessories required to complete all heating, air conditioning, ventilating, plumbing, drainage, heat recovery, and other mechanical systems as shown on plans and/or described in these specifications, including miscellaneous items required to provide a complete and functional facility.

B. Work shall include, but shall not be necessarily limited to, the following:

1. System commissioning
2. Testing
3. Balancing
4. Insulation systems
5. Roof drain system
6. Air distribution system
7. Exhaust systems
8. Sawdust exhaust system
9. Paint booth system
10. Automatic control systems
11. Air conditioning system
12. Plumbing systems
13. Compressed air systems
14. Replacement/relocation of existing systems
15. Demolition of existing systems
16. Connections to existing systems
17. Special systems
18. **Equipment start-up by factory trained and authorized technician.**

C. The mechanical contractor shall provide all miscellaneous electrical work and control wiring for special systems where the wiring requirements are provided by the equipment manufacturers and/or suppliers, unless all of the required wiring is clearly shown on the electrical drawings to be provided by the electrical contractor.

1.4 CODES AND ORDINANCES

A. All work shall be installed in accordance with the city, state, and local plumbing codes, and all other codes, ordinances, and regulations which govern the type of work covered by these specifications.

B. Should the drawings conflict with the code, the code shall govern the proper installation of the work, and no extra charge shall be made for such change.

C. Should the contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, industry standards, or utility company regulations, he shall bear all costs arising in correcting the deficiencies.

D. Where the work required by the drawings and specifications exceeds the minimum code requirements, the work shall be done as shown or specified.

E. NOTE: Code compliance, or similar terminology, shall be interpreted to mean "the interpretation of the code as enforced by the local building authority".

1.5 DRAWINGS AND SPECIFICATIONS

A. These specifications are intended to cover all labor, material, and standards of mechanical workmanship to be employed in the work shown on the drawings, called for in these specifications, or reasonably implied by terms of same. The drawings and specifications are intended to supplement one another, and any part of the work that may be mentioned in the one and not represented in the other shall be done the same as if it had been mentioned or represented in both.

B. Large scale drawings shall take precedence over layouts and small-scale details.

C. The mechanical drawings are schematic in nature, and show the general arrangement of all piping, ductwork, mechanical equipment, and appurtenances. They shall be followed as closely as the actual building construction and the work of other trades will permit.

D. ACAD or Revit drawing files <u>will not</u> be provided to contractor for use. PDF's of sheets may be provided by request for coordination purposes.

E. Due to tight structural conditions and space limitations in selected areas the contractor should anticipate structural and space conflicts and shall make allowances for them in his bid. Until the steel fabrication shop drawings are submitted for review, the mechanical coordination cannot be completed.

F. The architectural and structural drawings shall be considered part of the mechanical work insofar as these drawings furnish this Division with information relating to design and construction of the building. Architectural and structural drawings take precedence over the general building layouts and details shown on the mechanical drawings.

G. The structural engineer and architect shall approve all attachments to or modifications of any structural members in the building required for installation of the mechanical systems.

H. Because of the small scale of the mechanical drawings, it is not possible to indicate all offsets, fittings, and accessories which will actually be required. This contractor shall investigate the structural and finish conditions affecting the work and provide all necessary offsets, fittings, valves, trim, and accessories required to meet actual job-site conditions.

1. Dimensions -
   Verify dimensions governing mechanical work at the building. No extra compensation shall be claimed or allowed on account of differences between the actual job-site dimensions and those indicated on the drawings.

2. Adjoining work -
   Examine all adjoining work on which the mechanical work is dependent and report any work which must be corrected. No waiver of responsibility shall be claimed or allowed due to failure to report unfavorable conditions affecting the mechanical work.

1.6 INTERPRETATION OF DRAWINGS AND DOCUMENTS

A. If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the plans, specifications, or other proposed contract documents, or finds discrepancies in or omissions from the drawings or specifications, he may submit to the Owner's representative, a written request for an interpretation or correction thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation or correction of the proposed documents will be made only by addenda duly issued, and a copy of such addenda will be mailed or delivered to each person receiving a set of such documents. The Owner will not be responsible for any other explanations or interpretations of the proposed documents. All questions shall be submitted at least seven days in advance of bidding.

B. The Owner's representative will interpret the meaning of any part of the drawings and specifications about which any misunderstanding may arise, and his decisions will be final. Should there appear to be any error or discrepancy in or between the drawings and specifications, the contractor shall refer the matter to the Owner's representative for adjustment before proceeding with the work. Should the contractor proceed with the work without so referring to the matter, he does so on his own responsibility.

1.7 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.

1.8 SUBSTITUTIONS

A. See Special Conditions pertaining to Substitutions.

B. Requests for prior approval must be submitted to the owner’s representative a minimum of five working days prior to bid date.

1.9 FEES & PERMITS

A. This contractor shall obtain all necessary permits. South Sanpete School District shall pay all connection fees required in connection with the work.

B. Requirements of the local utility companies shall apply at the time of bidding. The contractor shall have checked with the local utility companies, and shall determine from them all valves, boxes, meter boxes, and meters which they will require to be installed, and shall figure cost of same in his bid. Utility connection fees will be paid by the School District.

C. Site utility contractor shall provide water meter and meter box as required by local water department.

1.10 SITE INSPECTION AND EXAMINATION OF DRAWINGS

A. The contractor shall carefully study all drawings and specifications pertaining to the work. If any of the work as laid out, indicated, or specified is contrary to or conflicts with any governing ordinances or regulations, the same shall be reported to the Owner's representative before submitting a bid. The Owner's representative will then issue instructions as to the procedure.

B. The contractor shall carefully examine the building site and compare the drawings with existing conditions. By the act of submitting a bid, the contractor shall be deemed to have made such examination, to have accepted such conditions, and to have made allowance therefore in preparing his bid.

1.11 VERIFICATION OF DIMENSIONS

A. Before proceeding with any work, the contractor shall carefully check and verify all dimensions, sizes, etc., and shall assume full responsibility for the rigging and fitting-in of his ductwork, piping, and equipment. Where apparatus and equipment has been indicated on the drawings, dimensions have been taken from typical equipment of the class indicated. The contractor shall carefully check the drawings to see that the equipment he is required to install will fit into the spaces provided and will allow for proper maintenance and service of the equipment.

1.12 COORDINATION

A. This contractor shall coordinate his work with other specification divisions and shall provide all necessary specialty items, trim, and incidental 115 volt and 24-volt power and control wiring (which is not shown or specified under other divisions) required to provide a complete functional acceptable system.

B. The Division 22 & 23 contractor shall coordinate his work such that all slots and openings through floors, walls, ceilings, and roofs are properly located and shall do any cutting and patching caused by neglecting to do so.

1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into the construction as the work proceeds.
2. It is the responsibility of Division 22 & 23 to locate these items and see that they are properly installed.

C. The locations of all piping, ducts, apparatus, and equipment indicated on the drawings are approximate only, and shall be changed as required to meet the actual architectural and structural conditions at the job site. All changes shall be approved by the Owner's representative. Any change in work which has not been installed shall be made by the contractor without additional compensation, except changes which are caused by architectural and structural changes which substantially increase the size of any of the mains, or which substantially increase the number of fixtures or length of pipe runs. Any and all changes shall be made only upon approval of a written change order.

1. Right of way - Lines which pitch shall have the right of way over those which do not pitch. For example, plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have right of way over lines whose elevations can be changed.

2. Offsets, transitions, and changes in direction in pipes and ducts shall be made as required to avoid conflicts with building footings and foundations or other buried ducts or utilities, and to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. Furnish and install all traps, air vents, sanitary vents, and devices as required to affect these offsets, transitions and changes in direction.

D. It shall be each contractor's responsibility to verify exact location, elevation, and/or route of the various mechanical system components with architectural details and with Owner's representative's personnel on job.

E. Where deviations from locations and/or arrangements described are necessary to meet actual job conditions, the changes shall be made without cost to the Owner.

F. The Owner's representative reserves the right to make any reasonable change in location of any outlet, piping, or equipment, before installation, without additional cost.

1.13 LOCATION OF CEILING OUTLETS:

A. This contractor shall assist the Owner's representative, General Contractor, Electrical Contractor and other interested parties in the establishment of room centerlines, axis of rooms and all walls.

B. All grilles, registers, ceiling diffusers, etc. shall be located with reference to these established data points.

C. These outlets shall be referenced to such features as room centerlines, walls and ceiling furrings, balanced border widths, etc.

D. Outlets in acoustical tiles, panels, etc. shall occur in joints or centers of whole pieces, etc.

E. The final determination of the exact location of all outlets shall be subject to the direction and approval of the Owner's representative.

1.14 PROVISIONS FOR REMOVAL & ADEQUATE CLEARANCE

A. Install Mechanical work to permit removal of heating and cooling coils, filters, belt guards, sheaves, drives, and other parts requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.

B. Arrange pipes, ducts, and equipment to permit ready access to filters, valves, cocks, traps, starters, motors, control components, and to clear the openings of swinging doors and access panels.

1.15 RECORD DRAWINGS

A. The contractor shall maintain one set of record drawings. These prints shall show the location, elevations and details of all items of work installed under this contract. Buried piping shall be located by dimensions from foundation walls and depths of bury shall be indicated. These shall be marked in red. The completed set of record drawings must be submitted to the Owner's representative before the contractor is eligible to receive the final payment. An up-to-date record set of drawings shall be maintained during the progress of the project and be available to the Owner's representative upon request.

1.16 COORDINATION DRAWINGS

A. The contractor shall provide coordination drawings, when requested by the Owner's representative, to ensure that the various mechanical system components are coordinated with each other, and with other building systems.

B. The coordination drawings shall be drawn to scale (usually 1/4" = 1'-0") and shall show all systems as they relate to each other, especially in areas of potential conflict.

C. Equipment room coordination drawings shall include, in addition to the information specified, the size and location of all piping, pipe fittings, valves, strainers, specialties, flexible connections, water treatment devices, control panels, etc., and their installed elevation.

D. Equipment room coordination drawings shall show the location of all pertinent electrical outlets, lights, panels, transformers and switch gear, and their required clearances from duct, piping, and equipment, and for maintenance access.

E. Footing and foundation coordination drawings shall be prepared showing the exact location, depth, and slope of all buried piping to be installed. These coordination drawings shall include all sand and grease interceptors, drains in depressed slab areas, and all necessary buried water piping.

F. This set of foundation coordination drawings shall be maintained in the construction trailer and shall be marked up daily to indicate exact location and elevation of all buried piping and conduit systems.

G. Coordination drawings shall be professionally drafted and shall be clear and concise in their presentation and clarity.

H. All coordination drawings shall be prepared in digital format in the latest version of Revit. Material shall be submitted in both printed and digital form.

I. All ductwork and piping attachments to the building structure shall be detailed and shall be coordinated with the Owner's representative.

1.17 COOPERATION WITH OTHERS

A. The contractor shall so organize the work that progress will harmonize with the work of all trades, so that all work may proceed as expeditiously as possible. The contractor shall be held responsible for any delays which might be caused by his negligence or failure to cooperate with other contractors or crafts.

1.18 FOREMAN

A. A full-time foreman shall be designated by the contractor to the Owner's representative and shall be available on site for consultation. This individual, when appointed, will not be replaced without prior approval from the Owner's representative. The foreman shall be responsible for the coordination and correct placing of the work.

1.19 GUARANTEE

A. By the acceptance of the contract award for the work herein described, the contractor assumes the full responsibility imposed by the guarantee as set forth herein and should protect himself through proper guarantee from equipment and specialty manufacturers and subcontractors as their interests may appear.

B. All materials and equipment provided and installed under this division of the specifications shall be guaranteed for a period of one (1) year from the date of substantial completion and acceptance by the Owner, unless specifically noted elsewhere in the specification. Should any trouble develop during this period due to defective materials or workmanship, the contractor agrees to correct the trouble without any cost to the Owner, any defect noticed at the time of installation and/or during the guarantee period shall be corrected immediately to the satisfaction of the Owner.

1.20 SCHEDULES, MATERIALS AND EQUIPMENT

A. As soon as practicable, and within 30 days after date of award of contract, and before commencement of work, a complete schedule of equipment and materials proposed for installation shall be submitted to the Owner's representative. The schedule shall include catalogs, cuts, drawings, and such other descriptive data or samples that are requested by the Owner's representative. Schedules shall include all items of equipment used. No partial submittals will be accepted.

B. Provide a complete digital copy of each required shop drawing or similar submittal to the Owner's representative for review, approval. DO NOT SUBMIT without the general contractor's signed stamp, indicating the general contractor has reviewed the submittal for completeness and conformance to the Contract Documents.

C. Inform the Owner's representative by notation, or in the letter of transmittal, of any proposed deviation from the requirements of the Contract Documents.

D. Provide required shop drawings or other submittals within time stipulated on approved progress schedule.

E. Do not commence work requiring a shop drawing or other submittal until approval of the required submittal has been received. Such approval will be based upon a review only for conformance with the design concept of the project and with the information given in the Contract Documents and does not relieve the contractor from responsibility for errors or omissions in the shop drawings.

F. Schedules shall be neatly bound in a digital format. Schedules shall be completely indexed, and shall include the following items:

1. Valves
2. Piping systems
3. Pipe supports & restraints
4. Rooftop units
5. Make-up air units
6. Paint booth
7. Sawdust collection system
8. Air conditioning systems
9. Unit heaters
10. Pressure gauges & thermometers
11. Plumbing fixtures
12. Supply air fans
13. Exhaust air fans
14. Welding extraction arms
15. Ventilation air fans
16. Filter banks
17. Dampers
18. Louvers

19. Low pressure flexible ducts
20. Grilles & registers
21. Diffusers
22. Insulation systems
23. Vibration isolators
24. Seismic restraints
25. Automatic temperature controls
26. Air balance contractor qualifications
27. System commissioning contractor's qualifications
28. Fire safing system with installation diagrams
29. Other schedule items

G. Submittals received which do not contain all of the above items will be returned unchecked.

H. Purpose and Contractor's Responsibility:

I. The purpose of the final submittal is to "assist the contractor in selecting the equipment." The contractor shall review the submittals prior to submission to the Owner's representative to make sure that the submittals are complete in all details including the following items:

1. Manufacturers' names shall be mentioned in specifications as accepted by Owner at time of bidding.
2. Equipment dimensions shall be verified to fit the spaces provided with sufficient clearances, as may be required by the equipment or indicated on the drawings.
3. Equipment shall be reviewed with respect to schedules, specifications, plans and details.
4. Equipment submittal sheets shall be clearly marked indicating equipment symbol and exact selection of proposed equipment.

J. Review:

Review and acceptance of submittal does not relieve the contractor of his responsibility to fulfill the contract requirements. Review and acceptance of the submittal will not be used as a means of changing the contract requirements. Items not covered in the accepted submittal, or items incorrectly covered but not recognized or identified, shall not be used when contrary to the requirements of the contract documents.

K. Acceptance of Substitute Equipment:

If the proposed installation is approved, this contractor shall make all incidental changes in piping, ductwork, supports, installation, wiring, heaters, panel boards, and as otherwise necessary. Provide any additional motors, valves, controllers, fittings, and other additional equipment required for the proper operation of the system resulting from the contractor's selection of alternate equipment, including all required changes in the effected trades.

L. Owner's Refusal Right:

In the event that items submitted are substitutions for specified items and are found to be not acceptable, the right shall be reserved to require the specified items.

1.21 OPERATING INSTRUCTIONS AND CATALOG INFORMATION

A. This prime Division 23 contractor shall compile in digital format, catalogs of every product used by him and subcontractors in the completion of the work. The manual shall also include copies of the test data (Section 230501), balancing reports (Section 230593), and system commissioning data (Section 230800). Before final acceptance by the Owner's representative, he shall turn over to the Owner this compilation of catalog data. A double index shall be provided, one giving an alphabetical list of products for which catalogs are included, and one giving their addresses, whose products are included in the work. Provide data for each item of equipment listed in SCHEDULES, MATERIALS & EQUIPMENT, as shown in Section 230100. Provide copy of submittal data. All products shall be assembled by Division.

B. One (1) digital copy shall be delivered to the Owner's representative for his approval.

C. Provide warranty schedule and schedule of overload protection as required in Section 230800.

D. Manuals not in compliance will not be reviewed and will be rejected.

E. Manual Shall be identified as follows.

MANTI HIGH SCHOOL SHOP & WRESTLING ROOM ADDITION
SOUTH SANPETE SCHOOL DISTRICT
OPERATING & MAINTENANCE MANUAL
2024-2025
SET #

PART 2 – PRODUCTS

2.1 MATERIALS, EQUIPMENT AND ACCESSORIES

A. Unless otherwise specified, all equipment, accessories, and materials shall be new and undamaged, and the workmanship shall be of the best quality for the use intended and shall be acceptable to the Owner's Representative.

B. Equipment, accessories, and materials shall be essentially the standard products of the manufacturer, or as specified herein. Where two or more units of the same class of new equipment are required, these units shall be products of a single manufacturer.

C. Should mechanical equipment other than that used in the design be furnished, it shall be the responsibility of the mechanical subcontractor to provide large scale (1/2" = 1'-0") installation drawings, as required, showing service and maintenance points with proper clearance allowances for service.

D. All equipment shall be selected to deliver full rated capacity at the job site elevation.

PART 3 – EXECUTION

3.1 FUNCTIONING AND OPERATION OF EQUIPMENT

A. Contractor's Responsibility:

Installation and startup shall be so made 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.

3.2 CLEANING AND PATCHING BY MECHANICAL CONTRACTOR

A. 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.

3.3 INSTRUCTIONS TO OWNER'S REPRESENTATIVES

A. The mechanical contractor shall provide, without expense to the Owner, competent instructors to train the Owner's representatives in the care, adjustment, maintenance, and operation of all parts on the heating, air conditioning, ventilating, plumbing, and automatic temperature control systems and equipment. Training shall be a minimum of 8 hours with no less than 2 hours for ATC training.

B. An additional 8 hours shall be provided by all mechanical subcontractors to walk through the building with the South Sanpete School District representative to verify operation of all Division 22, 23, & 25 items and control sequencing.

C. Instruction date shall be scheduled with the owner at the time of final inspection. A written report specifying times, dates, and the name of personnel instructed shall be forwarded to the Owner's representative.

D. No training shall begin until system commissioning is complete and accepted by the owner.

3.4 PROTECTION AGAINST THE ELEMENTS

A. The contractor shall, at all times, take reasonable and adequate precautions to protect his work and all stored materials and equipment from damage by the elements, including flooding, windstorms, etc., and shall not expose the work of any other contractor to such damage.

B. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by the Owner's representative until installed.

C. All items subject to moisture damage, such as controls, shall be stored in dry, heated spaces.

D. Protect all bearings during installation, and thoroughly grease steel shafts to prevent corrosion.

3.5 REMOVAL OF DEBRIS, ETC.

A. Upon completion of this division of the work, remove all surplus material and rubbish resulting from the work, and leave the premises in a clean and orderly condition.

3.6 MOTORS & STARTERS

A. This contractor shall furnish all motors required and necessary to operate equipment furnished by him. The voltage, phase, and horsepower of each motor shall be coordinated with the electrical contractor prior to ordering.

3.7 OPENINGS FOR MECHANICAL SYSTEMS

A. All openings required for installation of mechanical systems shall be provided by the mechanical contractor. Any piece of equipment which is to be installed in any space of the building and which is too large to permit access through stairways, doorways or shafts shall be brought to the job by the Contractor involved and placed in the space before the enclosing structure is completed. Materials shall be delivered at such stages of the work as will expedite the work as a whole.

3.8 SAFETY REGULATION

A. The contractor shall comply with all local 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.

3.9 OWNER FURNISHED EQUIPMENT

A. This contractor shall include in his bid the necessary labor and material to properly coordinate and install the required piping, trim, specialties, controls, ductwork, and other necessary utilities and services to equipment furnished by the Owner.

B. This contractor shall relocate (where noted), rough-in and make final connections to owner furnished equipment.

C. See bid documents for a list of owner furnished equipment which is not otherwise identified on the mechanical drawings or in the mechanical division of the specifications.

END OF SECTION 23 0100

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SECTION 23 0501

TESTING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work outlined in this section shall be performed by the several trades involved.

B. The mechanical contractor shall provide all supervision, labor, materials, tools, scaffolding, and equipment required to complete all system testing.

C. The mechanical contractor shall remove and repair any defective component as indicated by the system tests and retest.

D. The mechanical contractor shall test the operation of all safety and high limit controls to ensure proper installation and operation. Any defective devices shall be replaced.

1.2 TESTS AND ADJUSTMENTS

A. Before any piping is covered, tests shall be made in the presence of the Owner's Representative, and any leaks or defective work corrected. No caulking of threaded work will be permitted.

B. Before application of insulation covering, and as far as practical before concealing any piping, all piping shall be hydrostatically tested and proved tight.

C. Stubs shall be capped, and all control valves shall be removed during the test.

D. System may be tested in sections, providing connections to last section tested are included in each succeeding test.

E. Following minimum pressures shall be used for testing:

1. Natural gas piping at 150 psig for six hours.
2. Compressed air piping at 150 psig for six hours.
3. Domestic hot and cold-water piping at 150 psig for six hours.
4. Plumbing waste and vent piping at 10 ft. head for six hours.
5. Rainwater piping at 10 ft. head for six hours.
6. Low pressure air ducts in accordance with SMACNA standards
7. Sawdust collection systems ducts in accordance with SMACNA standards
8. Fire protection system piping at 150 psig for six hours
9. Refrigerant piping as required in 230900.

F. All valves and equipment which may be damaged shall not be subjected to test pressure.

G. 230501 contractor shall perform all duct pressure tests per specifications and owner requirements.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. The contractor shall furnish all necessary gauges, plugs, test fans, pumps, etc., as required to conduct the tests.

2.2 REPORTS

A. The contractor shall give the Owner's Representative one week's notice prior to performing the tests. All tests shall be recorded, and copies of reports bound in the O & M manuals and given to the Owner.

PART 3 – EXECUTION

3.1 PROCEDURE

A. The contractor shall be responsible for conducting all tests in a safe manner, protecting the work of other trades from water or physical damage.

B. The tests, as indicated, shall be in addition to any test, as required, by any governing agency. Submit all approved tests, as required, by any governing agency to the Owner's representative.

C. Each test and any necessary repairs and retest shall be performed by the contractor which installed the system.

D. Upon completion, a test shall demonstrate that the culinary hot water system is circulating, that all traps are properly vented, that there is an ample supply of hot and cold water to fixtures, that no fixture or equipment can be back siphoned, and that there are no back-flow connections.

END OF SECTION 23 0501

SECTION 23 0593

BALANCING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The mechanical contractor shall employ an independent technical firm to perform the checking, adjusting, and balancing (CAB) of the HVAC systems. This firm shall be one whose operations are limited to the field of professional CAB, and this firm shall meet the following qualifications:

1. The firm shall be a member of AABC and/or NEBB.
2. The firm shall be one which is organized to provide professional services of this specific type.
3. The firm shall have completed projects of similar scope within the past 12 months and shall be capable of performing the services specified at the location of the facility described within the time frame specified and following up the basic work as may be required.
4. All personnel used on the job site shall be engineering technicians, who shall have been permanent, full-time employees of the firm for a minimum of six (6) months prior to the start of the work for this project.
5. **Preferred contractors shall be Certified Test & Balance, Diamond Test & Balance, Independent Test & Balance, BTC Services, RS Analysis and Bonneville test & Balance.**

B. As a part of this contract, the mechanical contractor shall make all changes in the sheaves, belts, and dampers, including the addition of dampers required for correct balance as required by the CAB firm, at no additional cost to the Owner.

C. The mechanical contractor shall provide, and coordinate services of qualified, responsible subcontractors, suppliers, and personnel as required to correct, repair, or replace any and all deficient items or conditions found during the testing, adjusting, and balancing period.

D. In order that all systems may be properly checked, balanced, and adjusted as required by these specifications, the mechanical contractor shall operate said systems at his expense for the length of the time necessary to properly verify their completion and readiness for the CAB and shall further pay all costs of operation during the CAB period.

E. The project completion schedule shall be coordinated with the CAB work to provide sufficient times to permit the completion of CAB services prior to Owner occupancy.

1.2 DOCUMENTS

A. The Owner's representative will furnish, without charge to the CAB firm, one set of mechanical specifications, all pertinent change orders, and the following:

1. One complete set of plans less structural sheets.
2. One set of mechanical floor plans of the conditioned spaces.

B. Approved submittal data on equipment installed to accomplish the test procedures outlined in paragraph "Services of the CAB Firm" of this specification will be provided by the mechanical contractor.

C. The Owner's representative will transmit one copy of the following "Records for Owner" to the CAB firm for review and comments:

1. Record drawings
2. Approved fixture brochures, wiring diagrams, and control diagrams.
3. Shop drawings
4. Instructions
5. Motor and valve charts
6. Operating and Maintenance Manuals

1.3 SERVICES OF MECHANICAL CONTRACTOR

A. The mechanical contractor shall have all systems complete, calibrated, and in operational readiness prior to notifying the CAB firm that the project is ready for their services. The mechanical contractor shall coordinate system readiness with the system commissioning contractor and shall certify in writing to the Owner's representative that the system is complete and ready to balance.

1.4 SERVICES OF THE CAB FIRM

A. The technical CAB firm shall submit biographical data on the individual proposed to directly supervise the CAB work. It shall also submit their record of specialized experience in the field of air and hydronic system balancing.

B. Act as liaison between the Owner's representative and contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses. The inspection will cover only those parts of the systems relating to the checking and balancing.

C. To check, adjust, and balance system components to obtain optimum conditions in each conditioned space in the building.

D. Prepare and submit to the Owner's representative, complete reports on the balance and operations of the systems.

E. The CAB firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of the following general systems, including all components.

1. Rooftop units, controls, etc.
2. Make-up air systems and related controls.
3. Exhaust systems and related controls.
4. Freon compressor systems, including AC Systems, controls, etc.
5. Temperature control system in its entirety includes the verification of all control sequences and safety devices.
6. Domestic hot water re-circulating systems.

F. Before any adjustments are made, the air systems are to be checked for such items as dirty filter, duct leakage, damper leakage, equipment vibrations, correct damper operations, etc.

G. Before any adjustments are made to water systems, the strainers shall be cleaned, temperature control valve operation shall be checked, pump rotation shall be checked, pressure reducing valves shall be adjusted, etc.

H. It shall be the responsibility of the CAB personnel to check, adjust, and balance the components of the various systems as listed above using an applicable "proportionate balance procedure" in order that each of them will operate under optimum noise, temperature and air flow conditions in the conditioned spaces in the building "while simultaneously operating at the most energy efficient condition."

I. During the balancing process, if abnormalities or malfunctions of equipment or components are discovered by the CAB personnel, the owner's representative shall be advised promptly so that the condition may be corrected by the project contractor. Data from malfunctioning equipment or components shall not be recorded in the final CAB report.

J. Provide a minimum of 32 hours to coordinate with and assist Owners Independent Commissioning Agent as required.

PART 2 – PRODUCTS

2.1 EQUIPMENT AND INSTRUMENTS

A. This contractor shall provide all necessary labor, equipment, scaffolding, instruments, and materials required to adjust, balance, and check all systems.

PART 3 – EXECUTION

3.1 REPORT

A. The activities, as described hereinbefore, will culminate in a report to be provided to the Owner's representative. This report shall be furnished in six (6) copies. One copy shall be bound in each O & M manual. The intent of the final report is to provide a reference of actual operating conditions for the building operating personnel.

B. The CAB report shall include the following as a minimum:

1. Preface:
   A general discussion of the systems, any idiosyncrasies, any problems encountered, an outline of normal sequence of operation for the HVAC system cycles, any un-corrected noise problem.

2. Pitot Tube Traverses:
   For use in future trouble-shooting by maintenance personnel, all exhaust ducts, main supply ducts and return ducts will have air velocity and volume measured and recorded by the traverse method. Locations of these traverse test stations will be described on the sheet containing the data.

3. Temperature Tabulation:
   Of all conditioned spaces on a room-by-room basis, a total of at least three readings will be taken of each room on successive days. Record outside ambient temperature at two-hour intervals. The total variation in conditioned space temperatures shall not exceed 2 deg. variance from the thermostat settings.

4. Air Volumes and Velocities:
   As measured at each supply grille, return air grille, and exhaust air grille or air handling device. In all fan systems, the air quantities indicated on the plans may be varied as required to secure a maximum temperature variation of two degrees within each separately controlled space, but the total air quantity indicated for each zone must be obtained. It shall be the obligation of the contractor to furnish or revise fan drive and/or motors, if necessary, without cost to the Owner, to attain the specified air volumes.

5. Air Pressure:
   As measured across each supply fan, cooling coil, heating coil, air handling unit filter and exhaust fan. Relate these readings to the particular fan curve in terms of CFM handled at the various static pressures, and their relationship to fan power and fan instability.

6. Water Temperature:
   Shall be taken entering and leaving the snowmelt system & manifolds under maximum load conditions in each case.

7. Water Pressure:
   At all gauge connections, pressure readings at pumps shall be related to pump curves in terms of gpm handled and confirmed by gpm flow thru Venturi units at each snowmelt zone. The flow of water thru all manifolds shall be adjusted by manipulating valves until the rated pressure drop across each coil is obtained and total water flow is verified by Venturi readings.

8. Electrical Current/Voltage:
   Measurements to be taken at the drive motor on each piece of equipment.

9. Fan Speeds:
   To be measured in RPM.

10. Instrumentation List:
    A list of instruments by type and make used in gathering the CAB data.

11. Drawings:
    The CAB contractor's working drawings shall have the VAV, and supply air openings numbered and/or lettered to correspond to the numbers and letters used on the report data sheets so that data in the report can be correlated with each specific supply air opening in the building. If room numbers actually used in the building differ from those on the plans, the building room numbers shall be marked on these plans. Only one such marked-up set of drawings need be provided with the six copies of the CAB report.

C. Before final acceptance of the CAB report, the report data, at the discretion of the Owner's representative, shall be verified one time on the job site, by selection of check points (not to exceed 10 percent of total) at random, in the presence of the Owner's representative. Representatives of the testing firm doing the work shall be present and provide the necessary equipment for test data verification.

D. The firm shall be responsible for inspecting, adjusting, balancing, and logging the data on the performance of fans, all dampers in the duct system, all air distribution devices, the flows of freon or water thru all coils, and the power consumption of all motors.

E. During the CAB work, the temperature regulation will be adjusted for proper relationship between controlling instruments. The Owner's representative will be advised of any instruments out of calibration so that the controls subcontractor may come in and recalibrate, using data supplied by the balancing firm.

F. Make a total of three inspections within ninety (90) days after occupancy of the building to ensure that satisfactory conditions are being maintained throughout and to satisfy and unusual conditions.

G. An additional inspection in the building shall be made by the firm during the season opposite that in which the initial adjustments were made. At that time, any necessary modifications to the initial adjustment required to produce optimum operation of the system components shall be made to produce the proper seasonal conditions in each conditioned space.

H. At the time of opposite season checkout, the Owner's representative shall be given timely notification before any readings or adjustments are made so that they may participate in the checkout.

END OF SECTION 23 0593

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SECTION 23 0800

SYSTEM COMMISSIONING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work required under this section shall include, but not necessarily be limited to, the following:

B. The pre-startup inspection of all systems by installing contractor and coordinating of the subsequent correction of any incorrect items.

C. Repair, replacement, or adjustment of each item shall be performed by the installing contractor.

D. System operations inspection.

E. The contractor shall be required to provide a detailed report verifying proper operation of all equipment and devices, correct control sequences for all systems and proper air and water flow for systems throughout the building.

F. The installing contractor shall act as liaison between the Owner's representative and Owners Independent commissioning contractor and periodically inspect the installation of mechanical piping systems, sheet metal work, temperature controls and other component parts of the heating, air conditioning and ventilating systems as the installation progresses.

G. Verification of proper systems start-up, installation and ATC sequence shall be demonstrated to the owners representative prior to request for final inspection of systems.

H. An additional 16 hours of commissioning shall be provided by the installing contractor to be used as required to owner at the time of the 12-month warranty inspection.

I. The intent of this section is to provide for proper installation, startup, service, and operation of the mechanical systems in preparation for system balancing. See Section 230593 for balancing.

1.2 PRE-STARTUP INSPECTION

A. The pre-start-up inspection of all systems shall provide for verifying that each piece of equipment is properly installed and prepared for startup.

B. All pertinent items shall be checked, including, but not necessarily limited to, the following:

1. Removal of shipping stops.
2. Vibration isolators and seismic snubbers properly aligned and adjusted.
3. Flexible connections are properly aligned.
4. Belts are properly adjusted.
5. Belt guards and safety shields are in place.
6. Safety controls, safety valves, and high or low limits are properly installed and functioning.
7. All systems are properly filled.
8. Filters are in place with a proper seal around their edges.
9. Fire dampers are properly installed, linked, and serviceable.
10. Pressure and temperature gauges of the proper size and range are installed.

11. All test stations and measuring devices are properly installed and functioning.
12. Initial lubrication of equipment is complete.
13. Filters and strainers are clean.
14. Motor rotations are correct.
15. Voltages match nameplates.
16. Control system is operating properly.
17. All interlocks are wired and verified.
18. All controls have been connected and verified.
19. All valves, dampers, and operators are properly installed and operating.
20. All ductwork is installed and connected.
21. All roof-mounted equipment is properly flashed.
22. All water piping is either heat taped or located in spaces which are heated to prevent freezing.
23. Glycol % meet specification requirements.
24. Piping which is run above the roof or is otherwise subjected to freezing is properly heat taped and insulated.
25. All other items necessary to provide for proper start-up.
26. All seismic restraints are in place and secured.
27. All condensate drain lines are piped to discharge in proper drains.

1.3 FIRST RUN INSPECTION

A. Recheck all items outlined in pre-startup inspection to insure proper operation.

B. Check the following items:

1. Excessive vibration or noise.
2. Loose components.
3. Initial control settings.
4. Motor amperages.
5. Heat buildup in motors, bearings, etc.
6. Control system is sequencing properly, calibrated and functioning as required.
7. Heat tapes are wired & functioning.

C. Correct all items which are not operating properly.

1.4 SYSTEM OPERATION INSPECTION

A. The mechanical systems shall be observed by the owner under operation conditions for sufficient time to insure proper operation under varying conditions, such as daylight and heating-cooling.

B. Periodically check the following items:

1. Strainers and filters.
2. Visual check of air flow for "best guess" setting for preparation for system air balancing under Section 230593.
3. Control operation of time clocks, on-off sequences, system cycling, etc.
4. Visual checks for water flow, seals, packings, safety valves, operating pressures and temperatures.
5. Cleaning of excessive oil or grease.
6. Dampers close tightly.
7. Valves close tightly.
8. System leaks.

9. All other items pertaining to the proper operation of the mechanical system, whether specifically listed or not.

1.5 WARRANTY SCHEDULE

A. Provide a list in each O & M Manual of all motors, fans, and equipment with manufacturer's names, models, serial numbers and date of startup approved by the Owner's representative, date of warranty, extent of warranty, and equipment supplier with address and phone numbers.

1.6 SCHEDULE OF OVERLOAD PROTECTION

A. Provide a list in each O & M Manual of all motors with size, voltage, amperage, and size and rating of overload protection.

1.7 REPORT

A. Prior to the start of system balancing the installing contractor is required to submit a detailed written report to the owner's representative outlining the results of the installation and start-up of all systems and piece of equipment which lists any un-corrected system abnormalities.

1.8 CERTIFICATION

A. Provide written certification of all tests, and start-up procedures. Bind a copy of this certification in the O & M manuals. Certification shall include an itemized list of systems serviced during the system commissioning process with dates, times, and a complete description of the work completed, and the name of the responsible system commissioning mechanic.

1.9 BUILDING OPERATION DEMONSTRATION

A. Contractor shall include as a part of their bid an additional 16 hours for all Division 22 & 23 sub-contractors to demonstrate to building owner, and/or owner’s representative that proper installation, operation, air and water balance, control, and system commissioning has been completed properly for all equipment, material or systems provided and/or installed by Division 22 & 23 contractor.

B. All systems shall be verified in their entirety and all items resolved prior to this demonstration. This demonstration does not replace the owner training requirements.

END OF SECTION 23 0800

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SECTION 23 0900

BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the basic materials and methods to be used in Division 21, 22, 23 & 25 work.

1.2 MATERIALS & EQUIPMENT

A. All materials shall be new and undamaged. Protect all stored materials and equipment from damage by the elements, including exposure to excessive heat, flooding and rain, windstorms, etc.

B. All materials and equipment shall be installed in strict compliance with the manufacturer's recommendations.

1.3 CUTTING AND PATCHING

A. Any cutting, patching, or filling necessary for the proper execution of this work, except as noted in the drawings, shall be done by this contractor.

B. No rough or unsightly work will be allowed. Cutting of structural members shall be done only on approval of the Owner's representative.

C. The attention of the contractor is directed to the requirements of running pipes thru concrete slabs, walls, and beams. These conditions are to be anticipated, and sleeves installed as provided for under "Sleeves".

1.4 INSERTS

A. Furnish and set, in all necessary locations, before or during construction, unistrut inserts for use in connection with the support and seismic restraint of piping, ductwork, and equipment furnished under this division of the work.

1.5 SLEEVES

A. Sleeves for Concrete or Masonry Surfaces:

1. **For pipes passing thru masonry or concrete construction, provide sleeves at least two pipe sizes larger than the pipe passing thru and made from sections of steel pipe.**

B. Provide galvanized iron sleeves with collar on each side of wall for all ducts passing thru masonry or concrete construction.

C. Provide 22-gauge sheet metal collars on each side of wall for all ducts passing thru gypsum wall construction or similar construction.

D. Sleeves shall be placed in structural members only where approved by the Owner's representative.

E. Sleeves through foundation walls below grade shall be mechanical seal type with watertight sealing grommets and pressure rings. Sealing grommets shall be non-melting at temperatures incurred. Foundation wall sleeves shall be "O.Z. Type WSK".

F. Sleeves thru Finished Surfaces:

For pipes passing thru finished partitions or ceilings, provide galvanized sheet iron sleeves of suitable size. The sleeves shall be fastened to construction to prevent creep along pipe and the sleeve ends shall be flush with finished surfaces. Provide escutcheon plates at each side of finish wall or floor or ceiling for all pipes passing thru same.

1. Sleeves thru Fire-rated Surfaces:
   All pipe sleeves and ductwork penetrating fire walls and surfaces shall be packed inside after pipes and/or ducts have been placed with a U.L. listed fire safing system. The contractor shall submit to the Owner's representative for review and approval specific installation diagrams showing exact method(s) to be used.

2. Sleeves thru Sound Rated Surfaces:
   All pipe sleeves and ductwork penetrating sound rated walls or surfaces shall be packed with dense fiberglass, sealed with duct sealer and fitted with metal cover flanges on both sides.

3. Sleeves thru Floors:
   Sleeves thru floors above grade shall extend 1" above the floor and shall be sealed watertight with waterproof silicone caulking.

G. **All penetrations must be sleeved or core drilled/cut. Hammer drill is not an acceptable means.**

1.6 PIPING & DUCTWORK SUPPORT

A. Steel roof deck shall not be used to support loads from plumbing, HVAC ducts, light fixtures, architectural elements or equipment of any kind, unless specifically noted otherwise. Lightweight suspended acoustical ceilings with a total weight per wire not exceeding 50# may be hung from the steel roof deck. The hangers should be staggered to distribute the load over multiple deck flutes.

B. Bracing of miscellaneous items (mechanical, electrical, plumbing, etc.) to the bottom chord of joists or girders will not be allowed in any instance. All lateral braces must connect to the top flange/top chord of the framing member above unless noted otherwise on the structural drawing.

C. It is essential that all piping be supported from roof structure at joist within 6” of panel point location and from top or bottom chord of floor or roof joist.

1.7 PIPE LOCATION AND ARRANGEMENT:

A. No water supply piping inside the building shall be placed in direct contact with the earth. Buried water piping shall be placed in split tile or PVC pipe below the 4” of gravel to keep pipe from direct contact with ground.

B. Unless otherwise noted on the drawings, all water piping shall be kept out of concrete floor slabs.

C. Under no circumstances shall plastic piping or ducting materials be run inside of supply or return air plenums.

D. All piping shall be properly racked and supported to run straight and true.

E. All changes in direction shall be made with approved fittings. Pipes shall not be bent to change direction.

F. All piping shall be racked and run to facilitate maintenance work. Under no circumstances shall valves, shock absorbers, drip traps, or piping specialties be installed in a "closed space" without proper access provided for future maintenance. See "Access Doors" section of specifications.

G. NOTE: All piping shall be capped or plugged at the end of each work shift and when not being extended, to prevent the entry of rocks and debris.

H. Any timelines are broken or disconnected, they shall be capped immediately after flushing to remove rock and debris from pipes. If rocks or other foreign materials are found in the system after it has been closed, the contractor shall stand the expense of their removal.

I. All valves, piping, and equipment to be installed so as to permit disassembly for maintenance purposes.

J. Provide drain valves at all low points in piping systems. Run to floor drain where possible, otherwise provide 3/4" hose connection with vacuum breaker.

1.8 VERIFICATION OF INSTALLATION

A. At time of final inspection contractor shall provide a color video of all new 3" and larger buried storm sewer and sanitary sewer lines both inside and outside to 5'-0" beyond the building line.

B. Video must be taken after installation is complete to ensure that line is installed properly with no low spots, separations, etc. The video shall also ensure that all connections have been made properly and that no debris remains in piping system. The building owner shall be notified to witness video.

C. Provide final Digital copy. Video quality must be able to distinguish all pipe joints, turns, fittings, etc. to assure pipe system is clean, connected properly and no low spots.

D. All areas shall be clearly identified on video to directly relate to project 'Record Drawings'

1.9 PIPE JOINING

A. All joinings shall be made to maintain the full metal strength of the pipe, with neat and workmanlike appearance.

B. All piping must be perfectly clean before the system is filled.

C. Copper Piping in Domestic Water Service: Piping shall be cut (with a pipe cutter) so ends are square and will "bottom" in fittings. There must be no gaps left thru which solder can run into the line. If a hack saw must be used, it shall be guided with a miter box to ensure a square, even cut. Tubing shall be reamed to remove burrs, being careful not to expand tubing while reaming.

D. The outside of the copper pipe and the inside of the fittings, where solder will be applied, shall be burnished with fine crocus cloth or fittings brushes until all dirt and oxide is removed.

E. A light coat of soldering flux shall be applied to both pipe and fittings. Acid flux shall not be used.

F. Joints in copper pipe shall be uniformly heated to proper soldering temperature to ensure that solder will flow to all parts of the joint. The solder shall be fed to the joint until a uniform line of solder appears around the pipe at the end of the fittings.

G. Copper piping used in domestic water service shall be joined with 'Stay-Safe-50' or 'Silvabrite-100' no lead solder.

H. When valves are being installed in copper piping, the non-metallic parts shall be removed to prevent the heat of soldering from damaging the valves. No heat shall be applied near where an excessive temperature may cause damage.

I. All domestic copper piping 3" and larger shall be brazed.

1.10 SCREWED CONNECTIONS

A. All pipe shall be reamed at the ends and free of all inside scale or burrs. Threads shall be cut clean and sharp, and to a length equal to 1-l/8 the length of the female thread receiving the pipe. The pipe shall be screwed in the full length of the female thread.

B. Pipe shall be made tight with teflon thread tape or thread lubricant worked into male thread only. Surplus material shall be wiped off and the joint left neat and clean. Lubricant shall be powdered graphite and linseed oil, or plumbage and linseed oil.

1.11 PIPE GRADING

A. Piping shall be uniformly graded in direction of flow as noted below:

PIPING	FALL/RISE	DIRECTION	PER/RUN
Rainwater	1"	Down	8'
Water	1"	Up	40'
Waste - 4" & smaller	1"	Down	4'
Vent	1"	Up	4'
Condensate Drip	1"	Down	4'
Natural Gas	1"	Down	40'
Compressed Air	1”	Down	40’
Refrigerant	1"	Down	40'

1.12 THRUST BLOCKS

A. Plugs, caps, tees, and bends deflecting 22-1/2 degrees or more, either vertically or horizontally, on water lines 6 inches in diameter or larger, shall be provided with thrust blocking, or metal tie rods and clamps or lugs, as directed. Valves shall be securely anchored or shall be provided with thrust blocking to prevent movement. Thrust blocking shall be concrete of a mix not leaner than 1 cement: 2-1/2 sand: 5 gravel and having a compressive strength of not less than 2000 psi after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps shall be protected by galvanizing or by coating with bituminous paint.

1.13 EQUIPMENT BASES

A. Pumps, tanks and other equipment shown on the plans shall be set on 4" high concrete pads. The pads shall be furnished as indicated on plans. The mechanical contractor shall coordinate pad size and location with the general contractor.

B. Roof curbs shall provide a free height from the roof membrane to the top of the curb of at least 12" minimum. All roof curbs and platforms shall have a wood nailer strip around the top perimeter for securing the roof membrane and attaching roof flashings. All equipment mounted on roof curbs shall be installed level. Flashings by Division 7.

C. Roof curbs shall be attached to building structure as required by the 2021 IMC and local codes.

1.14 VIBRATION ISOLATION

A. All mechanical equipment over 5 H.P. shall be isolated in accordance with Table 34, Chapter 42, in the 2022 ASHRAE Handbook.

B. Care shall be taken by this contractor to prevent the transmission of vibration from equipment to building structure. Flexible connectors shall be installed in all piping connecting to pumps, air handling units, cooling towers, and other flexibly mounted equipment.

C. Flexible connection shall be specifically designed to absorb noise and vibration and to prevent damage to equipment caused by piping stress. Unit construction shall consist of heavy bellows type neoprene rubber hose sections with stainless steel liners and attachments to match piping.

PART 2 – PRODUCTS

2.1 PIPING SYSTEMS

A. All piping shall be in accordance with the American Society for Testing and Materials, ASTM A-53. No foreign made piping or connectors will be accepted in this construction.

B. Water piping to the pressure reducing station shall be Class 52 ductile iron pipe with mechanical joints.

C. Culinary cold, hot, and recirculating hot water above grade shall be Type "L" copper with soldered wrought copper fittings. Pull-T type fittings on copper piping are not allowed.

D. All rainwater buried waste and vent piping below slabs shall be standard weight DWV schedule 40, solid core PVC ASTM F 1488 piping.

E. Rainwater and waste and vent piping above grade shall be standard weight cast iron pipe with no-hub, tyseal, M-G, or A.B.I. 'Best' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".

F. All cast iron pipe and fittings, above ground, shall bear the collective trademark of the Cast Iron Soil Pipe Institute, or have prior approval of the engineer.

G. Rainwater and waste piping above grade shall be standard weight cast iron pipe with no-hub, tyseal, M-G, or A.B.I. 'Best' gasketed fittings for sizes 2" and larger; and galvanized Schedule 40 with tarred Durham drainage fittings for 1-1/2".

H. Condensate drip lines shall be Type "M" copper with soldered wrought fittings.

I. Gas lines shall be Schedule 40 black steel pipe. Fittings shall be standard black malleable screwed, or standard welding fittings where welding is required. All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Buried piping shall be coated or wrapped.

J. Gas lines below slab shall be corrugated stainless steel tube (CSST). All gas lines shall be installed in strict compliance with the local fuel supply company requirements. Piping below slab to be encased in a Schedule 40 PVC pipe with long sweep elbow. Casing to terminate 1" above slab. PVC casing to be two pipe sizes larger than carrier pipe but be 2" minimum.

K. Gas lines located outside the building and below finished grade shall be ASTM D2513 polyethylene plastic pipe. Fittings shall be ASTM D2513 polyethylene, butt-fusion type; and ASTM D2683, polyethylene socket-fusion type. Installation and piping material shall be in strict compliance with the local fuel supply company requirements.

L. Compressed air shall be type L copper with malleable copper fittings. Compressed air shall be type L copper with wrought copper fittings.

M. Refrigeration piping shall be Type "L" copper with malleable copper fittings. Piping shall be specifically treated and sealed for refrigeration systems piping, similar to Mueller.

N. NOTE: Pre-charged line sets will be permitted on refrigeration systems with rated capacities below 65,000 BTUH.

O. All fire sprinkler piping shall be schedule 40 black steel. All piping and fittings shall be U.S. manufacture. Thin wall and schedule 40 equivalent piping will not be allowed.

P. Horizontal waste piping from urinals shall be schedule 40 solid core PVC epoxy coated piping**.**

2.2 HANGERS AND SUPPORTS

A. Vertical Piping:

1. Attachment - Vertical piping shall be secured at sufficiently close intervals to keep the pipe in alignment and to carry the weight of the pipe and contents. Stacks shall be supported at their bases, and if over two (2) stories in height at each floor by approved metal floor clamps.

B. Cast iron soil pipe shall be supported at not less than each story height and at its base.

C. Screwed pipe (IPS) shall be supported at not less than every other story height.

D. Copper tubing shall be supported at each story for piping one and one-half (1-1/2) inches in diameter and at not more than six (6) foot intervals for piping one and one-quarter (1-1/4) inches in diameter and smaller. Piping shall be wrapped with three wraps of vinyl tape to isolate pipe from ferrous pipe supports.

E. Horizontal Piping:

1. Under no circumstances shall piping be supported from the metal roof deck.

F. It is essential that all piping be supported from top chord of roof structure at joist panel point locations. Coordinate with structural requirements.

G. Supports - Horizontal piping shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

H. Cast Iron Soil Pipe - Where joints occur, soil pipe shall be supported at not more than 5-foot intervals, except that where 10-foot pipe lengths are used, supports at 10-foot intervals are acceptable. Supports shall be placed within eighteen (18) inches of the hub or joint. No-hub joints and fittings shall be restrained with rods and clamps per manufacturer's recommendations.

I. Screwed pipe (IPS) shall be supported at approximately 12-foot intervals.

J. Copper tubing shall be supported at approximately 6-foot intervals for piping one and one-half inches and smaller in diameter and at 10-foot intervals for piping two inches and larger in diameter.

K. Piping placed underground shall be laid on a firm bed for its entire length.

L. Hangers shall be Grinnell Figure 260 for both bare and insulated pipe.

M. Furnish all hangers, inserts, brackets, anchors, guides, sliding supports, etc., and all auxiliary steel necessary for the installation. All supports shall be designed in accordance with the AISC Steel Handbook and painted with one shop coat of primer paint.

N. Insulation inserts and shields for cold surface piping will be provided under Section 220700 of these specifications.

O. Pipe covering protection saddles shall be installed at all pipe hangers which support insulated "hot surface" piping. Saddles shall be tack welded to the piping and shall match the insulation thickness applied.

P. All copper, fiberglass, or plastic piping shall be securely supported from the building structure at intervals specified and/or as recommended by the pipe manufacturer. Hanger shields for suspended piping shall be functionally similar to isolators with Grinnell Fib. 97. Non-ferrous piping shall be isolated from contact with ferrous supports with three wraps of vinyl tape.

Q. Plumbers' tape, chain, or wire will not be permitted for pipe support.

2.3 VALVES AND STRAINERS

A. All valves and strainers shall be by one manufacturer. Approved valve manufacturers are Crane, Stockham, W. C. Norris, Grinnell, or Powell. Crane numbers are used for convenience.

B. Domestic Hot and Cold Water:

C. Gate Valves:
   1. Valves 2" and smaller shall be Crane No. 428, bronze, screwed, 200# WOG gate valve with solid wedge disc and rising stem.

   2. NOTE: If unable to use a rising stem valve because of insufficient clearance, use a Crane No. 438 non-rising stem valve.

D. Globe Valves:
   1. Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, 200# WOG globe valve with a replaceable teflon disc and teflon packing. The disc shall be suitable for hot water up to 360 deg. F. at 150 psi.

E. Check Valves:
   1. Valves 1-1/2" and smaller shall be Crane No. 37, bronze, screwed, Y-pattern 200# WOG swing check valve. Valves 2" and larger shall be Crane No. 373.

F. Butterfly Valves:
   1. Valves 2-1/2" and larger shall be Crane No. 23N-BRB iron body and disc, lug type, stainless steel stem, 200# WOG EPT Nordel seat rated for 275 deg. F butterfly valve.

G. NOTE: Valves 6" and smaller shall be equipped with the proper size 10 position Multi-lock hand lever. Valves 8" and larger shall be equipped with the proper size Extra Power Manual weatherproof gear operator.

H. Ball Valves:
   1. For hot and cold domestic water service: Valves 2" and smaller shall be Crane No. 2190H bronze, screwed, 200# WOG, Gem ball valve with Buna-N rubber capsule. Watts B6000 or Apollo 70-100.

I. Strainers:
   1. Strainers 1-1/2" and smaller shall be Crane No. 988-1/2, iron body, screwed Y-pattern, 200# WOG, sediment separators with a 20-mesh Monel screen.

   2. All strainers shall be installed with fine mesh supplementary "construction screens" which shall remain in place while the system is flushed and chemically cleaned. The "construction strainer" basket shall be removed just prior to balancing the water systems.

   3. Provide blow-down ball valve on all strainers same size as strainer tapping.

J. Gas Service:

   1. Ball Valves:
      Valves 2" and smaller shall be Crane No. 2330-TF, bronze, screwed, 400# WOG Accesso ball valve with teflon seats, and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

   2. Gate Valves:
      Valves 3" and smaller shall be Crane No. 424, bronze, screwed, 400# WOG gate valve with Exelloy seats and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

   3. Globe Valves:
      Valves 2" and smaller shall be Crane No. 130, bronze, screwed, 400# WOG globe valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to the pressure limit of 250 psi set by that agency.

   4. Check Valves:
      Valves 2" and smaller shall be Crane No. 132, bronze, screwed, 400# WOG horizontal lift check valve with a No. 6 replaceable composition disc and shall have Underwriters' approval for LP gases up to 250 psi set by that agency.

   5. Pressure Regulators:
      Furnish and install approval type gas pressure regulators in gas piping ahead of each appliance and piece of equipment, to which is connected. Regulators located outside the building shall have weatherproof vent with bugproof screen. Regulators located inside of building shall be vented to the outside with weatherproof vent and bugproof screen.

2.4 NON-SLAMMING OR SPRING-LOADED CHECK VALVES

A. Types: Provide valves of the fully guided or cone-and-diaphragm types.

B. Bodies: Provide flanged or wafer type bodies constructed of cast iron ASTM A 126, Class B; cast steel ASTM A 216/A 216M, Class WCB; stainless steel, Type 304 or cast bronze ASTM B 61.

C. Trim: Seats, discs and springs shall be constructed of 18-8 stainless steel or bronze complying with ASTM B 62. Seats may be of elastomers suitable for 250 degrees F. minimum continuous working temperature or not less than 50 degrees F. above the operating temperature of the system, whichever is higher.

D. Mating Surfaces: Mating surfaces of closure faces shall be bronze or Type 316 or 17-4PH stainless steel or elastomer approved for the particular service and materials must be compatible to prevent electrolytic action.

E. Pressure Loss: Pressure loss through the valves, measured in feet of water, shall not exceed 6/10 of the water velocity in feet per second.

F. Bubble-Tight: Non-slamming and spring-loaded check valves shall provide bubble-tight shut-off when handling water up to 250 degrees F. and 125 pounds per square inch differential pressure. Design shall prevent rubbing of seat materials when opening and closing. Poppet valves shall have conical springs.

2.5 GENERAL DUTY VALVES & SPECIALTY COCKS

A. Cocks:

1. Balancing cocks 1-1/2" and smaller shall be Crane No. 80E, bronze, screwed, 200# WOG.
2. Balancing cocks 2" and larger shall be Crane No. 325, all iron, flanged 125# WOG.
3. Gas cocks 2" and smaller shall be Crane No. 270, flat head, bronze screwed.
4. Gage cocks shall be Crane No. 744, 1/4", bronze, screwed.
5. Petcocks shall be Crane No. 702, 1/4", bronze, screwed with lever handle.
6. Trycocks shall be Crane No. 734, 3/8", bronze, screwed, 250# rated with stuffing box.
7. Provide two complete sets of wrenches for all cocks and stops.

2.6 BACKFLOW PREVENTERS

A. Backflow preventers shall comply with the requirements of the Local Health Code, Utah State Plumbing Code & 2021 IPC as to type, style, size, location, and arrangement for the actual installed duty.

B. Where backflow preventers are installed which release water thru the valve to the atmosphere, these units shall be provided with drip pans which collect the free water. The drip pans shall be piped to the nearest drain.

C. All backflow preventers shall be installed with all necessary isolation valves and test cocks.

2.7 AUTOMATIC VALVES AND WELLS

A. The mechanical subcontractor shall install the automatic temperature control valves, temperature sensing wells, and flow switches, as directed by the automatic temperature control subcontractor.

2.8 UNIONS

A. Ground joint unions shall be installed on pipe 2-1/2" and under, where indicated on drawings. Whenever piping is connected to a major piece of apparatus, unions shall be provided as near as practical on each side of the apparatus.

2.9 ISOLATION FITTINGS

A. Approved isolation fittings shall be installed at the junction of all copper and steel piping to prevent electrolytic action. **Fittings shall be NZR brass unions or fittings.**

B. Optional isolation fittings (IF APPROVED BY OWNER) may be dielectric type with high temperature silicon gaskets.

2.10 V-BELT DRIVES

A. Capacity of V-belt drives at rated RPM shall be not less than 150 percent of motor nameplate horsepower rating.

B. V-belt drive combinations shall be limited to A, B, C, and fractional horsepower belts. 3V, 5V, and 8V belts and sheaves shall not be used.

C. Drives requiring single belt application shall be of the adjustable pitch type. Multiple belt drives shall be of the non-adjustable type. All fixed pitch sheaves, including single groove fan sheaves, shall be of the bused type. Fixed bore sheaves will not be acceptable for non-adjustable pitch sheaves.

2.11 HEATING CABLE (Roof drains & piping as indicated on plans)

A. Furnish and install complete electrical heating cable on all pipe and fittings which may be exposed to freezing. Heat cable shall be of the self-regulating low temperature type with a heat output of 5 watts/ft. (17 BTUH/ft). The heating cable shall automatically adjust heat output to correspond with the heat loss rate. Cable shall be UL and FM approved.

B. Cable system shall be furnished with power termination, end seal kits, splice and tee fittings, and all accessories required for a complete installation.

C. Thermon or prior approved equal.

2.12 MAGNETIC STARTERS

A. Contractor furnishing "packaged equipment" with 1/2 HP and larger motors shall furnish factory-mounted magnetic starters. Magnetic starters shall provide both overload and undervoltage protection and shall have integral hand-off-auto switch, auxiliary contacts, and pilot. All motors installed under this contract shall have a disconnect switch in the immediate vicinity of the motor. Starters on three phase motors shall protect all three legs of the circuit. Starters to be Cutler-Hammer, Square "D", or Westinghouse.

B. Starters for all motors on other than "packaged equipment" which are furnished under the mechanical section of the work will be installed by the electrical contractor.

C. Starters shall be two-speed type or explosion-proof type where required.

D. Provide a heater index bound in the O & M manuals for all starters furnished on the project.

2.13 MISCELLANEOUS ITEMS

A. Motors:

1. Motors shall be furnished and installed under the applicable Mechanical Sections of the Specifications.

B. Each motor shall be provided with a nameplate for the electrical characteristics shown on the Drawings or as otherwise noted.

C. Motors shall be constructed and rated to deliver full nameplate capacity at the project altitude.

D. Horsepower shall be at least equal to that shown on the drawings. Where equipment is submitted and approved for the installation which requires larger motor sizes than shown, the wire and starter sizes shall be increased and means provided for operation and control suitable for the larger motors with no increase in cost to the Owner.

E. Unless otherwise specified, or required for controller sequencing, all motors over 5 HP shall be high efficiency type, and all fractional HP single phase motors 1/2 HP & under shall be permanent split capacitor (PSC) type.

F. Premium efficiency motors shall be based on CEE premium efficiency criteria for OPD motors at 1800 RPM.

HORSEPOWER	NEMA PREMIUM EFFICIENCY
5	89.5%
7.5	91.0%
10	91.7%
15	93.0%
20	93.0%
25	93.6%
30	94.1%
40	94.1%
50	94.5%

G. Motors for V-belt drives shall be provided with cast iron or steel base, with slide rail and adjustable screw device and shall be isolated by rubber-in-shear devices.

H. Motors shall have sufficient capacity to start and operate the machine it drives without exceeding the motor nameplate rating at the speed specified or at any speed and load which may be obtained by the drive actually furnished.

I. Motors provided with automatic control shall be capable of making as frequent starts as the control device may demand. Motors not provided with automatic control shall be capable of making not less than 4 starts per hour.

J. All belt-connected motors, regardless of size, shall be equipped with shafts and bearings that will withstand both the normal belt pull of the drive furnished and the momentary or continuous overloads due to acceleration of incorrect belt tension.

K. Motors shall be air cooled and shall be guaranteed to operate continuously at 115% of full load with temperature rise in any part not to exceed 40 degrees C above the ambient air temperature.

L. Motors shall be open drip-proof or totally enclosed fan cooled type as required and shall be commercially dynamically balanced and tested at the factory before shipment.

M. Motors shall be selected for quiet operation. Sound power levels shall be within NEMA MGI-12.49.

N. Motors shall comply with requirements of ANSI C 50, NEMA MG-1, and all NEMA standards.

O. Motors controlled by variable frequency drives shall have characteristics which are fully compatible with the drives to which they are connected. Provide written confirmation of coordination with VFD supplier.

P. Approved Manufacturers: Allis-Chalmers, Century, Gould, Lincoln, Reliance, Westinghouse, U.S.

2.14 SEISMIC RESTRAINTS

A. All Division 21, 22 & 23 equipment, piping, and ductwork shall be anchored and seismically restrained as required by the IBC for the site Seismic Zone, NFPA 90A (current edition), UL Standard 181, Tri-services Manual Fagel Et Al 1973, and the SMACNA Guidelines for seismic restraints of mechanical systems.

B. The Division 21, 22 & 23 contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the current Seismic Zone per the 2021 International Building Code.

C. All supports, hangers, bases, anchorage and bracing for all isolated equipment shall be designed by a professional engineer employed by the restraint manufacturer, qualified with seismic experience in bracing for mechanical equipment.

D. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal.

E. The above qualified seismic engineer shall determine specific requirements on equipment anchorage and restraints, locations and sizes based on shop drawings for the mechanical equipment which have been submitted, reviewed and accepted by the Owner's representative for this project.

F. The Division 21, 22 & 23 contractor shall require all equipment suppliers to furnish equipment that meets the seismic code, with bases designed to receive seismic bracing and/or anchorage. All isolated mechanical equipment bracing to be used in the project shall be designed for the equipment shop drawings and certified correct by the equipment manufacturer for the required Seismic Zone with direct anchorage capability.

G. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

1. Complete engineering calculations and shop drawings for all vibration and seismic requirements for all equipment to be isolated and restrained.
2. The professional seal of the engineer who is responsible for the design of the Vibration and Seismic restraint System for isolated equipment.
3. Details for all the isolators and seismic bracing with snubbers proposed for items in this specification and on the drawings.
4. Details for steel frames, concrete inertia bases, and anchors to be used in conjunction with the isolation of the items in this specification and drawings.
5. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors and snubbers.
6. The location of all restraints of pipes and ducts with the locations shown on a floor plan noting the size and type of anchorage and restraint to be used.

H. Snubbers:

1. Snubbers shall be double acting and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.
2. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch nor more than 1/4 inch.
3. A one "g" minimum vertical and lateral level shall be used in the design of all snubbers restraining isolated equipment.

I. Design and Installation:

J. General: All mechanical equipment, piping and ductwork shall be braced, anchored, snubbed or supported to withstand seismic disturbances and remain operational. Provide all engineering, labor, materials and equipment for protection against seismic disturbances as specified herein.

K. All equipment not anchored directly to the floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

L. Isolated Equipment: All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.

M. Piping: All isolated and non-isolated piping 2-1/2" I.D. and larger shall be protected in all planes by restraints to accommodate thermal movement as well as restrain seismic motion. Where necessary the piping restraints shall be resiliently attached to the piping with vibration dampening inserts to prevent the transmission of vibration to the building structure. Locations shall be as scheduled and shall include but not be limited to:

1. At all drops to equipment and at flexible connections.
2. At all 45 deg. or greater changes in direction of pipe.
3. At horizontal runs of pipe, not to exceed 30 ft. O.C. spacing.
4. Piping shall be restrained by a cable restraining system using a minimum of two cables at all restraint points.

N. Piping in mechanical rooms shall have additional restraints as scheduled.

O. Non-Isolated Equipment: The restraint systems for all non-isolated equipment are to be installed to resist stresses produced by lateral forces according to Sec. 2312 of the Uniform Building Code with an Occupancy Importance Factor of 1.5, a Seismic Zone Factor of Z = 0.75 for Zone D and a Horizontal Force Factor for Elements of Structures and Nonstructural Components of Cp = 0.3. In addition, the vertical forces restraint requirement shall be half the value of the horizontal forces. All equipment not anchored directly to floors shall be restrained by cables as designed and furnished by the Restraint Manufacturer.

P. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company

Q. Manufacture and design of restraints and anchors for internally isolated equipment shall be the responsibility of the manufacturer of the vibration isolators furnished with the equipment.

R. Piping, ductwork, and equipment without moving parts shall be restrained as shown and noted on the drawings. Locations shown are approximate and shall be coordinated with other trades and with the structural engineer at the job site.

S. Field Services:

The seismic restraint manufacturer's engineer shall inspect the final installation and shall certify that all seismic restraints have been installed per manufacturer's instructions and applicable codes and standards.

2.15 GREASING AND OILING

A. Prior to placing the equipment in operation, the bearings on all motors, fans, pumps, etc., shall be properly lubricated with a lubricant suitable for the service.

B. Lubrication instruction tags are to be left on "all" bearings and equipment for the Owner's future use. Only lubricants recommended by the equipment manufacturers shall be used.

C. It shall be incumbent on the contractor to operate the building equipment used for temporary heat, etc., in a prudent manner to ensure that when the building is turned over to the Owner all equipment is in a "first-class" condition.

D. Equipment shall not be operated unless:

1. All safety devices are installed and functioning properly.
2. Filters are in place on fan systems. Filters to be new and clean.
3. Equipment is properly greased and oiled.
4. Belts and drives are properly aligned and adjusted.

E. The contractor shall maintain a current "equipment maintenance" chart in the construction shack at all times. This chart shall be posted in a conspicuous place and shall include all items of maintenance necessary for proper operation of the equipment.

F. Equipment used for temporary heat and cooling shall, if requested by the Contracting officer, have tube bundles pulled by contractor for Owner inspection prior to acceptance.

2.16 VALVE TAGGING

A. All valves shall be designated by distinguishing numbers and letters on required charts and diagrams. The contractor shall furnish and install approved brass tags for all designated items, which numbers and letters on the tags corresponding to those on the charts and diagrams.

B. Brass tags shall be not less than 1-1/2" diameter with depressed black filled numbers not less than 1/2" high and black filled letters not less than 1/4" high. Tags shall be securely fastened to valves with approved brass "S" hooks, or brass jack chain, in a manner to permit easy reading. Zips ties are not acceptable. Do not attach to valve wheel. Brass tags shall be as manufactured by Seton Name Plate Company, New Haven, Connecticut, or approved equal.

C. Each valve shall have an identifying number identifying the unit. Standard identifications may be used for identifying type of service or fluid in pipe. The contractor shall submit his system of identification to the Owner's representative for approval prior to ordering. Any work done without this approval is done at the contractor's risk.

D. Charts of all valves shall be furnished to the Owner's representative by the contractor.

E. A chart to be mounted in a frame with clear glass front and secured on the wall in the main Mechanical Equipment Room.

F. Second chart shall be prepared for use outside of the equipment room, and to be provided with an approved heavy transparent plastic closure for permanent protection. Two (2) holes to be punched at top of plastic closure to allow for affixing approximately an 8" length of nickel-plated bead chain. Each hole to be reinforced by means of a small brass or nickel grommet. Plastic closure shall be as manufactured by Seton Name Plate Company, New Haven, Conn., or approved equal.

G. Identify all valves. A sample identification shall be as follows:

VALVE IDENTIFICATION CHART

NUMBER	DESCRIPTION	LOCATION	NORMAL POSITION
1.	Cold Water Supply to Water Heater	Mech. Room #121	Open
2.	Cold Water Supply to Hose	Room #13	Open
3.	Cold Water Supply to Equip. in Room #12	Room #18	Open
4.	Hot Water Supply to Toilet Room #212	Chase #210	Open
5.	Air Vents - Cooling Coil #12 (2 required)	Fan Room 3122	Closed
6.	Heating Hot Water Balancing Valve (Southwest Zone)	Above Ceiling Room #412	Marked on Valve

H. The above room numbers shall be the room numbers used.

I. Mechanical Equipment & Ductwork:

All mechanical equipment, including meters, fans, pumps, and other devices shall be identified with signs made of laminated plastic 1/8" or larger engraved letters. Signs shall be securely attached by rustproof screws or some other permanent means (no adhesives).

J. Information on sign shall include name of equipment, rating, maintenance instructions, and any other important data not included on factory attached nameplate.

K. Signs shall be attached to equipment so they can be easily read.

L. Identify all ducts exposed in mechanical equipment rooms and in ducts and pipe chases. Sample duct identification shall be as follows:

1. "Cold Duct - High Pressure - To Second Floor System"
2. "Exhaust Duct - Toilet Room - To EF-3"
3. "Ventilation Air Duct - To Utility Room #228"

M. Ducts shall be labeled at all wall penetrations and at connections to equipment.

2.17 PAINTING

A. 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.

B. Mechanical Contractor:
   1. Spot painting for application of pipe and equipment identification markers.
   2. All piping exposed to weather.

C. Painting Contractor: All insulated piping and all piping in equipment rooms of finished areas shall be painted, as required by the painting specifications. Colors to be selected by owner.

D. Coding, Pipe Identification & Painting:

E. All pipes are to be labeled and color coded with contents clearly identified and arrows indicating direction of flow. Pipes shall be identified at the following locations:

   1. Adjacent to each valve.
   2. At every point of entry and exit where piping passes thru wall or floor.
   3. Every 50 feet on long continuous lines.
   4. On each riser and junction.
   5. Adjacent to all special fittings or devices (regulating valves, etc.)
   6. Connection to equipment.

F. Piping systems with glycol shall be clearly identified at all labels as to system and % of glycol.

G. Apply markers to they can be read from floor.

H. Labels and markers shall be of the self-sticking, all temperature permanent type as manufactured by W. H. Brady Co., 727 West Glendale Avenue, Milwaukee, Wisconsin, or Seton Name Plate Corp., 592 Boulevard, New Haven, Connecticut.

I. Pipe color coding shall be uniform throughout.

J. Background colors shall be as follows:

Yellow:	Dangerous Materials (natural gas condensate, etc.)
Bright Blue:	Protective Materials (filtered water)
Green:	Safe Materials (chilled water, cold water, instrument air, sanitary sewer, etc.)

K. Letters of identification legend shall be 2" high for pipes 3" and larger, and 1" high for pipes 2-1/2" and under.

L. Markers shall be installed in strict accordance with the manufacturer’s instructions.

M. On chalky and loose insulation, soft, porous, fiber-filled or fiberglass coverings, a spiral wrap of pipe banding tape shall be made around the circumference of the pipe. Sufficient spiral wraps shall be made to accommodate the horizontal dimension of the pipe marker.

N. On bare pipes, painted pipes, and pipes insulated with a firm covering, pipe banding tape matching the background color of the marker shall be used for 360 deg. color coding. After applying pipe markers, wrap pipe banding tape around pipe at each end of marker. Tape should cover 1/4" to 1/2" of each end of marker and should overlap approximately 1/2" to 1" on itself. Be sure pipe surface is dry and free of dirt or grease before applying markers or banding tape.

O. Stenciling may be used in lieu of the above labels and markers if finished application gives the same overall appearance, that is that stenciling is applied over a background color. If stenciling is used, letter heights, background colors, banding, and arrow shall be as specified above. Submit sample to Owner's representative before proceeding with work.

P. Plastic Marking Tape:

Q. Provide and install a continuous plastic tape over the top of all underground utilities. Tape shall be placed 1/2 way between finished grade and top of utility line.

R. Plastic marking tape for underground utilities shall be acid and alkali-resistant Polyethylene film, 6 inches wide with minimum thickness of 0.004 inch. Tape shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in Table 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1 – TAPE COLOR

Yellow	Gas, Oil, Dangerous Materials
Blue	Water Systems
Green	Sewer Systems

S. Ceiling Markers:

Use stick on ceiling markers on all accessible ceiling grid to indicate location of VAV boxes, valves, and dampers.

1. Color code as follows:

Yellow	HVAC
Green	Plumbing
Blue	Air
White	Duct valves
Orange	Electrical Devices
Red	Fire

PART 3 – EXECUTION

3.1 COORDINATION

A. All equipment and piping shall be arranged to allow for easy maintenance and access to service valves.

B. Provide valves and unions or flanges at all pieces of equipment to allow maintenance.

C. Install all automatic valves, sensor well, flow switches, etc., as directed by the control contractor.

3.2 TESTING

A. All piping shall be tested in accordance with Section 230501 prior to applying insulation or concealing in partitions, wall, etc.

3.3 ACCESS

A. All valves and equipment shall be located to allow easy access for inspection, service and maintenance, test and balance, and operation. If valves are installed in inaccessible locations, it shall be this contractor's responsibility to furnish and install access doors of a type approved by the owner's representative.

B. Locate piping, valves, etc., to allow easy access to and maintenance of equipment. Do not block walkways, filter access, maintenance access, or tube-pull space in equipment rooms.

3.4 LOCATIONS & ARRANGEMENTS

A. All pressure gages shall be so installed as to be easily readable from an eye level 5' -6" above the floor.

B. Test plugs on flow measuring stations shall be unobstructed and shall be arranged in the piping per manufacturer's recommendations.

C. All equipment and accessories shall be installed to facilitate proper service and maintenance in compliance with the manufacturer's recommendations.

3.5 WIRING BY THE ELECTRICAL CONTRACTOR

A. It is the intent of these specifications that all line voltage electrical power wiring and power connections to equipment be furnished and installed by the electrical contractor, unless otherwise specified or shown on the drawings.

B. The mechanical contractor shall coordinate actual job-site power requirements with the electrical contractor prior to installation of power wiring and electrical equipment.

C. The electrical contractor shall provide necessary wiring to electric heat tape as required and shall coordinate with the mechanical contractor the location and capacity of required circuits.

D. When mechanical system components are furnished with remote mounted control panels, alarm bells, alternators, etc. the electrical contractor shall run all required line voltage power wiring as directed by the mechanical contractor. It shall be the mechanical contractor's responsibility to coordinate the work and provide the necessary wiring diagrams.

E. When exhaust fans are provided which are not controlled by the ATC contractor, they shall be wired to local line voltage wall switches. The wall switch locations shall be coordinated with the owner's representative.

F. Line and low voltage control wiring will be furnished and installed by the ATC contractor in accordance with NEC and Division 26. Minimum 3/4" conduit.

3.6 STORAGE AND INSTALLATION OF MOTORS

A. Handle motors carefully to prevent damage, denting and scoring. Do not install damaged motors or components; replace with new.

B. Store motors and components in a clean, dry place. Protect from weather, dirt, water, construction debris, and physical damage.

C. Install motors, where indicated on the drawings and in accordance with manufacturer's drawings and in accordance with manufacturer's published installation instructions.

D. Install each direct-connected motor such that it is securely mounted in accurate alignment. The drive must be free from both angular and parallel misalignment when both motor and driven machine are operating at normal temperatures. Provide each belt-connected motor with a securely mounted adjustable base to permit installation and adjustment of belts.

3.7 INSTALLATION OF ABOVE GROUND PIPING

A. Provide piping systems of sizes indicated on the drawings. Systems shall be installed complete.

B. Install piping systems in conformance with ANSI B31.

C. Install piping to allow for expansion and contraction of the piping systems. Provide offsets and swing joint connections at coils, pumps and other equipment to eliminate undue strain to the equipment connections.

1. Connect flanges and tack weld piping systems in place before full circumferential welds are made.
2. Springing of piping at equipment connections will not be permitted.
3. The use of "cold-spring" is not permitted.

D. Branch connections to up feed systems shall be made at the top or at a 45-degree angle above the centerline. Branch connections for down feed systems shall be made at the bottom or at a 45-degree angle below the centerline.

E. Install water piping with a pitch or slope of not less than 1-inch in 40 feet.

1. Provide 3/4-inch diameter plugged drain valves at each low point in mechanical rooms.

F. High Points: At each high point of the piping system provide a 3/8-inch diameter plugged globe valve.

1. Where high points are located in an inaccessible position, provide a 3/8-inch diameter bleed line from the high point of the piping system and extend to an approved location, with access. Anchor bleed piping and provide 3/8-inch diameter globe valve.

G. Support, anchor, and guide piping systems to preserve piping flexibility and the isolation effects of sound and vibration isolation hangers.

1. pipe clamps on piping 4-inch diameter and larger and verify alignment before welding.

H. All installed pipelines shall be straight, free from dents, scars and burrs, with ends reamed smooth and shall remain straight against strains tending to cause distortion during system operation. The Contractor shall make proper allowance for pipeline expansion and contraction so that no unsightly distortion, noise, damage or improper operation will occur.

I. Piping shall be run in a neat and efficient manner and shall be neatly organized. Piping shall be run parallel or at right angles to the building walls or construction. The Contractor shall study the general, electrical, and other drawings to eliminate conflict of piping with structure, sheet metal, lighting, or other services. Unless specified otherwise, no piping shall be exposed in a finished room, all changes in direction shall be made with fittings.

J. All piping shall be clean and free from acids and loose dirt when installed.

K. Temporary pipe plugs of rags, wool, cottons, waste or similar materials shall not be used.

L. All piping shall be so arranged to not interfere with removal of other equipment or devices and shall not block access openings, etc.

M. Piping shall be arranged to facilitate equipment maintenance.

N. Flanges or unions shall be provided in the piping at connections to all items of equipment.

O. All piping shall be installed to insure noiseless circulation.

P. All valves and specialties shall be so placed to permit easy operation and access, and all valves shall be regulated and adjusted at the completion of the work.

3.8 VALVE INSTALLATION

A. After piping system has been tested and put into service, but before final testing, adjusting and balance, inspect each valve for possible leak. Open and close each valve to verify proper operation.

3.9 INSTALLATION OF UNDERGROUND PIPING

A. Coordinate the routing and location of all underground piping with building footings. See structural drawings.

B. Outside pipe placed underground shall be buried deep enough to protect against freezing.

C. Depth of bury of services shall be:

	Minimum	Preferred
Sewer	48”	48”
Rainwater	48”	48”
Water	60”	60”
Gas	36”	36”
Fire	60”	60”

D. Services shall be buried at the "preferred" depth unless site conditions require the "minimum" depth as listed above.

E. Handling: Pipe and accessories shall be handled so as to insure delivery to the trench in sound, undamaged condition. Particular care shall be taken not to injure the pipe coating. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. No other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the owner. Rubber gaskets that are not to be installed immediately shall be stored in a cool dark place.

F. Coated and wrapped steel pipe shall be handled in conformance with AWWA Standard C203.

G. Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contractor Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutters shall be used when practicable.

H. Copper tubing shall be cut square, and all burrs shall be removed.

I. Locating: Where the location of the water pipe is not clearly defined by dimensions on the drawings, the water pipe shall not be laid closer horizontally than 10 feet from a sewer except where the bottom of the water pipe will be at least 12 inches above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 6 feet from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe for a distance of at least 10 feet each side of the crossing shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 3 feet horizontally of the crossing. Water lines shall, in all cases, cross above sewage force mains or inverted siphons and shall be not less than 2 feet above the sewer main. Joints in the sewer main, closer horizontally than 3 feet to the crossing, shall be encased in concrete.

J. Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

K. Copper tubing shall not be installed in the same trench with ferrous piping materials.

L. Nonferrous metallic pipe: Where nonferrous metallic pipe, e.g., copper tubing, crosses any ferrous piping material, a minimum vertical separation of 12 inches must be maintained between pipes.

M. Plastic pipe shall be insulated against heat from steam lines, water lines, or other heat sources.

N. Placing and Laying: Pipe and accessories shall be carefully lowered into the trench. Under no circumstances shall any of the materials be dropped or dumped into the trench. Care shall be taken to avoid abrasion of the pipe coating. Pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon a compacted sand bed, with recessed excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and re-laid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until jointing is completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by the Contractor at his expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as required.

O. Where prescribed by the manufacturer of the pipe, gaskets shall be placed in the groove on the end of the pipe before the pipe is placed in the trench. After the pipe has been forced together, the position of the rubber gasket shall be checked with a feeler gage in accordance with the pipe manufacturer's recommendations.

P. Pipe shall be protected during handling against impact shocks and free fall and the pipe interior shall be free of extraneous material.

Q. Laying of gravity drain shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the pipe has a uniform invert. As the work progresses, the interior of the pipe shall be cleared of all superfluous materials.

R. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints in gravity drain lines shall then be placed, fitted, joined, and adjusted so as to obtain the degree of water tightness required.

3.10 EXCAVATION

A. Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsatisfactory excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the owner. Excavated material not required or not satisfactory for backfill shall be removed from the site. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Sheeting and shoring for the work and for the safety of personnel shall be in compliance with applicable safety standards.

B. Trench Excavation: The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the manufacturer's installation manual. The trench width below the top of the pipe shall not exceed that recommended in the installation manual. Where no manufacturer's installation manuals are available, trench walls below the top of the pipe shall be vertical, and trench walls above the top of the pipe shall be sloped as required to properly complete the work. Trench width below the top of the pipe shall not exceed 24 inches plus pipe outside diameter (O.D.). Where recommended trench widths are exceeded, redesign shall be performed by the Contractor using stronger pipe or special installation procedures. The cost of this redesign and the increased cost of the pipe or installation procedures shall be borne by the Contractor without additional cost to the Owner.

C. Bottom Preparation: The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 3 inches or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

D. Removal of Unyielding Material: Where over depth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with suitable materials.

E. Removal of Unstable Material: Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material. When removal of unstable material is required due to the fault or neglect of the Contractor in his performance of the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Owner.

F. Excavation for Appurtenances: Excavation for manholes, catch basins, inlets, or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structural footings and foundations as shown. Removal of unstable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.11 BACKFILLING

A. Backfill material shall consist of satisfactory material. Backfill shall be placed in layers not exceeding 4 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density unless otherwise specified.

B. Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 2 feet above the top of the pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

C. Replacement of Material: Material removed from the bottom of the trench shall be replaced with 6” sand base prior to the installation of piping. Piping shall be encased in sand with a 6” top layer over the top of the piping.

D. Initial backfill material shall be placed in layers of a maximum of 4 inches loose thickness and compacted with approved tampers to the density of the adjacent soil and to a height of at least 1 foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of pipe for full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe. Backfill material in this portion of the trench shall consist of satisfactory material at a moisture content that will facilitate compaction free from stones of such size as recommended by the pipe manufacturer, or larger than 2 inches in any dimension, whichever is smaller, except that where the pipe is coated or wrapped for protection against corrosion, the backfill material shall be free of stones larger than 1 inch in any dimension, or as recommended by the pipe manufacturer, whichever is smaller.

E. The remainder of the trench, except for special materials for roadways, shall be backfilled with satisfactory material. Backfill material shall be deposited ad compacted as follows:

F. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, Method B or D.

3.12 INSTALLATION OF VALVES

A. Gas Cocks: Provide and install gas cocks at connection to gas train for each gas-fired equipment item; and on risers and branches, where indicated on the drawings. Locate gas cocks where easily accessible and where they will be protected from possible injury.

B. Pressure Regulating Valves: Install pressure regulating valves in accordance with local utility company's requirements and manufacturer's installation instructions. Install gas shutoff valve upstream of each pressure regulating valve. Each pressure regulating valve shall have an independent vent piped to the outside of the building. Vents shall be terminated with an approved bug screen fitting.

3.13 INSTALLATION OF NATURAL GAS PIPING

A. General: Install natural gas piping as shown on the drawings in accordance with NFPA 54 and as follows.

B. Caulk spaces watertight between pipes and sleeves passing through exterior walls, slabs on grade and over crawl spaces, and waterproofed floors. Pack and seal spaces between pipes and sleeves passing through floors, walls, and ceilings of machine spaces, such as mechanical equipment, refrigeration, boiler, pump, fan, and machinery rooms at both ends of sleeve to provide an airtight acoustical barrier.

C. Unless otherwise indicated, gas piping shall be run exposed. Where concealed piping is indicated, it shall be installed inside of a welded steel casing which is vented on both ends and, in a location, to permit access to the piping casing with a minimum amount of damage to the building.

D. The gas supply pipe shall be of the size indicated on the drawings.

E. A stop cock or tee handled gate valve, with cast-iron extension box and cover, shall be installed in the gas supply pipe near the curb. A brass gas cock shall be installed in the gas supply pipe just inside the building wall. If the gas supply pipe is larger than 2-inch size, a bronze mounted iron body gate valve may be provided in lieu of the brass cock.

F. Joints shall be welded from the seismic shut-off valves to the gas train connections at the boilers. Other non-welded joints shall be made with graphite and oil or an approved graphite compound applied to the male thread only. After cutting, and before threading, pipe shall be reamed, and all burrs shall be removed. Threads shall be accurately cut, and not more than three threads shall remain exposed outside each fitting after the joint has been made up. Each length of pipe shall be hammered, and all scale shall be blown out before assembling. Threaded joints shall not be caulked to prevent or stop leaks.

G. An approved type gas cock shall be installed in the branch connection to each riser and near each appliance. Plugged or capped outlets for future extensions or connections shall be provided where noted on drawings.

H. Piping shall be graded not less than 1-inch in 40 feet of length to prevent trapping. The gas supply pipe from the main in the street to the meter shall grade up toward the meter. Horizontal lines from the meter to the risers shall grade down toward the risers and branches from risers to appliances shall grade up toward the risers and branches from risers to appliances shall grade up toward the appliances.

I. A full-size tee fitting and a 6-inch long capped drip pocket shall be installed at the bottom of each riser or drop and at each low point in a horizontal gas line.

J. Unions shall be installed in the gas piping between the gas burning appliance and the gas shut-off valve serving the appliance.

END OF SECTION 23 0900

SECTION 23 3000

AIR DISTRIBUTION

PART 1 – GENERAL

1.1 SCOPE

A. Work shall include the air distribution, ventilation, and exhaust duct systems, and all materials, equipment, and labor required to complete the systems shown on plans and specified herein.

PART 2 – PRODUCTS

2.1 GENERAL

A. Construct all ducts, plenums, etc., of the gauges specified in the latest editions of the applicable SMACNA manuals, unless otherwise shown. Sheets shall be free from blisters, slivers, pits, and imperfectly galvanized spots.

B. Duct construction and installation details shall comply with the latest edition of the SMACNA Duct Construction Standards.

C. Supply air ducts shall be designed to meet the requirements for +2-inch pressurized ducts. All exhaust ducts shall be -2-inch suction ducts.

2.2 ACCESS DOORS AND PANELS

A. Location: Provide access doors in casings, plenums, and ducts where shown on the drawings and where specified for ready access to operating parts including fire dampers, smoke dampers, valves, and concealed coils.

B. Pressure Clarification: Construct and install access doors in accordance with SMACNA Standards to suit the static pressure classifications and the locations where installed.

C. Access Doors in Ducts: Provide and size doors as follows:

1. Minimum 24-inch by 24-inch clear opening.
2. When field conditions require an access opening smaller than 16-inch by 12-inch, provide a 24-inch long removable section of casing or duct, secured with quick acting locking devices, 6 inches on centers, to permit ready access without dismantling other equipment.

D. Door Requirements: Provide doors in casings and duct as follows:

1. Arrange doors so that system air pressure will assist closure and prevent opening when the system is in operation.
2. Coordinate doors and equipment to provide unrestricted passage through clear door opening, without removal of any equipment.
3. Where pressure regulating dampers are installed in ducts or plenums, provide access doors with a clear wire glass observation port, 6-inch by 6-inch minimum size. Anchor port with structural metal frame, resilient gaskets and stainless-steel bolts.
4. Hinges for doors in zinc coated or aluminum construction shall be steel or iron, zinc coated with brass pins.

5. Hinges for doors in copper, copper nickel alloy construction shall all be brass.

2.3 CLOSURE COLLARS

A. A duct ending at a wall or partition shall have the edge turned back to form a closure collar and flanged tight to the wall or partition so that no sharp or ragged edge appears.

2.4 FLASHING

A. Where ducts pierce roof construction, the flashing shall be provided as part of Division 7.

B. The equipment bases and duct opening bases on the roof shall be constructed by this Contractor as shown on the drawings. The base shall be constructed to fit the equipment approved for construction. This Contractor shall construct and install a weatherproof inverted pan over the wood bases to act as a counterflashing and weatherproof hood for the base. All openings through the pan for equipment mounting shall be sealed weathertight with lead washers.

2.5 TEST HOLES IN DUCTWORK

A. Test holes for testing air quantities in ducts shall be installed at locations to be specified by the Balancing Contractor. Rubber stoppers shall be provided for closing the test holes. Where these holes are installed in insulated ductwork, a removable plug of approved insulation material shall be provided. An instrument port shall be provided in the following locations for each fan system.

1. Return air shaft and/or duct upstream of sound traps:
2. Return air fan plenum
3. Main return air duct upstream of fresh air dampers
4. Mixed air plenum
5. Supply fan plenum

B. Additional ports are to be installed in locations determined by the Owner's representative.

C. Instrument ports shall be die-cast with screwed cover for the insulation thickness specified. Ports shall be located outside of the plenum with 20-gauge sheet metal sleeve of the same size as the port opening, passing through insulation where ducts have interior insulation.

2.6 CLEANOUT OPENINGS

A. Duct systems shall have cleanout openings equipped with tight fitting sheet metal doors. Doors shall be tightly latched without the use of tools.

2.7 FIRE-RESISTIVE ACCESS OPENING

A. When cleanout openings are located in ducts within a fire-resistive shaft or enclosure, access openings shall be provided in the shaft or enclosure at each cleanout point.

B. These access openings shall be equipped with tight-fitting sliding or hinged doors which are equal in fire-resistive protection to that of the shaft or enclosure.

2.8 CLEARANCES

A. Duct systems shall have a clearance from combustible construction of not less than 18 inches. This clearance may be reduced to not less than three inches, provided the combustible material is protected with materials approved for one-hour fire-resistive construction on the duct side.

2.9 EXHAUST OUTLETS

A. Exhaust outlets shall extend thru the roof, unless otherwise noted. Such extension shall be at least two feet above the roof surface, at least 10 feet from any adjacent building, property line, or air intake opening into any building, and shall be located at least 10 feet above the adjoining grade level.

2.10 BRANCH TAKEOFFS

A. Branch takeoffs shall be as shown on the drawings, and shall be fitted with adjustable lock balancing dampers, complete with locking quadrants. Where dampers are not accessible for adjustment from above, concealed ceiling regulators with adjustable chrome-plated covers shall be provided.

2.11 WALL PENETRATIONS

A. All ducts penetrating structural or architectural walls shall be sealed air and sound tight.

2.12 FIRE RATED SURFACE PENETRATIONS

A. All ducts penetrating fire rated surfaces shall be sealed as directed in 230900.

2.13 EXPOSED ROUND +2" PRESSURE CLASS

A. All joints and fittings shall be sealed with thermo-fit duct band by Raychem or approved equal. The contractor shall take care to ensure that all joints and fittings are neat in appearance.

2.14 SAWDUST EXHAUST DUCT SYSTEM

A. General: All exhaust systems shall be constructed with the materials recommended herewith and installed in a permanent and workmanlike manner. Interior of all ducts shall be smooth and free from obstructions with joints either welded or bonded with adhesive airtight.

B. Materials: Ducts shall be constructed of black iron welded or of galvanized sheet steel riveted and soldered. Interior of all ducts shall be smooth and free from obstructions with joints, either welded or soldered airtight, as specified above.

C. The following metal thickness shall be supplied for all ducts:

Dia. of Straight Ducts	U.S. Standard Gauge for Steel Duct
Up to 8" dia.	22 gauge
8" to 18" dia.	20 gauge

D. Elbows and angles shall be a minimum of two gauges heavier than straight lengths of equal diameter.

E. Where flexible piping is necessary, a non-collapsible type of flexible piping shall be used and it shall be kept at a minimum length.

F. Construction: Longitudinal joints of ducts shall be lapped and riveted or spot-welded on 3" centers maximum.

G. Girth joints of ducts shall be made with lap in direction of air flow, with 1" lap for diameters thru 19", and 1-1/4" lap for diameters over 19".

H. Elbows and angles should have an inside or throat radius of two pipe diameters whenever possible, but radius shall never be less than one pipe diameter. Large radii are recommended for heavy concentrations of highly abrasive ducts.

I. Construct elbows 6" or less in diameter of at least five sections, over 6" diameter of seven sections. Angles shall be pieced proportionately.

2.23 DUCTWORK

A. All duct work shall be fabricated and installed in compliance with the latest SMACNA duct manuals.

B. Sheet metal ducts shall be properly braced and reinforced with and, where they protrude above roof, they shall be properly flashed.

1. Underground ductwork and fittings shall be constructed of fiberglass reinforced plastic and shall be all requirements of the 2018 IMC and listed with ICC-ES for direct burial application.
2. All ducts and fittings shall bear labels indicating all code listings.
3. All field joints shall be watertight and constructed per duct manufacturer requirements.
4. Duct and fittings shall be sand bedded.

2.24 DUCT JOINTS

A. All duct joints must be sealed airtight as required by Table 1-2 "SEAL CLASSIFICATION" of the "HVAC Duct Construction Manual". The term "seal" or "sealed" means use of mastic or mastic plus tape or gasketing as appropriate.

2.25 DIMENSIONS

A. Ducts, unless otherwise approved, shall conform accurately to the dimensions indicated on the drawings, and shall be straight and smooth on the inside with joints neatly finished. All duct sizes shown on the drawings are free area inside dimensions. Acoustically-lined ducts shall have outside dimensions increased as required to accommodate the acoustic lining specified and still maintain the free area inside dimensions shown on the drawings.

B. Under no circumstances shall the cross section of any duct be decreased by dents, pipes, or hanger rods running through it unless otherwise indicated on the drawings. Neither shall the shape be changed without approval. No abrupt transitions that restrict the area shall be used. Where necessary to gain clearance, the duct seams may be turned inside. Structural and Architectural drawings shall be consulted for areas with restrictive clearances.

2.26 FIELD VERIFICATION

A. No ductwork shall be fabricated without first field verifying that the available space (under actual job conditions) will permit installation of the ductwork without structural or other conflicts.

2.27 FLEXIBLE CONNECTION

A. This contractor shall provide flexible connections not less than 4 inches wide, constructed of heavy, waterproof, woven plastic-coated glass fabric at the inlet and outlet connections of each fan unit, securely fastened to the unit and to the ductwork by a galvanized iron band, and provided with tightening screws. Corners shall be sewn tight shut.

2.28 AIR FLOW MEASURING DEVICES

A. The sheet metal contractor shall install the air flow measuring devices as specified in Section 251000. The devices will be furnished by the control contractor.

2.29 BELT GUARDS

A. Belt guards shall be fabricated and installed. Guards shall be constructed of 10-gauge wire, 1-inch mesh in 1-1/2-inch angle-iron welded frames. All guards shall be provided with an opening for a tachometer and shall be either the split type or easily removable for belt repair. The guards shall be anchored securely to the floor or walls to prevent any vibration.

2.30 PRE-MANUFACTURED DUCTS

A. Runouts above ceiling from the branch ducts to the ceiling diffusers shall be similar to "Genflex - Type IL". Maximum allowance length is 5'-0" in any given duct run. Duct to be factory fabricated with spring steel wire helix and 1" thick glass fiber insulation covered with external vapor barrier and lined with continuous non-perforated inner sleeve.

B. Material shall comply with the 2021 IMC Standard 10-1.

2.31 RECTANGULAR DUCT LINING

A. The interior surface of all rectangular supply, return, fresh, relief, and exhaust air ducts (except where noted otherwise), shall be lined with 1" thick fiberglass dual density duct liner, having an average "K" factor of .24 BTU at 75 deg. F mean. The liner shall meet standards NFPA No. 90A and No. 90B and shall have the Underwriters' Laboratories, Inc., label.

B. Duct liner shall be applied to the flat sheet with a 100% coverage of duct adhesive. The duct liner shall be cut to assure snug corner joints. The black surface of the liner shall face the air stream. On horizontal runs, tops of ducts over 12" in width and sides over 16" in height shall be additionally secured with welded pins and speed clips on a maximum of 15" centers. On vertical runs, gripnails or welded pins and speed clips shall be spaced on a maximum of 15" centers on all width dimensions over 12". Pins shall start within 2" of all cross joints within the duct section.

C. Welded pins shall be cut virtually flush with the liner surface. Clips should be drawn down flush only and not so as to compress the liner and cause the leading edge of raise. All exposed edges and the leading edge of all cross joints of the liner shall be coated with adhesive.

D. Material shall comply with 2021 IMC Standard 10-1.

2.32 GAS VENTS

A. Flues for gas-fired equipment shall be of the sizes shown on the drawings. Flues shall be insulated double wall, with stainless steel liner. Gas vent approved for continuous flue temperatures up to 1000 deg. F. Units shall be Metalbestos, Metalvent, or Dura-Vent.

B. Top flues with Metalbestos Type "S-CT" vent cap especially designed for non-backdraft application. Flash and counter flash around flue at point of roof penetration to make watertight. Vertical and horizontal flues shall be double wall stainless steel construction.

C. Flue which serves boiler must be a positive pressure type. All flues must be of type approved by local gas company for application.

2.33 REGISTERS, GRILLES AND DIFFUSERS

A. All registers, grilles, and diffusers located in toilet room areas shall be all aluminum construction.

B. Supply Air Registers:

1. Furnish and install all supply air registers shown and specified on the drawings. All units to have opposed blade balancing dampers. Registers to have 4-way air deflection. All register cores shall be removable, or plaster frames shall be furnished with units. Registers shall be of steel, or anodized aluminum construction. Finish shall be bright white unless otherwise noted.
2. Registers shall be Titus, Tuttle & Bailey, Metalaire, Nailor, Carnes or Price.

C. Return, Exhaust & Transfer Air Registers:

1. Furnish and install all ceiling and sidewall return, exhaust, and transfer air registers shown and specified on the drawings. All units to be painted steel, or aluminum construction (where permitted by fire code) with bright white finish and opposed blade balancing dampers. All cores shall be removable, or plaster frames shall be furnished with units. Registers located near the floor shall be heavy duty gymnasium type. Registers shall be Titus, Tuttle & Bailey, Metalaire, Nailor, Carnes or Price.

D. Ceiling Diffusers:

1. All ceiling diffusers shall be of the round, square, or rectangular type with louvered face and 1, 2, 3, or 4-way air pattern as indicated on the drawings. Units shall be painted steel, or aluminum construction (where permitted by fire code) with bright white finish and inner assembly shall be easily removable from outer frame without special tools. Louvers shall be spaced on 1-1/2" centers maximum.

2. All diffusers shall be furnished with round or square opposed blade volume control and air extractor. Diffusers shall be Titus, Tuttle & Bailey, Price, Metalaire, Nailor, or Carnes.

E. General:

1. All registers, grilles, and diffusers located in locker/shower area shall be all aluminum construction.
2. Color and finish of all grilles, registers, and diffusers shall match ceiling grid. Coordinate with the Owner's representative.

2.34 PACKAGED ROOFTOP HEATING AND AIR CONDITIONING UNITS

A. Furnish and install complete the roof-mounted packaged type Gas/DX cooling unit or cooling only unit, as shown and specified on the plans. Unit to be factory-wired and tested and of capacities as listed. the unit shall be shipped completely assembled, pre-charged, piped, and wired internally, ready for field connections. In addition, manufacturer shall provide field start-up and test for each unit and shall forward a copy of the start-up report to the Architect.

B. The unit shall be complete with integrated economizer capable of simultaneous economizer and compressor operation. Economizer shall include all hardware and controls for cooling with outside air, low leakage dampers not to exceed 3% leakage at 1.0 in. wg pressure differential, capable of introducing up to 100% outside air and equipped with gravity relief air damper. Provide 0-10 VAC control points as required for ATC contractor.

C. Gas-fired heat exchanger shall be constructed of aluminized steel. Power burner shall have electric direct spark ignition, 100% safety shut-off electronic flame sensing controls, pre-purging and combustion air adjustment. All controls shall be listed for operation at low outdoor air temperatures. System shall be equipped with dual limit safety controls, shall be AGA design certified for outdoor installation for natural gas firing, shall be rated and tested according to D.O.E. and F.T.C.

D. Roof curb shall be of steel construction and shall extend 12" minimum above the finished roof surface. The mounting shall made to the bottom perimeter of equipment and distribute the unit weight uniformly to the structure.

E. High- and low-pressure switches shall be factory-installed and wired. These switches shall protect the system against abnormal operating conditions. Low pressure switch shall be automatically reset, high pressure switch shall be manual reset.

F. The unit shall be furnished complete with a field installed starting kit to aid the compressor when the compressor is starting under a condition of low voltage.

G. All components, wiring, and inspection areas shall be completely accessible thru removable panels which have locking door handles.

H. Provide factory hail guards.

I. Provide a factory mounted weather-proof 120-volt GFI outlet.

J. Provide factory hard wired wall mounted programmable thermostats for base bid units.

K. Provide a factory terminal strip for DDC system connection for Wrestling Room unit under alternate 01,

L. The compressor section shall carry a 5-year guarantee.

M. Units shall be Carrier, Lennox or approved equal.

2.35 DIRECT FIRED GAS FIRED MAKEUP AIR UNITS

A. GENERAL DESCRIPTION

1. Furnish and install, where shown on plans, the direct fired make-up air heating and ventilating package units. Units shall be approved by American Gas Association for outdoor installation.

B. QUALITY ASSURANCE

1. ETL-Listed to the American National Standard/CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4, CSA 3.7.

2. ETL-Listed to the American National Standard/CSA Standard for Gas Unit Heaters And Gas-Fired Duct Furnaces ANSI Z83.4, CSA 3.7, and Z83.18. (Recirculating)

3. The Safety Control Board is ETL-Listed to standards UL 60730-2-9, UL 60730-1; CSA E60730-1, and CSA E60730-2-9.

C. WARRANTY

1. All parts shall carry minimum manufacturer guarantee as follows:

    a. 100% hot dipped galvanized cabinet and blower wheel: 5 yrs.
    b. Stainless steel heating element: 5 yrs.

D. GENERAL ASSEMBLY

1. Unit(s) shall be factory assembled, tested and shipped as a complete packaged assembly, for indoor or outdoor mounting, consisting of the following specifications, deliver all capacities scheduled, and conform to design indicated herein. Alternate layouts or dimensional changes will not be accepted.

E. CABINET

1. Unit(s) shall be constructed of minimum 20-gauge G-90 galvanized steel riveted together via structural pop-rivets. All metal shall be CNC bent for precise assembly.

    a. Base Construction: The base shall be constructed of galvanized steel for improved rigidity. Base shall be structurally reinforced to accommodate the blower assembly and burner.

    b. Rigging Provisions: The unit shall have a structural base constructed of minimum 14-gauge G-90 galvanized steel and include lifting points on all four sides.

    c. Roof Construction: Roof shall be pitched to allow for proper drainage.

    d. Exterior Wall Construction: All exterior walls shall consist of insulated galvanized steel construction.

    e. Service Access Doors: All door jambs shall be gasketed around their perimeter. Doors may be mounted via spring actuated, stainless steel hinges with stainless steel rivets, and self-compressing stainless steel pad lockable latches or through removable sliding panels.

    f. Each compartment shall have removable access panels to allow for ease of service and maintainability. Electrical cabinet doors shall be outfitted with manual pouches mounted on the door, along with wiring diagram attached to the indoor from the factory.

2. Entire interior and exterior casing shall be constructed of minimum 20-gauge G-90 galvanized steel with no painting and shall have undergone a salt spray corrosion test as per ASTM B 117.

3. An observation port shall be located on the exterior of the unit for observation of the main flame and pilot flame. All controls, gas valves, modulating controls and electrical components shall be mounted within the burner vestibule. The burner vestibule shall be an integral part of the unit and not extend outside the exterior casing of the unit and not exposed to the main air stream.

F. AIRFLOW CONFIGURATIONS

1. Unit shall be configurable for down (vertical) discharge through unit.

2. 100 percent outdoor air unit - The intake airflow configuration shall be through use of a fresh/outdoor Damper. 80/20 percent outdoor air unit - The intake airflow configuration shall be through use of a fresh/outdoor and return air damper.

    a. Damper: Manufacturer shall provide and install on unit, when possible, a two-position, motor-operated damper with internal end switch to energize the blower-starter circuit, when damper is 80% open. Blades shall be a maximum of 6" wide 16-gauge G-90 galvanized steel and shall be made to guarantee the absence of noticeable vibration at design air velocities. Damper blades are to be mounted on friction-free synthetic bearings. Damper edges shall have PVC coated polyester fabric mechanically locked into blade edge. Jamb seals used are flexible metal, compression type. Dampers shall exceed AMCA Class 1A standard for low leakage.

    b. Insulated Damper: Shall be thermally broken with insulation R-value = 5.

    c. Discharge Diffuser: Shall be constructed of G-90 galvanized steel with horizontal and vertical blades capable of four-way diffusion.

    d. Actuator: A single direct drive damper actuator shall be used with spring return to ensure that the outdoor air section opens when not powered.

G. SUPPLY AIR BLOWER AND MOTOR

1. All supply fans shall be:

    a. Direct Drive: Blower assembly shall consist of a centrifugal backward inclined, non-overloading wheel secured directly to a heavy-duty, ball bearing type motor via two set screws. The motor and wheel assembly shall be mounted to a heavy gauge galvanized steel frame. The motor shall be controlled by a variable frequency drive, allowing for variable airflow without the need of belts and pulleys.
    b. Belt Drive: Blower(s) shall be forward-curved, centrifugal, Class I or II (depending on application requirements), double width, double inlet, constructed G-90 galvanized steel. Unit shall have a heavy-duty, solid-steel shaft. Belts shall be oil and heat resistant, non-static, grip-notch type. Drives shall be cast type, precision machined and keyed and secured attached to the fan and motor shafts. Fan operating speed shall be factory set using adjustable pitch motor pulleys. All drives shall be a minimum of 2 grooves above 2 HP.

2. Blower Motor: Motor shall be a premium efficiency motor available as:

    a. Electronically Commutated Motor (ECM).

3. Fans to be selected at or near efficiency peak. Check fan curves provided with job.

4. Blower and motor assembly shall be dynamically balanced. The entire blower and motor assembly shall be mounted on rubber vibration isolators. Wheels balanced as per AMCA 204-96; Balance Quality and Vibration Levels for fans.

H. SHAFTS AND BEARINGS

1. Shafts shall be precision ground and polished. Heavy duty, pre-lubricated bearings designed for, and individually tested, specifically for use in air handling applications.

I. HEATING SYSTEM

1. The gas burner shall be natural gas at an inlet-supply pressure to the unit of 7" w.c. minimum natural gas.

2. Burner design shall be capable of using natural gas. Burner ignition shall be of the direct-spark design with remote flame sensing at the pilot assembly to detect the presence of flame in the burner.

3. Direct-sparking sequence shall last through the complete duration of the trial for ignition period for guaranteed light-off. Each burner ignition module shall have LED indicators for troubleshooting and a set of exposed prongs for testing flame indication signal.

4. Unit should include self-adjusting burner profile plates, which ensure proper air velocity and pressure drop across the burner for clean combustion. Spring-loaded profile plates should react to the momentum of the fresh air stream. No motors or actuators are needed to drive them, nor should they need to be manually set to a specific position. Units should be capable of variable air volume applications.

5. Each furnace shall have:

    a. The burner shall have non-clogging, stainless steel combustion baffles attached to a ductile aluminum gas-supply section with no moving parts to wear out or fail. The burner shall be capable of 92% combustion efficiency with a maximum turndown ratio of up to 30 to 1.

    b. Stainless steel Quick Seal Connection for gas connection.

    c. Manifold and Input gas pressure gauges.

    d. High gas-pressure switches to disable heating if gas pressure is too high.
    e. Low gas-pressure switch to disable heating if gas pressure is too low.

    f. Proof-of-closure switch to energize the main-burner circuit only if the motorized gas valve is in a closed position.

J. FILTERS

1. Provide filters as part of unit. All filters shall be furnished and installed to meet the performance requirements set forth in the schedule and as specified under another section of this work.

2. The filters shall be 2" thick, aluminum mesh coated with super-filter adhesive, aluminum mesh with polyester foam or pleated throw away. Aluminum-mesh filters shall have aluminum frames with media to be layers of slit and expanded aluminum, varying in pattern to obtain maximum depth loading. Washable 2" filters shall be enclosed in two-piece, die-cut frame with diagonal supports. Frame shall be constructed of heavy-duty beverage board. Filter media is supported on the air leaving side by a metal grid.

3. All filters shall be installed on tracks for easy removal from the unit.

4. Shall be either insulated or non-insulated constructed of G-90 galvanized steel with filters supported by internal slides and with removable access panels.

5. Unit shall have an optional adjustable pressure differential sensor for the filter bank to alert in the event of a clogged filter.

K. ELECTRICAL

1. All controls shall be pre-wired and housed in an insulated electrical cabinet within the unit to protect against the risk of condensation.

2. All direct fired heating/ventilating only units shall be provided with single point electrical connection.

3. Unit shall be provided with a door safety switch that de-energizes the supply fan when the door is opened.

4. Units shall be provided with a factory mounted averaging intake air temperature sensor to allow for accurate intake temperature reading regardless of how the OA/RA dampers are positioned.

5. Provide a factory mounted weather-proof non powered 120-volt GFI outlet.

6. The electrical cabinet shall be outfitted with the following:

    a. LED electrical cabinet service light with automatic activation upon door switch.
    b. Color wiring schematics, laminated to the interior wall of the cabinet doors.
    c. Factory mounted disconnect with unit bottom knockouts.
    d. A LED backlit, LCD Human-Machine Interface (HMI) shall be mounted within the unit's control cabinet to allow for all set points configuration and refrigeration system monitoring at the unit.
    e. Up to 4 additional space mounted HMIs available. Additional HMIs shall allow for full programming capabilities and are outfitted with integral temperature and humidity sensors. Additional HMIs shall be capable of being individually averaged for space temperature/humidity readings. All HMIs shall be wired using standard CAT5/6 cables.

L. CONTROLS

1. Unit shall be outfitted with a control board to allow for full control of the entire unit.

2. Provide onboard air flow switch located on MUA control board to sense air flow.

3. All unit controls shall be compatible with BACnet or LonWorks based building management systems. Coordinate with Division 251000 contractor.

4. Control panels shall provide choice of heating or ventilating function. Units shall have all internal wiring, including motor and motor controls, factory wired and pre-tested.

5. Unit shall be furnished with factory magnetic starter containing all necessary auxiliary contacts for interlocking the make-up air units with the related exhaust fans. Coordinate with Division 251000 contractor.

6. Temperature Control System:

    a. Discharge Temp Control (Heating) - Unit modulates the burner flame to accurately maintain the desired discharge temperature set point and compensate for fluctuations in entering air temperature, air volume and % of OA using heating PID controls.

M. Activation Controls:

1. Activate Based on Stat (Heating) - Unit will activate heating when the space thermostat sends a 24V signal to W and G on the main control board. Unit will modulate to maintain a constant discharge heat set point.

2. Activate Based on Stat (Cooling) - Unit will activate cooling when the space thermostat sends a 24V signal to Y and G on the main control board. The unit will modulate to maintain a constant discharge cool set point.

N. ROOF CURBS

1. Unit shall be factory assembled and constructed of 18GA galvanized steel.

2. Unit shall be factory assembled and constructed of 16-gauge galvanized steel.

3. Curb shall be fully insulated with 1" acoustical and thermal insulation.

4. Curb shall be factory outfitted with duct support hangers.

O. SYSTEM START-UP

1. System start-up is performed by a factory-trained Service Technician.

P. MANUFACTURES

1. Units shall be Econ- Air, Greenheck or Captive Air.

2.36 UNIT HEATERS (Gas Fired)

A. Furnish and install in the locations shown on the plans the sealed combustion gas-fired unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.

B. Heat exchangers shall be either open or sealed type as shown on drawings and shall be aluminized steel designed to accommodate thermal stresses without internal damage. Burners shall be AGA approved with 24-volt control circuit and automatic safety pilot.

C. Unit casings shall be of not less than 16-gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

F. Units shall be furnished with 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

G. Provide factory vent and intake kit.

H. Unit heaters shall be Reznor, Hastings or Lennox.

2.37 UNIT HEATERS (Electric)

A. Furnish and install in the locations shown on the plans the UL rated electric unit heater shown and specified. Each unit to have capacity, air delivery, fan type, and motor characteristics as shown on the plans.

B. The electric heating coils shall be heavy duty, low watt density, fin tubular construction. The heating coil section shall include U.L. listed safety switches to protect the system from overheating.

C. Unit casings shall be of not less than 16-gauge steel. All casings to be phosphatized for rust resistance and finished with a baked enamel. All hardware shall be plated for rust resistance.

D. Motors and fans shall be designed for unit heater service and shall be tested for continuous duty as applied on each size to eliminate vibration and minimize sound.

E. Horizontal delivery units shall be equipped with formed louvers, 4-way individually adjustable.

F. Units shall be furnished with 2-stage room thermostat (fan only and fan & heat) and all controls for automatic operation.

G. Provide factory limit controls with re-set, summer fan switch and overheat protection.

H. Unit heaters shall be Chromalox, Markel or approved equal.

2.38 EXHAUST FANS

A. Roof Mounted Type:

1. Furnish and install complete the low-profile roof mounted exhaust fans of the size and capacity shown on the drawings.
2. Roof mounted fans shall be of the centrifugal type with spun aluminum hood. All parts exposed to weather and all fastenings shall be either aluminum or stainless steel. All fans to be equipped with permanently lubricated two-speed (where specified) ball bearing motors located in separate compartment out of the air stream. Fan shall have adjustable V-belt drive, self-flashing insulated curb, backdraft dampers, bird screen, disconnect switch, and shall be complete with all necessary fittings and transition pieces for a complete installation. All units shall bear the AMCA certified performance seal.
3. Fans shall be Greenheck, Twin City, Cook or Penn.

D. Utility Type:

1. Utility type exhaust fans shall be backward inclined, non-overloading type. Fan shall be statically and dynamically balanced at factory. Fan shall be furnished complete with ball bearings, vibration isolators, adjustable V-belt drives, greaseproof housings and belt guard. The motor shall be mounted on a heavy bed plate attached to the fan housing with bolts. Motors shall be resilient mounted to absorb the electrical hum and provide quiet operation. Fan shall bear AMCA certified rating seal. Fan shall be mounted on a welded angle frame. Installation shall be vibration free. All fans to have backdraft dampers, grease drains, and disconnect switch.
2. Fan shall be Twin City, Cook, Penn or Greenheck.

2.39 SMOKE FILTERATON UNIT

A. Provide a horizontal 2-stage electrostatic air cleaner with 4-way diffuser as required for welding smoke.

B. Unit shall be UL rated

2.40 PAINT BOOTH - PB-1 WOOD SHOP

A. Furnish and install a packaged spray booth with capacity as scheduled on plans. Unit to be complete with galvanized panels, non-ferrous explosion proof fan, Class 1, Division 2 fluorescent energy saving lights, air solenoid valve, safety shut down system, control panel, and high efficiency paint arresting filters. Appropriate components to be U.L. approved. Spray booth to be Spray Systems Inc. or approved equal.

2.41 SAWDUST COLLECTOR – SC-1

A. Furnish and install complete the "AAF" high efficiency, pulse sawdust collector shown and specified on the drawings. Unit shall have self-cleaning, high performance centrifugal fan on the upstream side. Collector cyclone shall have an efficiency of 99% on fine sawdust, with steel construction for installation, with prime-coated finish, and storage hopper. Unit shall be complete with factory-mounted starter and of size and capacity shown on the plans and in the equipment schedule.

B. Unit shall be complete code complaint system and installed as a turn-key system
   a. No return valve
   b. Abort gate
   c. Spark detector
   d. Factory control panels
   e. Factory start-up

C. Factory certified technician shall provide 4 hours of training for shop instructor and maintenance personnel.

D. Sawdust collector shall be complete with ECOMAXX no return explosion isolation valve, high speed abort gate by Boss Products, spark detection and all controls for automatic operation.

E. Sawdust collector shall be AAF, UAS, or Torit,

2.42 WELDING EXTRACTION ARMS

A. Furnish and install complete extraction arm systems as shown on plans and specified in the Equipment Schedule. Provide arm swivel assembly, structural supports, duct sections & flexible duct, all required hardware, light kit with LKF kit, including control box, wall bracket, duct swivel, and all accessories required for a complete installation.

B. Extraction arms shall be Car-Mon or approved equal.

2.43 AIR FILTER BANKS

A. Furnish and install the filtering bank systems shown and specified on the drawings. Filter banks shall be suitable for the space available. Filter banks shall be constructed and installed so as to prevent the passage of unfiltered air. Felt, rubber, or neoprene gaskets shall be provided between filter frames and unit casing, etc. Steel filter parts shall be protected against corrosion.

B. Filter bank shall consist of MERVE 9, 40%-45% efficient (ASHRAE 52-5 test standard) replaceable media type air filters. The supporting front grid of each filter section shall be hinged to facilitate easy replacement of filter media. Filter frames shall be of 18-gauge galvanized steel construction with 11-gauge galvanized steel wire grids to support the media.

C. At the time of acceptance of the work, new filter media shall be furnished and installed by the contractor.

D. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each filter bank and store on site as directed by the owner's representative.

E. Air filter banks shall be Cambridge, AAF, or Farr.

2.44 AIR FILTERS

A. Provide one complete set of spare filter media (in addition to the new filters installed at time of acceptance) for each unit filter bank and store on site as directed by Architect.

B. Air filter banks shall be Cambridge, AAF, or Eco-Air.

2.45 HVAC SMOKE DETECTORS

A. All units above 2000 CFM shall be provided with smoke detectors located in the return air intake and supply air discharge as per IMC. Detectors to be provided and wired under Section 26. ATC contractor to install all detectors.

B. Duct smoke detectors shall not be installed until just prior to final inspection to prevent dust and debris from contaminating detector.

2.46 FUSIBLE LINK FIRE DAMPERS

A. Furnish and install complete the fire dampers shown on the plans and specified herein. Dampers shall be provided and installed in accordance with NFPA-90A and bear the UL Label of Approval. Fire and ceiling radiation dampers shall be curtain-type with fusible link located in the air stream. Submit installation drawings.

B. Spring catches shall hold the dampers in a closed position when F.L. is broken. The weight of the duct and mounting frames shall comply with the National Board of Fire Underwriters and approved installation drawings. Sleeves with angles are required at all locations.

C. Provide hinged, gasketed, and latched access panels in duct at each damper. Stencil "Fire Damper" in 1" high red letters on white background at each access panel.

D. Provide ceiling access panels approved by the Owner's representative at each duct access panel when required, for maintenance and inspection of the fusible link.

E. Fire dampers shall be Air Balance, Pottorff or Nailor.

2.47 DAMPERS - GENERAL

A. Damper frames shall be of not less than 18-gauge galvanized steel, formed for extra strength, with mounting holes for enclosed duct mounting.

B. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must be of not over 6" in width. Blades shall be secured to 1/2" diameter zinc-plated axles by zinc-plated bolts and nuts. All blade bearings shall be nylon. Blade side edges shall seal off against spring stainless steel seals. Teflon-coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blades linkage hardware shall be constructed of corrosion-resistant, zinc-plated steel and brass.

2.48 AUTOMATIC DAMPERS

A. The ATC contractor shall furnish all automatic control dampers. The sheet metal contractor shall install all dampers and transition all ductwork to the dampers.

PART 3 – EXECUTION

3.1 JOB SITE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

2. Verify that the work of this section may be installed in accordance with all pertinent codes and regulations in the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect.
2. Do not proceed with installation in areas of discrepancy, until all such discrepancies have been fully resolved.

3.2 INSTALLATION OF EQUIPMENT

A. Install all equipment with adequate space for service and maintenance. **Minimum of 30" clearance for all service and control access.**

B. Equipment which requires periodic service and maintenance shall be installed in plenum space within 2 ft. of finished ceilings, or within 2 ft. of the bottom chord of the structure.

C. All visible surfaces behind grilles and registers shall be painted flat black.

D. Care shall be taken to avoid interference with structure and the work of other trades. Do not cut into load carrying members without the approval of the Owner's representative.

3.3 INSTALLATION OF DUCTS

A. All ducts shall be installed in compliance with the latest editions of the SMACNA manuals.

B. All necessary allowance and provisions shall be made in the installation of sheet metal ducts for the structural conditions of the building, and ducts shall be transformed or divided as may be required. Whenever this is necessary, the required area shall be maintained. All changes, however, must be approved and installed as directed.

C. Pre-manufactured ducts shall be connected to rigid ducts and equipment with the solid wraps of fabric duct tape and tyton bands drawn tight to form an airtight joint.

D. During the installation, the open ends of all ducts shall be protected by covering with plastic sheet tied in place to prevent debris and dirt from entering.

E. Install this work in cooperation with other trades so that there will be no delay in progress of construction work. It is extremely important that the duct system be clean before connections are made to the ceiling diffusers.

F. The contractor shall take special care when running exposed ductwork to ensure that the final installation is neat in appearance.

G. Spiral ducts running exposed in occupied areas shall be hung with an aircraft cable type hanger, or single duct strap at center of duct.

H. Under no circumstances shall ductwork be supported from the metal roof deck. (See general requirements 230100 & 230900)

I. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires or straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings or metal roof deck.

J. Hanger and Supports:

1. Hangers for ducts up to 18" in width shall be placed on not more than 8'-0" centers. Ducts 19" and over in width shall be supported on not more than 4'-0" centers. Hangers shall be placed plumb and present a near appearance. Construct hangers from galvanized band iron 1" x 1/8" for duct up to 36" wide. Hangers shall extend down the sides of the ducts not less than 9". On ducts less than 9" in depth, hangers shall extend the full depth of the ducts. Attach hangers to ducts using not less than three rivets or parker screws of appropriate sizes. It is essential that all ducts be rigidly supported. Where vertical ducts pass thru floors or roofs, supporting angles shall be rigidly attached to ducts and to the structure. Angles shall be galvanized and of sufficient size to support the ductwork rigidly. Place supporting angles on at least two sides of the duct. For round ducts, strap hangers shall extend completely around ducts.
2. Ceiling outlets shall be rigidly supported from the overhead structure with G.I. wires on straps, or from rigid galvanized iron ductwork. Outlets shall not be supported from T-bar ceilings unless approved by the owner's representative.

K. Ducts at Masonry:

1. Where ducts are shown connecting to masonry openings and along edges of all plenums at floors and walls, provide a continuous 2" x 2" x 3/8" galvanized angle iron which shall be bolted to the construction and made airtight to the same by applying caulking compound. Sheet metal at these locations shall be bolted to the angle irons.

3.4 STORAGE OF DUCTS

A. Ductwork shall be stored in a protected area to prevent physical damage to the duct liner, and to ensure that the duct liner is not exposed to excessive heat or moisture which would deteriorate the air side surface.

B. Ductwork which has been improperly stored and/or sustained physical damage will be rejected and shall be removed from the job site as directed by the Owner's representative.

3.5 CLEANING OF DUCTS

A. Before ducts are insulated and before the ceiling is installed and final connections made, the fans shall be operated at full capacity to blow out any dirt and debris from ducts. If it is not practical to use the main supply blower for this cleaning, the ducts may be blown out in sections by a portable fan. After the ducts have been cleaned and initially pressure tested, prior to final connection.

3.6 TESTING OF DUCTS

A. Supply, return, and exhaust ducts, plenums, and casings operating at duct pressures from +2" to -2" shall be tested and made substantially airtight at static pressure indicated for the system before covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean a leakage rate less than 5% of the rated airflow.

B. Ducts including all flexible runouts shall be tested in accordance with SMACNA Duct Construction Standards.

C. After the vertical duct risers or branch ducts have all been tested and tied into the mains the mains shall be tested in accordance with SMACNA Duct Construction Standards.

END OF SECTION 23 3000

SECTION 25 1000

AUTOMATIC TEMPERATURE CONTROLS

PART 1 – GENERAL

1.1 GENERAL CONDITIONS

A. The General Conditions, Supplementary General Conditions, alternates and addenda, applicable drawings and the technical specifications, shall all apply to all work under this division.

1.2 SCOPE OF WORK

A. The scope of work shall include all labor, material, and equipment necessary to supply an automatic temperature control system for the facility. The Contractor under this heading shall furnish and install a complete direct digital control system as specified.

B. Contractor shall provide at time of bid a statement of compliance including, but not limited to:

1. Detailed points list.
2. Any deviations from base specification with listed costs.

C. Install a complete, fully programmable, customized Direct Digital Control (DDC) system for control of the systems. This DDC control system shall be configured to operate over the district wide network.

D. Provide the following:

1. Demolition of existing systems as required for new installation
2. Integration with the existing master DDC Control Panel
3. Local DDC Control Panels
4. ATC Interface Panels
5. Local Area Network Wiring & Setup
6. Room Temperature Control
7. Building Fire Alarm Interlocks
8. Wrestling Room System controls & interlocks under Alternate #1
9. Interface with existing building systems as noted

1.3 SYSTEM DESCRIPTION

A. BASE BID SYSTEM

1. A web-based, password protected DDC automatic temperature controls shall be furnished and installed as a part of this contract to give the owner a completely operable system.

2. Manufacturers: Subject to the existing Temperature Control work installed previously under a separate contract, the Temperature Control work for this project shall be provided, installed and sequenced with the existing system.

3. Bidder must comply with all requirements of bidding documents to remain consistent with the district wide automation system. Any deviation or alternations will not be permitted. No substitutions or variances from the bid documents or the approved installers and/or manufactures will be permitted.

4. System shall fully interface with the existing campus system

B. **A <u>detailed points list</u> shall be provided by the contractor with their bid.**

C. Division 25 contractor is required to supply and install a complete 3/4" EMT conduit system for the DDC control system at all areas with the exception of the ceiling plenum. 3/4" EMT conduit shall be installed at all wall areas, hard ceiling areas, exposed ceiling areas, mechanical rooms, AC units & rooftop equipment.

D. Division 25 Contractor shall provide raceways and boxes for all Building Automation System components, including but not necessarily limited to the following:

1. All BAS Box and raceway rough-in for all walls, regardless of construction, from the electrical box to above the ceilings as shown on the Mechanical and/or Plumbing drawings. This includes but is not limited to thermostats, push button mushroom switches, kitchen panels, etc.
2. Any raceways required for Network or BAS communications from the Structure containing the Head end equipment to any outlying structures, equipment, and/or locations that require BMS communication. This includes but is not limited to outbuildings, concessions, generators, chillers, boiler rooms, fan rooms, etc.

E. All ATC / BAS conduits, connections, etc. shall be white, ¾" EMT.

F. Plenum rated wire with permanent label may be installed above areas with lay-in ceilings by Division 25.

1. Plenum rated cable may be used in lieu of conduit above drop-in ceilings.
2. Cables shall be run neat and straight, above ceiling without sagging.
3. Cables shall not rest on or be supported by the ceiling.
4. Cables shall be grouped according to system. Grouped cables shall be Velcroed together, **zip ties shall not be allowed.**
5. Velcro straps shall be tagged with the various system and identified on 20-foot centers.
6. Cables shall not receive excessive force when being installed.
7. Cables that have been damaged during installation shall be replaced at contractors' expense. Contractor shall verify that all connections are in proper working order, terminated correctly and provide documentation to engineer prior to final walk through.
8. All cables being run (not in conduit) shall, as a minimum standard, be listed and appropriately labeled as being resistant to the spread of smoke and fire in accordance with applicable article of NFPA-70 (NEC).

G. Wireless devices or systems **WILL NOT** be accepted.

1.4 WORK TO BE PERFORMED BY OTHERS

A. Division 26 shall furnish and install all single phase and multiple phase electrical power wiring to magnetic starters, disconnect switches, VFD's and motors. Division 26 shall also provide 120 VAC, 20 Ampere power sources to each group of ATC panels and equipment as shown. The ATC contractor shall be responsible for all step-down transformers and 24 VAC wiring to ATC equipment.

B. Division 26 shall furnish all duct smoke detectors. Refer to Duct Detectors in this specification for the ATC contractor responsibilities.

C. Division 25 shall make final connections to the District security alarm systems for all division 25 requirements.

D. The sheet metal contractor shall install all dampers supplied by the ATC contractor. Each damper shall be installed so that it will operate freely and without binding. To ensure that the damper both opens and closes completely with less than 7#/sq. ft. torque applied at the operating shaft, each damper shall be checked after its installation, but before the damper actuators are attached. Dampers not properly installed or meeting this torque requirement shall be replaced and/or reinstalled without additional cost to the ATC contractor or the South Sanpete School District.

E. The mechanical contractor shall install all valves, immersion wells and pressure taps supplied to him by the ATC contractor.

1.5 INSTALLATION BY AUTOMATIC TEMPERATURE CONTROL (ATC) CONTRACTOR

A. The successful control contractor shall furnish and install all necessary electrical control wiring for the complete temperature control system, heating and ventilating equipment motor starting circuit controls and all electrical control interlocks for same, and for control wiring for miscellaneous HVAC equipment furnished by the Owner.

B. The ATC contractor shall be a licensed Electrical Contractor in the State of Utah with full time Master, Journeyman and apprentice electricians. If the ATC subcontracts the installation, it shall be to a licensed Electrical Contractor in the State of Utah. Full-time Master, Journeyman and apprentice electricians shall be utilized for the installation.

C. **All line and low voltage electrical and control wiring shall be installed in EMT conduit** & in accordance with the current version of the National Electrical Code and applicable local codes and in accordance with Division 26 of this specification. 3/4" nominal trade conduit shall be installed. Plenum cable may be installed as long as it is installed inside EMT or intermediate or rigid metal tubing. When connecting to controllers, valves etc. that have no provisions for EMT connections, EMT may terminate in a junction box located within 36" of the controller or control valve. When making a transition between EMT and plenum cable, protect cable from abrasion by installing an insulating connector or equivalent on the exposed end of the EMT.

D. The ATC contractor shall furnish & install all necessary electrical control wiring for all temperature controls, heating and ventilating equipment motor starting circuit controls, all electrical control interlocks for same and for miscellaneous packaged equipment as defined within this specification. Full-time Master, Journeyman and apprentice electricians shall be utilized for the installation.

E. When connecting to controllers, valves etc. that have no provisions for EMT connections, EMT may terminate in a junction box located within 36" of the controller or control valve. When making a transition between EMT and plenum cable, protect cable from abrasion by installing an insulating connector or equivalent on the exposed end of the EMT. Full time employees holding Master, Journeyman and apprentice electrician licenses in the State of Utah shall be utilized for the installation.

F. Plenum rated cable may be used in lieu of conduit above drop-in ceilings per 1.3.P.

G. All ATC rough-in boxes shall be identified with the letters "ATC" written across the inside of the box with permanent marker. In addition, each ATC cover plate shall be painted white with the letters "ATC" stenciled in black.

1.6 QUALITY ASSURANCE

A. Provide an unconditional TWO-YEAR parts and service warranty. This warranty shall commence at the time of substantial completion of the various portions of the system.

B. All parts and material and their installation methods shall be in accordance with the manufacturer's recommendations and specifications. All parts and material shall be new.

C. The Contractor or firm executing the work of this section shall have at least 10 years' experience in completing work of similar scope and nature to that specified.

D. Provide an unconditional **TWO-YEAR** parts and service warranty. This warranty shall commence at the time of demonstration of system completion of all portions of the ATC system.

E. Emergency response by contractor shall be available 24 hrs/day 7 days/week 365 days/yr. Response time shall not be greater than 12 hours from time of call.

1.7 SUBMITTAL AND TECHNICAL INFORMATION

A. Submit shop drawings and manufacturer's data for the following items to the mechanical engineer:

1. Wiring and installation diagrams.
2. ATC device specification sheets
3. Complete and detailed point list
4. Control flow diagrams, complete with all control schematics and sequences of operation.

5. Documentation of all software and hardware. These manuals shall be complete with installation procedures as well as startup and programming instructions. They should also contain any testing or maintenance procedures required to operate the system on a continuing basis.

1.8 PROJECT COMPLETION REQUIREMENTS

A. Upon completion of the project, the ATC contractor shall spend a minimum of 8 hours with the South Sanpete School District maintenance personnel to adequately instruct them on the operation and maintenance of the system. These training sessions shall be scheduled at times convenient to the School District and shall be conducted at the project. One on one, live, local hands-on training will be provided.

B. The ATC contractor shall provide as part of his contract the on-site services of a technician familiar with the system to assist the air & water balance contractor in completing his portion of the project. The technician shall be available for a minimum of an additional 8 hours for this assistance.

C. The ATC contractor shall provide as part of his contract the on-site services of a programmer familiar with the system for an additional 16 hours which the Engineer and/or the School District may use as they see fit to fine-tune or add features to the system.

D. 6 months after the completion date of the project, the ATC contractor will provide 4 hours of onsite training with the owner. This training is part of this scope of work and costs shall be inclusive. The hours can be allotted in separate training sessions as determined by the owner. One on one, live, local hands-on training will be provided.

E. Provide a digital copy of the project operating and maintenance instruction manuals for use during the training sessions. Each manual shall contain all system components and DDC system programming.

F. Operation & Maintenance Manuals:

1. These manuals shall provide descriptions of maintenance procedures for all system components, including sensors and controlled devices. They shall cover inspection, periodic preventative maintenance, fault diagnosis, and repair or replacement of defective components. They shall include complete as-built ATC installation drawings with sequences of operation for all mechanical systems controlled by the ATC contractor. They shall each include a digital copy of all as-built system programming.

PART 2 – EQUIPMENT

2.1 CONTROLLERS

A. Provide open BACNet controls with freely programmable controllers shall be utilized as indicated and specified elsewhere in this specification. Proprietary control system communication protocols will not be accepted.

B. All main level controller inputs shall have at least 12-bit A/D converters for input accuracy. Less resolution is unacceptable for main level controllers or any controllers using an air monitoring station or monitoring building pressure. All main level controller outputs shall have board mounted hand-off-auto switches for local output override capability.

C. The contractor shall utilize and employ only the following controllers for any central plant systems and air handling units. A single controller shall be designated with all programming and I/O for each system. This will allow standalone equipment operation in the event of communications failure. Connection of multiple small controllers or combined operation with other programmable controllers on air handlers and central plant equipment is not permitted. All controllers shall be freely programmable; controllers with canned programming are not acceptable.

D. All controllers and devices shall be identified.

2.2 DDC INPUT DEVICES

A. All DDC input devices shall provide industry standard signals and shall be compatible with the DDC controllers used.

B. All temperature input devices shall have a rated accuracy of 1% or better.

C. All pressure input devices shall have a rated accuracy of 2% or better. Pressure transmitters shall be selected to match the application and shall not be damaged by pressures at five times the maximum measurable pressure.

D. Miscellaneous input devices shall have accuracies as individually specified. All miscellaneous devices shall be specifically identified (with specifications) with submittals.

2.3 DDC OUTPUTS

A. Modulating outputs shall be in accordance with industry standards and shall be compatible with the driven DDC devices.

B. Outputs shall be 0-10 VAC/VOC or 0.5 sec - 5.0 sec. 4-20 MA, or a pneumatic signal 0-20 PSI.

C. DDC digital outputs shall be either relay contact closures or Triacs rated for the application.

2.4 MANUFACTURERS

A. Provide a new Direct Digital Control (DDC) system manufactured by listed manufactures for the facility mechanical equipment. The new system shall be installed, programmed and commissioned by the installing ATC contractor.

2.5 DUCT SMOKE DETECTORS

A. Duct smoke detectors are to be furnished and wired by Division 26. Detectors shall be installed by the ATC contractor. Detectors will be provided for the return air inlet.

B. Detectors shall be wired to allow monitoring by the DDC system as well as the fire alarm system.

C. Division 26 shall furnish & install a fire alarm/fan shutdown relay at each fan system. The ATC contractor shall wire between the alarm relay contacts and the fan system starter to lock out the supply fans when the building is in fire alarm.

D. Shutdown relay shall be wired to allow monitoring by the DDC System.

2.6 MOTORIZED ATC DAMPERS

A. Motorized control dampers that are not supplied with the rooftop units shall be furnished by the Automatic Temperature Control Contractor. Dampers shall be factory-built, low leakage units such as Ruskin CD-50 or approved equal. Blades shall be 6" maximum width, 6063-T5 extruded aluminum width, 1/2" axles, and Oilite or Cycoloy bearings. No round shafts will be accepted.

B. All blade-to-blade linkages shall be external and accessible. No linkage within the damper frame channel will be accepted.

C. Frames shall be 5" x 1", 6063-T5 extruded aluminum hat channel design, 0.125" minimum thickness with corner braces to assure squareness.

D. Dampers shall be low leakage type with compressible end seals and neoprene or extruded vinyl blade and jamb seals. Leakage shall not exceed 6.2 cfm/sq. ft. at 4" W.G. Dampers shall require less than 7#-in/sq. ft. torque at the operating shaft for proper operation.

E. Outdoor & return air dampers shall be parallel blade with blade direction oriented to assist mixing of air streams with spring return to fail closed. Relief air and other volume control dampers shall be opposed blade.

2.7 DAMPER ACTUATORS

A. Damper actuators shall be of the gear-train type. All moving parts shall be permanently lubricated and not require addition or replacement of oil. Actuators shall meet the NEMA 2 rating and shall have an ambient temperature operating rating of -40°F to 140°F, without the addition of extra equipment.

B. Damper actuators shall accept the appropriate Ma, VDC or digital output signals provided by the DDC controllers.

C. Damper actuators shall be mounted outside the air stream whenever possible and be of sufficient size to operate the connected damper. Mount damper actuator on firm baseplate.

D. Damper actuators linked to outdoor air and relief air dampers shall close their attached dampers upon power failure or fan shutdown by means of a mechanical spring return.

E. Actuator manufacturers shall be Belimo or Johnson. No substitutions.

2.8 ROOM THERMOSTATS

A. Wall-mounted space temperature thermostat. Thermostats shall be provided with the rooftop units, installed and wired by the ATC contractor.

B. Thermostats shall be located on interior stud walls wherever possible.

C. Standardized locations and mounting heights shall be predetermined with owner prior to rough-in.

2.9 ROOM THERMOSTATS -WRESTLING ROOM – ALTERNATE 01

A. Wall-mounted space temperature thermostat. Thermostats shall be as required by the owner and shall match the latest thermostats installed at the facility. The setpoint range shall be adjustable by owner via building control system. Flat plate, stainless steel plate sensors will not be accepted.

B. Thermostats shall be located on interior stud walls wherever possible.

C. Standardized locations and mounting heights shall be predetermined with owner prior to rough-in.

2.10 LABELING

A. All ATC supplied panels and devices shall be permanently labeled with engraved plastic laminate labels indicating device name, system identifier and function within the system.

PART 3 – SEQUENCE OF OPERATION

3.1 PACKAGED ROOFTOP UNITS

A. The package rooftop unit is a gas fired DX cooling unit with factory economizer & power exhaust.

B. The controls contractor shall provide heating / cooling thermostats and wiring as required for a functioning system. The programmable thermostat shall be connected directly to the DDC control system network and communicate via a factory provided terminal strip for DDC system connection. The DDC system shall enable each RTU and provide room thermostat in each area to report the space temperature to the DDC system. A fan status point shall also be tied to the DDC system, and an alarm shall be generated whenever the RTU is turned on and the fan fails to start. During occupied mode, the fan shall run continuously, and the temperature control shall be by the thermostat. The space temperature, fan status, output stages, cooling stages, discharge air temp and time scheduling shall all be shown on the DDC system. During unoccupied mode, the fan system shall be enabled when the temperature sensor in the space exceeds its low limit value.

C. Provide discharge air, return air and mixed air sensors. All temperatures shall be represented on the system graphics.

D. The control contractor shall wire to the factory provided BACnet card or Terminal Strip. (Coordinate with installation contractor and unit provider)

3.2 GAS FIRED UNIT HEATER CONTROL

A. A room temperature sensor, acting through a DDC controller, shall cycle the gas fired unit heater to maintain desired room space temperature.

B. Gas fire unit heaters a shop areas shall be 2nd stage of heat.

3.3 ELECTRIC UNIT HEATER CONTROL

A. A wall-mounted line voltage thermostat shall control the unit heater and fan to maintain space temperature setpoint with a room thermostat reading to the BMS.

B. A low temperature alarm (adjustable) shall be sent to the owner's security via the LAN Network.

3.4 CONTROL OF EXISTING SYSTEMS

A. Provide interface with existing HVAC units at existing auditorium to interface with new motorized outside air dampers at new roof hoods.

B. Demolition of existing and re-programing shall be provided as required.

3.5 SHOP GENERAL EXHAUST FANS CONTROL

A. These exhaust fans shall run on an occupancy schedule.

B. Provide a 60-minute override and labeled button.

C. Provide required control and installation for required control panels.

3.6 METALS SHOP MAKE-UP AIR UNIT & EXHAUST FAN CONTROL

A. Install duct thermostat and remote-control panel furnished by make-up air unit manufacturer in custom panel as indicated on plans. Interlock make-up air unit with space exhaust fan & associated relief air damper.

B. Provide required control and installation for required control panels.

3.7 PAINT BOOTH PB-1 CONTROL

A. An OFF-AUTO switch with green pilot light shall start the paint booth exhaust fan.

B. The ATC contractor shall interlock the spray booth exhaust fan exhaust fan (provided with booth) to the associated wall switch & and booth interlock.

C. The ATC contractor shall provide an automatic valve for the compressed air system serving the paint booth. Valve shall interlock with the booth exhaust fan. No air until proof of air flow is made.

3.8 PAINT BOOTH PB-1 EXHAUST FAN / MAKE-UP AIR UNIT CONTROL

A. The ATC contractor shall interlock the spray booth exhaust fan exhaust fan (provided with booth) to the associated wall switch & and booth interlock.

B. The paint booth exhaust fan shall interlock with the associated make-up air unit MUA-1. Paint booth fan shall not be energized until proof of air flow from MUA-1 is proven.

3.9 SAWDUST COLLECTOR SC-1

A. Sawdust collector shall be controlled by a wall-mounted push button type ON-OFF switch with green indicating light with engraved plastic label. Switch shall be located in the wood shop near the garage door. The sawdust collector fan shall terminate upon indication of high sawdust level indicator. The sawdust collector fan shall terminate upon indication of high limit from filter bank (FB-1) differential pressure transmitter. Provide LED differential pressure displays for sawdust collector filter and filter bank in inches of water. Sawdust collector shall cycle through filter cleaning system upon filter set-point differential pressure and upon unit shutdown.

B. Install main control at unit, and remote-control panel in wood shop area as indicated on plans.

3.10 SAWDUST COLLECTOR SYSTEM FILTER BANK ALARMS

A. A differential pressure transmitter with its static pressure tips located across fan.

B. system make up air filter bank shall provide the sawdust control system with the differential pressure drop across the pre-filter in the filter bank. An alarm shall be supplied to the sawdust control system whenever the filter differential pressure remains above 0.60" w.c. adj. for more than 15 continuous minutes.

3.11 SAWDUST COLLECTOR FIRE ALARM FAN SHUTDOWN

A. Interlock sawdust collector system fan to automatically shut off when the fire alarm system is energized. All fans to automatically start up again when fire alarm system is shut off.

3.12 EMERGENCY SHUTDOWN

A. Sawdust Collector (SC-1) shall be controlled by a wall-mounted push button type integrated control panel with remote start relay. ON-OFF switch with green indicating light with engraved plastic label located in existing wood shop.

3.13 SAWDUST COLLECTOR AUTOMATIC DUCT GATE CONTROL

A. Automatic duct gates shall be interlocked with woodworking equipment served and controlled thru the ON-OFF switch. When the switch is turned on, duct gate shall open. When switch is turned off, duct gate shall close. All wiring associated with the duct gates shall be by the ATC Contractor and run in a minimum of ¾" EMT conduit.

3.14 SAWDUST COLLECTOR NO RETURN EXPOSION ISOLATION VALVE AND HIGH-SPEED ABORT GATE

A. Valve and gate shall be wired by an ATC controller. Wiring shall be installed in EMT conduit. Provide wiring necessary for spark detection panel.

3.15 WELDING EXHAUST FAN & MAKE-UP AIR UNIT CONTROL

A. Install duct thermostat and remote-control panel furnished by make-up air unit manufacturer in custom panel as indicated on plans. Interlock make-up air unit with shop exhaust hood fans and wire them to stop upon smoke detection system activation.

B. The ATC contractor shall provide a recessed ATC panel for control of the exhaust & make-up systems. This panel shall incorporate the make-up air unit control panels, and in addition shall have fan switches and pilot lights for control of shop exhaust fans.

C. Install duct thermostat and remote-control panel furnished by make-up air unit manufacturer in custom panel as indicated on plans. Interlock make-up air unit with space exhaust fan & associated relief air damper.

3.16 EXTRACTION ARM EXHAUST FAN CONTROL

A. The ATC contractor shall furnish & install an EXHAUST FAN-ON-OFF switch w/ pilot light at each exhaust fan. Exhaust fan shall be interlocked to operate with associated make-up air unit and relief air damper.

3.17 FIRE RISER ROOM SPACE TEMPERATURE ALARM

A. Provide an analog DDC temperature sensor for the fire riser room. Coordinate alarm to the District remote security facility with Division 26. Alarm shall be generated to the District security whenever temperatures **drop below** the owner determined limits via a status contact closure to the security system. Division 25 contractor shall run line to building security dam for tie into building security system. System must be configured to follow the alarm requirements defined within this specification. Coordinate line to security panel with Division 26.

3.18 AREA SECURITY TEMPERATURE ALARMS

A. Temperature sensors located in an area served by each fan system shall continuously monitor the space temperature and alarm the District security system anytime the space temperature drops below or rises above preset set points. Division 25 contractor shall run line to building security dam for tie into building security system.

B. Upon receiving an alarm from the District security system, the Host computer at the school and at the District Offices shall indicate which area(s) of the building are in alarm through a graphic floor plan display of the building(s). Current space temperatures shall also be displayed at the Host computer.

C. Division 25 contractor shall run line to building security dam for tie into building security system. Provide status contact closure to the security system. Coordinate line to security panel with Division 26.

D. It is the intent that Division 251000 provide all wiring, etc. as required to tie listed systems into the South Sanpete SD security alarm system in partner with Division 260000.

3.19 FIRE ALARM FAN SHUT-DOWN: (All Fan Systems)

A. All heating, ventilating and air conditioning system supply fans shall automatically shut off when the building fire alarm system is energized. All fans to automatically start up again when fire alarm system is reset. Fire alarm system fan relays shall be "normally energized" and shall be installed by Division 26 at each fan system.

3.20 FAN SYSTEM FILTER BANK ALARMS

A. A differential pressure indication control element with its static pressure tips located across each fan system filter bank & makeup air unit filter bank shall provide the DDC system with the differential pressure drop across each filter bank. An alarm shall be supplied to the DDC system whenever the filter differential pressure remains above 0.35" w.c. for more than 15 continuous minutes.

3.21 INTERFACE WITH LIGHTING CONTROL

A. Provide (6) dedicated control points for interface with campus lighting control systems. Coordinate with Division 26.

END OF SECTION 25 1000

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SECTION 26 0500

ELECTRICAL GENERAL PROVISIONS

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 work of this section.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical work is indicated on drawings and/or specified in Divisions 26, 27 and 28 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

	ITEM	SECTION
1.	Electrical General Provisions	26 0500
2.	Mechanical and Electrical Coordination	26 0501
3.	Electrical Submittals O & M Manuals and Spare Parts	26 0502
4.	Electrical Connections for Equipment	26 0507
5.	Conductors and Cables	26 0519
6.	Grounding	26 0526
7.	Supporting Devices	26 0529
8.	Conduit Raceway	26 0532
9.	Electrical Boxes and Fittings	26 0533
10.	Electrical Seismic Control	26 0548
11.	Electrical Identification	26 0553
12.	Panelboards	26 2416
13.	Wiring Devices	26 2726
14.	Overcurrent Protective Devices	26 2815
15.	Motor and Circuit Disconnects	26 2816
16.	Motor Starters	26 2913
17.	Demolition	26 4119
18.	Interior and Exterior Building Lighting	26 5100
19.	Telephone/Data Systems	27 1500
20.	Audiovisual Systems	27 4100
21.	Audiovisual System Checklists	27 4101
22.	Intercommunication Systems	27 5123
23.	Access Control System	28 2205
24.	IP Video Surveillance System	28 2300

B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.

C. Visit the site during the bidding period to determine existing conditions affecting

electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 PHASING AND SEQUENCING OF WORK

A. Contractor shall refer to the architectural package for understanding of the various phases of construction.

B. Contractor shall thoroughly coordinate with the General Contractor for the construction phasing and sequencing of operations/installations prior to bid and during construction. The phasing and sequencing of scope has not been completely addressed in the electrical contract documents.

C. It is the Contractor's responsibility to provide temporary system operation/support as required to support the phasing/sequence of work plan developed by the General Contractor.

D. Several systems will be impacted by the partial building demolition and establishment of a new main communications room for the project. These systems include but are not limited to the electrical system, lighting control system, telephone/data system, fire alarm system, intercom system, video surveillance system, access control system, intrusion detection system, etc.

1.4 DEFINITION OF TERMS:

A. The following terms used in Divisions 26, 27 and 28 documents are defined as follows:

1. "Provide": Means furnish, install and connect, unless otherwise indicated.
2. "Furnish": Means purchase and deliver to project site.
3. "Install": Means to physically install the items in-place.
4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.5 RELATED SECTIONS:

A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 26, 27 and 28 sections.

C. Earthwork:

1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes, lighting pole foundations, etc. See Division 31, Sitework, and other portions of Divisions 26, 27 and 28, for material and installation requirements.

D. Concrete Work:

1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for underground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc. See Division 3, Concrete for material and installation requirements.

E. Miscellaneous Metal Work:

1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution

boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.

F. Miscellaneous Lumber and Framing Work:

1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.

G. Moisture Protection:

1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vapor tight. See Division 7, Thermal and Moisture Protection for material and installation requirements.

H. Access panels and doors:

1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

I. Painting:

1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.6 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:

1. Electric motors.
2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
3. Flow switches and valve monitors.
4. Motorized dampers.
5. Fire and smoke dampers
6. Duct mounted smoke detectors.
7. Elevator/Escalator Controllers.
8. Irrigation controllers.
9. Door hold-open/release devices.
10. Motorized projection screens.
11. Wheel chair lifts.
12. Roll down doors.
13. Electric hardware.
14. Temperature control panels.
15. Variable frequency controllers.
16. Chiller starters.
17. Motorized Chalkboards/Markerboards/Whiteboards.
18. Display cases.
19. Water coolers.

20. Kitchen equipment including ovens, fryers, mixers, disposers, dishwashers, etc.
21. Fire sprinkler alarm bells.
22. Electric heat trace cable for domestic and industrial hot water piping systems.
23. Electric heat trace cable for guttering, drain lines, etc.
24. Anti-sweat heaters, fan coils, etc. for walk-in coolers and freezers.
25. Hand dryers, hair dryers.
26. Systems/Open Office Furniture

1.7 ITEMS FURNISHED UNDER ANOTHER DIVISION, BUT INSTALLED AND CONNECTED UNDER THIS DIVISION:

A. Items furnished under other Divisions, but turned over to Division 26 for installation and final connection include, but are not necessarily limited to, the following:

1. Wall mounted control stations for motorized roll-up doors/grills.
2. Wall mounted control stations for motorized projection screens.
3. Wall mounted control stations for handicap lift.
4. Lighting fixtures for kitchen hoods.
5. Lighting fixtures for walk-in freezers and coolers.

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.9 QUALITY ASSURANCE:

A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.

B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:

1. National Electric Code (NEC).
2. International Building Code (IBC).
3. International Fire Code (IFC).
4. International Mechanical Code (IMC).

C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.

1.	UL	Underwriters' Laboratories
2.	ASTM	American Society for Testing Materials
3.	CBN	Certified Ballast Manufacturers

4. IPCEA Insulated Power Cable Engineers Association
5. NEMA National Electrical Manufacturer's Association
6. ANSI American National Standards Institute
7. ETL Electrical Testing Laboratories

D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.

E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents that may be in excess of the aforementioned requirements, and not contrary to same.

F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.

G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.

H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

I. Required Pre-Electrical Construction Meeting with Electrical Engineer: Electrical contractor/representative will be required to attend a pre-electrical construction meeting (approximately 30-60 minutes) with engineering representative in the electrical engineer’s office prior to electrical construction commencement. This meeting will address any questions on the part of the contractor and the expectations of the Engineer with regard to specifications, plans and site visits for both rough and finish electrical work.

J. Electrical Contractor shall inform the AV Installer of pre-construction meeting. AV Contractor shall be in attendance at the pre-construction meeting.

1.10 CONSTRUCTION CHANGE ORDER PROPOSALS

A. In the event that a submission of a change order is issued by the contractor, the following information will be required to be submitted by the contractor, prior to any consideration by the owner/architect.
   a. All equipment, including conduit and wire, shall be itemized, identifying unit costs and quantities of equipment. Distributor quotes shall accompany all change order requests. The distributor quotes shall include costs for all equipment including conduit and wire. Lot pricing for equipment is not acceptable.
   b. The general contractor shall review and confirm that the quantity and costs of materials submitted appear reasonable for the scope proposed.
   c. Labor units shall not exceed base NECA #1 standards. No adjustment factors shall be approved.
   d. Any research and labeling time, shall be the responsibility of the electrical contractor and shall not be included in the change order request.

e. Any costs associated with the purchase of tools or transportation shall be fully itemized for review by architect/owner.
f. Overtime rates shall only be approved where additional manpower cannot achieve the same result.
g. Change order form shall follow the following format:
    i. PCO number
    ii. Detailed description of work being performed
    iii. Location on project where work is performed
    iv. Chosen NECA column
    v. Identified material:
        1. QTY
        2. Unit cost
        3. Mark up
        4. Material total
    vi. Identified labor:
        1. QTY
        2. Unit cost
        3. Composite labor rate
        4. Labor total

1.11 RECORD DRAWINGS:

A. Maintain, on a daily basis, a complete set of “Record Drawings”, reflecting an accurate record of work in accordance with the following:

1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)
2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).
3. Show all changes, deviations, addendum items, change orders, job instructions, etc., that change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.

B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The “Record Drawings” for daily recording shall consist of a set of blue line prints of the Contract Drawings.

C. Upon completion of the work, purchase a complete set of electronic drawings. Transfer all “Record” information from the blue line prints to the drawings via the current CAD program that it was written. The Architect/Engineer shall review the drawings and the Contractor shall incorporate the resulting comments into the final record drawings. The Contractor shall make two complete copies of the drawings electronically and forward this to the Engineer.

D. Certify the “Record Drawings” for correctness by placing and signing the following certifications of the first sheet of the drawings:

"CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By: _____ Date: _____

(Name of Electrical Contractor)

By: _____ Date: _____

1.12 GUARANTEE:

A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials that develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

1.13 OTHER:

A. Right to Hire. “Client” agrees that during the project and for a period of twenty four (24) months following substantial completion that it will not, directly or indirectly, employ or solicit to employ BNA Personnel.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.

B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.

C. Samples may be required for non-standard or substituted items before installation during

construction. Provide all samples as required.

D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.

E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.

B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.

C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.

D. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.

E. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.

F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.

B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.

C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

A. General: Locate and protect existing utilities and other underground work in manner that will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner that protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more stringent), unless noted otherwise on drawings.

B. Protect persons from injury at excavations, by barricades, warnings and illumination.

C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.

D. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or sub-bases.

E. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.

F. Store excavated material (temporarily) near excavation, in a manner that will not interfere with or damage excavation or other work. Do not store under trees (within drip line).

G. Retain excavated material that complies with requirements for backfill material. Dispose of excavated material that is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.

B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.

C. For top 6" of excavation - Top soil.

D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven

hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
2. Paved Areas, Other than Roadways (90 percent for cohesive soils, 95 percent for cohesionless soils).

E. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

1.1 CONCRETE BASES:

A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 404.8.

B. Concrete bases shall be provided under Divisions 26, 27 and 28. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.

C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Rocky Mountain Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

1.2 ROOF PENETRATIONS:

A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

1.3 FIRE PENETRATION SEALS:

A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling that it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M CID cast-in device for floor slabs. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

1.4 PROJECT FINALIZATION AND START-UP:

A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.

B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.

C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:

1. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.
2. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

SYSTEM	FACTORY REPRESENTATIVE
(List systems included)	(List name and address of Factory Representative)

Owner's Representative	Contractor

D. Send copy of acceptance to Architect/Engineer.

1.5 FINAL REVIEW:

A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 26 0500

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SECTION 26 0501

MECHANICAL / ELECTRICAL & OWNER PROVIDED EQUIPMENT COORDINATION

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 work of this section.

B. Architectural, Structural, Vertical Transportation, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

1.2 CONTRACTOR RESPONSIBILITIES

A. Electrical Contractor shall verify electrical service provided prior to ordering any electrical equipment serving owner-provided equipment / mechanical equipment, and Electrical Contractor shall have the final responsibility for properly coordinating the electrical work, including the exact location, quantity and sizes of the electrical connection(s).

1. Circuit breakers, disconnects, starters, fuses, conduit sizes, wire sizes, VFDs, etc. have been coordinated by Engineers and sized according to the mechanical systems “Basis of Design”. Coordinate with Division 23 Contractor for any changes arising from substituted equipment or changes to the basis of design in any way. Coordinate all requirements of multi-motor VFD control (including fanwall units) and ensure all provisions accordingly. Prepare documentation showing changes in the electrical characteristics of each piece of equipment that has changed and submit for acceptance. All costs arising from said changes shall be the responsibility of Division 23.

2. Circuit breakers, disconnects, starters, fuses, conduit sizes, wire sizes, VFDs, etc. have been coordinated by Engineers and sized according to the owner-provided equipment for the shop (Kilns, compressors, dust collectors, welders, plasma cutters, shop equipment, etc.) as a “Basis of Design”. Coordinate with Owner for any changes arising from substituted equipment or changes to the basis of design in any way. Prepare documentation showing changes in the electrical characteristics of each piece of equipment that has changed and submit for acceptance. Organize meeting with Owner representatives to finalize location and services.

B. Division-26 is responsible to provide conduit and rough-in for all thermostat controls located within walls. Refer division 21-23 drawings and coordinate with Controls Contractor to verify exact location of all thermostats. Obtain and review submittals of Temperature Control Equipment from Controls Contractor and Divisions 21-23

C. Obtain submittals of all mechanical equipment from Division 21 through 23 contractor(s) as they are submitted to the design team.

1. Notify engineer of any modifications between contract documents and submittals. It shall be the contractor’s responsibility to ensure compliance with the documents.

D. Obtain submittals of all owner-provided equipment from Owner Representative prior to rough-in. It is not acceptable to proceed with the rough-in phase of work until this has been completed—if contractor elects to proceed they do at their own risk.

1. Notify engineer of any modifications between contract documents and submittals. It shall be the contractor’s responsibility to ensure compliance with the

documents.

E. Electrical contractor shall be responsible for coordinating all their own blockouts and coordinating their space of a shared blockout.

F. Coordinate all interfaces between Mechanical and Electrical/Communications/Security Divisions before submitting any equipment for review or beginning installation.

1.3 ABBREVIATIONS

A. MC: Mechanical Contractor = Divisions 21 through 23 Contractor who provides equipment and motor.

B. TC: Temperature Controls = Division 25 1000 Contractor who provides control.

C. EC: Electrical Contractor = Divisions 26 through 28 Contractor who provides power/data.

D. FA: Fire Alarm Contractor = Division 28 Contractor who furnishes Fire Alarm System.

1.4 RESPONSIBILITY SCHEDULE

A. Responsibility: Unless otherwise indicated, all equipment, motors, and controls for Divisions 21 through 23 equipment shall be furnished, set in place and wired in accordance with the following schedule:

ITEM -	Furnished Under	Set In Place Under	Power Wiring Under	Control Wiring Under
AHU Interior Lights (Note 8)	MC	MC	MC	MC
AHU Light Switch	EC	EC	EC	EC
RTU Light Switch	MC	MC	EC	EC
Equipment Motors	MC	MC	EC	TC
Automatically or Manually Controlled Starters/Contactors: (Note 4)				
-Separate	EC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
Variable Frequency Drives				
-Separate	MC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
In Motor Control Centers (Note 4)	EC	EC	EC	TC
Motor Speed Controllers: (Note 4)				
-Separate	MC	EC	EC	TC
-Factory Mounted and Wired	MC	MC	EC	TC
Disconnect Switches (Note 1)	EC	EC	EC	--
Thermal Overload Switches (Note 1)	EC	EC	EC	--
Switches (Manual or Automatic other than disconnect) (Note 2)	MC or TC	MC or TC	EC or TC	TC or MC
Control Relays (Note 2)	MC or TC	MC or TC	--	TC
Control Transformers	TC	MC or TC	EC (120V)	TC
Thermostat and Controls: Integral with Equipment or Directly Attached to Ducts, Pipes, etc. (Note 2)	TC	MC or TC	TC	TC
Equipment in Temperature Control Panels	TC	TC	EC	TC

ITEM -	Furnished Under	Set In Place Under	Power Wiring Under	Control Wiring Under
Standalone Control Panels (BAS) (Note 6)	TC	TC	EC (120V)	TC
Valve Motors, Damper Motors, Solenoid Valves, etc.	MC & TC	MC & TC	TC	TC
EP Valves or Switches, P.E. Switches, etc.	TC	TC	--	TC
Fire Alarm System (Note 3)	FA	FA	EC	FA
Fire Sprinkler Alarm (Note 3)	FA	FA	EC	FA
Duct System Smoke Detectors (Note 5)	FA	MC	EC	TC/FA
Relays for Fan Control via duct detectors (Note 5)	MC	EC	EC	FA
Room Smoke Detectors Including Relays for Fan Control (Note 3)	FA	EC	EC	EC
Smoke Management Curtain and Shutters (Note 6)			EC	EC/FA
CO Sensors	FA	FA	EC	FA
Equipment Interlocks	TC	TC	--	TC
Fire/Smoke and Smoke Dampers (Note 7)	MC	MC	EC	FA
Positive Indication Devices (i.e., current sensors, end switches, airflow sensors)	TC	TC	--	FA/TC
Freezer and Refrigerator Temperature Controls (Intrusion)	MC	MC	EC	EC
Domestic Water Flow Switch (Intrusion) Located downstream past the cooling tower. Provide 120V power.	MC	MC	EC	EC
Low Building Temperature Sensor (Intrusion)	MC	MC	EC	EC

B. Responsibility Schedule Notes:

1. If furnished as part of factory wired equipment furnished and set in place by MC, wiring and connections by EC.

2. If float switches, line thermostats, P.E. switches, time switches, or other controls carry the FULL LOAD CURRENT to any motor, they shall be furnished by MC, but they shall be set in place and connected by EC, except that where such items are an integral part of the mechanical equipment, or directly attached to ducts, piping, or other mechanical equipment, they shall be furnished and set in place by MC and connected by EC. If they do not carry the FULL LOAD CURRENT to any motor, they shall be furnished, set in place and wired by TC contractor.

3. Electrical contractor is responsible for wiring from starter to motor, unless factory wired.

4. Temperature control contractor shall provide conduit and wire from auxiliary contact in motor starter to the detector so that the unit shuts down in all operating modes. Fire Alarm Contractor to wire from detector to fire alarm panel.

5. Each division shall be fully responsible for any control panels as called for on the drawings or specifications.

   a. Division 26 and 28 shall provide all power and control wiring to fire/smoke and/or smoke dampers. Division 23 shall provide parallel control wiring (with 28 fire alarm having priority signal) to dampers and equipment utilized in both normal and smoke control modes. Refer to Smoke Control and Fire Alarm Drawings and the Fire Alarm Matrix.

b. Fire alarm system shall override automated building control system during smoke exhaust mode.

c. TC wiring required only when damper also serves HVAC system.

6. FA wires from the fire alarm control panel necessary for the initiation and monitoring of the Smoke Management System Control Panel. TC wires to components and smoke control fans and dampers utilized in the control and monitoring of the Automated Building Control System.

a. Provide 120V emergency circuit and fire alarm connections to each curtain and shutter. Coordinate exact locations with curtain and shutter contractor.

7. Division 26 shall provide power to junction box on the exterior of the AHU.

8. Exhaust Fans -Division 26 shall provide power and connection to all exhaust fans:

a. Exhaust fans utilized for restrooms shall be operate on/off with the local lighting occupancy sensor. Provide pre-wired relay to accept contact from occupancy sensor to exhaust fan operating voltage.

C. Power Wiring by Divisions 21 through 23: The electrical power for certain equipment provided under Divisions 21 through 23 has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the Divisions 21 through 23 trades requiring such power. Electrical contractor shall review Division 21 through 23 drawings and coordinate with said contractors to confirm power needs.

1. Sufficient power for this purpose shall be furnished as “spare” dedicated circuit capacity in Division 26’s panelboards. All wiring, conduit and electrical devices downstream of the panelboards are the responsibility of the Divisions 21 through 23 trades requiring the power.

a. Such equipment is hereby defined as:

2. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings (Division 22 work).

3. Dry-pipe control panels and valves. Required connections are included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.

a. Such equipment is hereby defined as:

b. Electrical heat trace. Required heat trace locations, capacities and specification are shown on the plumbing drawings (Division 22 work).

c. Fire protection air compressors, dry-pipe control panels and valves. Required connections are included in the Division 21 work, and will be shown by that contractor’s engineered system design drawings.

d. Pre-action system alarm and trouble initiation signals (such as smoke detectors or general alarm conditions in a pre-action zone) shall be provided under Division 28 fire alarm work.

e. Division 21 shall provide pre-action control panel and interconnection between pre-action panel and location of pre-action valve(s). See Specification 21-5000 for FM 200.

f. Division 28 shall provide interconnection between fire command center alarm panel (provided under Division 28) and remote communication fire alarm panel (provided under Division 28).

4. Infrared plumbing fixtures. Fixtures requiring power are shown on the plumbing drawings and schedules. Provide junction box and or receptacle as required by

manufacturer.

5. Temperature control panels, control air compressors and line voltage power for 24v control transformers. Required connections are included in Division 23 09 00 and will be shown by that contractor's control submittal drawings.
6. Condensate pumps. Provide power from associated unit or from nearby panelboard.
7. BAS or Control System Gateways. Provide power from nearest panelboard and single data cable from nearest telecommunications room.

1.5 GENERAL REQUIREMENTS

A. Special Requirements:

1. Motors, starters and other electrical equipment installed in moist areas or areas of special conditions, such as explosion proof, shall be designed and approved for installation in such areas with appropriate enclosure.

B. Building Management System Controls:

1. Provide 120V circuit and single data cable to each building management control panel. Coordinate exact locations with controls contractor. See Specification 27-1500
2. Low voltage wiring from J-boxes to distributed control components, all low voltage connections, all control panels and all control transformers (not part of unitary equipment) shall be provided under Division 23.
3. Any additional power requirements shall be the responsibility of the Division 23 Contractor requiring same, and shall be provided at no additional cost to the owner.

1.6 CEILING AND CHASE CAVITY PRECEDENCE

A. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electric systems within the cavity space allocation in the following order of precedence. A system with higher precedence may direct that systems of lower precedence be relocated from space, which is required for expedient routing of the precedent system.

1. Plumbing waste, cooling coil drain piping, and roof drain mains and leaders.
2. Condensate piping.
3. Hydronic main piping (8" and larger).
4. Plumbing vent piping.
5. Supply, return and exhaust ductwork.
6. Cable tray systems.
7. Electrical conduit 4" diameter or greater.
8. Hydronic branch and mains (greater than 2", but less than 8").
9. Domestic water piping.
10. Fire sprinkler mains and leaders.
11. Hydronic branch piping (2" and less).
12. Domestic hot and cold-water branches.
13. Electrical branch conduits.
14. Pneumatic control piping.

15. Fire sprinkler branch piping and sprinkler runouts.

B. Light fixtures have precedence in a zone, which is the same height above the ceiling as the depth of the fixture (plus 2”).

C. Examine the contract documents of all trades (e.g. all Divisions 21 through 23 and 26 through 28 drawings, the architectural floor plans, reflected ceiling plans, elevations and sections, structural plans and sections, etc.).

D. Coordinate necessary equipment, ductwork and piping locations so that the final installation is compatible with the materials and equipment of the other trades.

E. Prepare shop drawings for installation of all new work before installation to verify coordination of work between trades.

F. Provide access doors for all electrical and communications equipment which require access for adjustment or servicing and which are in otherwise inaccessible locations. All access door locations must be approved by the architect prior to installation and be in as inconspicuous location as possible.

1. For equipment located in “accessible locations” such as lay-in ceilings: Locate equipment to provide adequate service clearance for normal maintenance without removing architectural, mechanical, electrical or structural elements such as the ceiling support system, electrical fixtures, etc. “Normal maintenance” includes, but is not limited to: replacement of drivers, fuses, etc.

1.7 BLOCKOUT USAGE

A. Electrical and Mechanical Contractors shall review the contract documents and advise if additional blockouts are necessary for the execution of work. Electrical and Mechanical Contractors shall coordinate and hold meetings with other contractors who will occupy the blockouts to ensure sufficient space is allocated for their scope of work. It is not acceptable to delay this meeting until conduit/piping/tray is being installed. Change orders are not acceptable due to a lack of contractor coordination prior to commencing rough in.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 26 0501

SECTION 26 0502

ELECTRICAL SUBMITTALS AND O & M MANUALS

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 all Division 26, 27 and 28 sections.

B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full. Contractor must review the entire set of plans and specifications. Reviewing only the electrical set is not acceptable.

C. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.

1.2 SUBMITTAL REQUIREMENTS:

A. GENERAL:

1. After the Contract is awarded but prior to ordering, manufacture, or installation of any equipment, prepare complete Submittals including shop drawings, product data, brochures, etc. for materials and equipment as required by each section of the specification.
2. Review of Submittals shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.
3. Submittals are reviewed, not approved. Comments made within submittals do not alter the contract documents in any way. The contractor is still responsible, regardless of comments (if any) made within submittals, for complying with drawings and specifications.
4. Notify engineer in writing if any of the comments noted in the submittals alter the contract cost. A comment within the submittal process which increases/decreases cost of product is not an authorization to the contractor under any circumstances to proceed.
5. Notify engineer of any modifications between contract documents and submittals. It is the responsibility of the contractor to ensure compliance.
6. ELECTRONIC SUBMITTAL REQUIREMENTS:
    a. Provide submittals in Portable Document Format (PDF).
    b. Documents must be electronically bookmarked and keyword searchable using Adobe Acrobat (http://www.adobe.com/acrobat) or Bluebeam Revu (http://www.bluebeam.com) for each relevant section. For example, include electronic bookmarks separating “Light Fixtures” from “Panelboards”.

c. Electronically highlight all options for light fixtures, electrical equipment, etc. Manual highlighting and scanning of the documents is NOT acceptable and will NOT be reviewed.

d. Provide only completed cutsheets for all fixture and equipment types. Blank cutsheets submitted with a schedule are NOT acceptable and will NOT be reviewed.

e. At the time of submission, the electrical contractor shall provide a complete and comprehensive submission of all required specification sections/shop drawings at the same time. Exceptions may be given, with prior approval, for time-sensitive equipment.

f. A maximum of one submittal per specification section is allowed. It is NOT acceptable to provide a product by product submittal. Single product by product submittals will NOT be reviewed.

B. SCHEDULING

1. GENERAL

a. A minimum period of two weeks, exclusive of transmittal time, will be required each time Submittals are submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data.

b. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of $1,200.00 for the third review and any additional reviews required prior to commencement of the third review.

C. QUALITY ASSURANCE

1. PRE-SUBMITTAL PREPARATION

a. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to ensure proper clearance for installation of equipment.

b. Shop drawings requiring the use of electronic documents (floor plans, Lighting plans, fire alarm plans, etc.) shall be requested via a request for information (RFI) through the general contractor. Electronic documents will be provided to the Architect for distribution. No direct vendor requests will be accepted.

c. Contractor is completely responsible for the content of the submittal

2. SUBMITTAL REQUIREMENTS

a. Certifications shall be written or in the form of rubber stamp impressions as follows:

i. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Name_____.

Position_____Date_____.

b. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs that describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or

unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

c. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.

d. Observe the following rules when submitting the Shop Drawings and Brochures.

i. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.

1. Submittal Identification shall include the following:

a. A unique number, sequentially assigned, shall be noted on the transmittal form accompanying each item submitted.

b. Original submittal numbers shall have the following format: “XXX-Y;” where “XXX” is the originally assigned submittal number and “Y” is a sequential letter assigned for resubmittals (for example, A, B, or C being the first, second, and third resubmittals, respectively). Submittal 25B, for example, is the second resubmittal of Submittal 25.

e. SPECIFICATION section and paragraph to which submittal applies.

D. POST-SUBMITTAL

1. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents.

1.3 PROVIDE SUBMITTALS AS REQUESTED FOR EACH OF THE SECTIONS LISTED BELOW:

A. 26 0519 Conductors and Cables

1. (600V and Below)

a. Submit megohmmeter test data for circuits under 600 volts.

2. Conductors and Cables (Medium and Low Voltage)

a. Submit manufacturer's data on electrical cable and connectors for use above 600 volts. Upon request of Architect/Engineer, submit certificate of compliance indicating that cable has been tested in accordance with ICEA S-68-516, AE16 #6 and UL Standard 1072, and meets or exceeds minimum requirements.

b. Submit test data in accordance with IEEE Standard 400-2001 showing ambient conditions, voltage levels, level durations, and conduction current for each step. Include effective insulation resistance in submittal.

c. Submit medium voltage cable Splicer/Terminator certification of competency and experience 20 days before splices or terminations are made in medium voltage cables. Splicer/Terminator experience during the immediate past 3 years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.

B. 26 0526 Grounding

1. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

C. 26 0532 Conduit Raceway

1. Submit manufacturer’s data on Power & Control/Signal Cable.

D. 26 0533 Electrical Boxes and Fittings

1. Submit manufacturer’s data including specifications, installation instruction and general recommendations for each type of floor box used on project.

E. 26 0536 Raceway Systems

1. Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway as follows: Surface Metal Raceways, Cable Tray Systems, Overhead metal raceways, Wire basket cable tray systems

2. Submit dimensioned drawings of raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment, and adjoining raceways, for each type of raceway as follows: Surface metal Raceways, Cable Tray Systems, Overhead metal raceways, Wire basket cable tray systems

F. 26 0548 Electrical Seismic Control

1. A single submittal shall be provided for all seismic anchorage and restraints for all Division 26 equipment and systems provided as part of this project. Individual submittals for specific systems will not be accepted.

2. Submit shop drawings, calculations, and printed data for the following items under provisions of the General Conditions of the Contract:

a. Complete engineering calculations and shop drawings for all seismic requirements for all equipment to be restrained as outlined in Section 26 0548 Specification, and as detailed on drawings.

b. The professional seal of the engineer who is responsible for the design of the Seismic Restraint System.

c. Details for all seismic bracing.

d. Details for steel frames, concrete inertia bases, and housekeeping pads. Include dimensions, embed depths, dowelling details, and concrete reinforcing requirements.

e. Clearly outlined procedures for installing and adjusting the isolators, seismic bracing anchors, snubbers, cables, and bolt connections.

f. Floor plan noting the locations, size, and type of anchorage and restraint to be used.

g. Include confirmation that all calculations are based on the design criteria listed in appropriate Section.

h. Certificate of Compliance.

i. Where equipment is exempt per this specification provide a written

certificate of compliance for each of the systems noted with the professional seal of engineer who has reviewed the electrical system.

G. 26 0553 Electrical Identification

1. Submit manufacturer’s data on each type of electrical identification products

   a. Submit one sample of each component of the electrical identification system as follows: Wire/cable tape marker, Tags, Engraved, plastic laminate labels, Arc-flash hazard labels

H. 26 0923 Occupancy Sensors

1. Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, interconnection diagrams and any related accessories.

2. Submit scaled drawings with lighting fixtures shown clearly marked by manufacturer showing proper product, location and orientation of each sensor.

I. 26 0943 Lighting Control Equipment

1. Submit manufacturer’s data on lighting control equipment including, but not limited to published catalog data sheets, rough-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.

2. Meet with the electrical engineer at their office prior to preparation of shop drawings to discuss and verify specific programming and zoning requirements of system(s).

3. Meet with the lighting representative/manufacturer of the approved and accepted lighting control equipment to verify and understand specific installation requirements associated with that system.

4. Submit detailed drawings and documentation of lighting control components and interconnection including, but not necessarily limited to:

   a. Electronic controllers

   b. Control stations

   c. Photo sensors

   d. Occupancy sensors

   e. Network wiring details

   f. Input and output wiring details

   g. Lighting control panel load schedules

   h. Provide a complete sequencing and programming schedules for all devices, zones and scenes.

   i. Wallstations layouts

   j. Accurately scaled equipment layouts, wire/cable routing and connections to control wiring and electrical power feeders.

J. 26 2200 Transformers

1. Submit manufacturer's data on transformers, including certification of transformer performance efficiency, percentage regulation at 100 percent and 80 percent power factor, no-load and full load losses in watts, percent impedance at 75 degrees C, hot-spot and average temperature rise above 40 degrees C ambient, sound level in decibels, and standard published data. Before submitting product data, verify that dimensions of units to be supplied allow proper code required clearances adjacent to unit.

2. Submit dimensioned drawings of transformer installations, showing layout, mountings and supports, and spatial relationship to proximate walls and equipment.

3. For types and ratings required, furnish additional fuses, amounting to one unit for every five installed units, but not less than three units of each (including ELSP fuses when specified).

K. 26 2416 Panelboards

1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

2. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.

3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2416 submittals received prior to submission of the preliminary protective device study will be REJECTED.

L. 26 2726 Wiring Devices

1. Submit manufacturer's data on electrical wiring devices.

M. 26 2815 Overcurrent Protective Devices

1. Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.

2. Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.

3. Submit manufacturer's data and shop drawings only after completion of the preliminary protective device study (see Section 26 0573 as applicable). Any Section 26 2815 submittals received prior to submission of the preliminary protective device study will be REJECTED.

4. For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.

5. Submit time-current trip curves (in log-log format) and trip setting parameter/range information (for each trip function) for all solid-state circuit breakers.

6. Manufacturer shall also provide recommended trip settings with the shop drawing submittal (including ground fault settings) for coordination with downstream overcurrent devices. Manufacturer shall base recommendations on the AIC rating of the electrical equipment.

7. Where the Protective Device Study specification section 260573 is included in the project, the time-current curves and recommended trip settings for all solid-state circuit breakers shall be submitted as part of the protective device study.

N. 26 2816 Motor and Circuit Disconnects

1. Submit manufacturer's data including specifications, installation and general recommendations, for each type of motor and circuit disconnect switch required.

2. Submit dimensioned drawings of electrical motor and circuit disconnect switches that have rating of 100 amperes and larger.

O. 26 2913 Motor Starters

1. Submit manufacturer's data on motor starters.
2. Submit dimensioned drawings of motor starters showing accurately scaled equipment layouts.
3. After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.

P. 26 4313 Surge Protective Devices (SPD)

1. Submit manufacturer's data on SPD's listing all performance ratings specified or required herein.
2. Submit dimensioned drawings of SPD's including, but not necessarily limited to, the following.
   a. Complete data sheet.
   b. Set of outline drawings giving complete mounting information, conduit entry and exit locations and dimensions, overall unit dimensions, weights, physical characteristics, etc.
   c. Set of complete electrical drawings for power and control wiring.
   d. Manufacturer's literature giving detailed information of equipment including parts numbers, model numbers and ratings.
   e. UL 1449 suppressed voltage rating documentation.

Q. 26 5100 Interior and Exterior Building Lighting

1. Submit manufacturer's data on interior and exterior building lighting fixtures.
2. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in PDF format with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture catalog number and accessories clearly indicated on each sheet.
3. When applicable submit standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided.
4. Submit driver manufacturer cut sheets.
5. Submit a list of all lamps used on projects.
   a. Stock of all spare items shall be delivered as directed to Owner's storage space. All components shall be labeled to match construction document nomenclature,

R. 26 5600 Exterior Area Lighting

1. Submit manufacturer's data on lighting units, including certified dimension drawings of components including, but not necessarily limited to, poles and standards, mast arms, brackets, hardware and fixtures.

S. 27 1500 Telephone/Data Systems

1. See District Specification for more information regarding submittal requirements.
2. Provide electronic submittals in Adobe PDF format within one file. Organize pages within submittal to be in the same order as the specification items (for example, racks prior to cabling). Where multiple submittals are provided due to submittal. If three or more reviews are required of the 27-1500 submittals, Contractor shall reimburse the Engineer for $1,200 before the Engineer will commence the third review. rejections/corrections, upon completing the submittal process with "No

Exceptions Taken", provide a consolidated single PDF submittal showing all products on the project.

3. Provide proof of RDIGITAL COPYD certification and connectivity manufacturer certification.
4. Provide submittals for all racks/cabinets; patch panels, devices, cabling, firestopping solutions, tray, non-continuous cable support devices, grounding equipment, and miscellaneous equipment to be used on project. Where multiple part numbers are listed on a datasheet/cutsheet, highlight or circle applicable part.
5. Provide submittals showing complete racking layout in plan and elevation view to scale. Coordinate exact rack layout with Owner Information Technology Representative prior to submittal.
6. Provide color samples of all available standard color faceplates to architect.
7. Provide proposed labeling scheme for approval by owner/engineer.
8. Provide catalog cutsheets of all test equipment that will be used.
9. Provide results of all copper and fiber optic cable tests.

T. 27 4100 Audiovisual Systems

1. The following items shall be included in the shop drawings submittal:
   a. Project manager's written proof, with signature and date, that shop drawings and/or brochure has been checked for accuracy prior to submittal. Shop drawings to comply in all respects with the requirements of the contract drawings and specifications for this project.
   b. A complete bill of materials, broken out per system type, for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.
      i. The bill of material is intended to be used to verify equipment within each system. Only one cut sheet per unique product type is required.
      ii. Example several systems may require the same flat panel display mount, that mount should be listed in each system type with only one (1) cut sheet provided for that product.
   c. Manufacturer's data sheets and installation details for all devices, plates, cables and similar equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options, products and/or models being provided.
   d. Signal flow drawings showing all audio, video, control, network and power connections required between all pieces of equipment within each system.
      i. Unique cable/wire identifier for each connection that correspond to field cabling labelling scheme.
      ii. All connections require connector type and sex to be identified. Type shall correspond to a connector legend or shall be clearly identified per instance.
      iii. Wiring pinouts for all multipin connectors used
      iv. Detailed panel drawings showing wall, floor, rack, etc. input/output panel dimensions, connector types and text labeling for each connection shown
      v. Physical location information for each device.

vi. Upon request AV Consult's signal flow drawings may be utilized for signal flow documentation within the shop drawings, provided, the items above are included. Contractor shall make request for electronic files as indicated in section 1.2.C.

e. Equipment rack elevations.

f. Matrix routing and preset configuration tables, and digital signal processing configuration details.

g. Wireless microphone transmission frequencies.

h. Submit all manufacturer training, 3rd party and/or organization certificates for each equipment and/or systems required for the implementation of this specification.

i. Provide current equivalent if specified model has been discontinued.

2. All touch panel layouts, page logic functions and control system functionality, shall be submitted and approved by the Owner and AV Consultant prior to installation and programming of the control systems. Contractor shall submit the following information at the following stages during the construction of the GUI.

a. Draft Stage: Draft drawings and/or sketches of; basic layouts, button details, text details and page flip progression. Include control schemes for all applicable devices in system.

b. Intermediate Stage: Intermediate Touch Panel Menus designed with manufacturer's software. Submit printouts and/or software files for review. Include detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from previous stage mentioned above.

c. Demo Stage: Provide an active Touch Panel and controller to extensively demonstrate the operation of the control system. Demo of system shall be subject for review and considered as a deliverable. Include all revised detailed layouts, extensive control schemes for all controlled components, comprehensive button and text configurations, page flips and pop-up progression. Incorporate any changes or comments from the previous stage mentioned above.

d. Final Stage: Submit Final Touch Panel Menus designed with manufacturer's software. Submit printouts and software files for review. Include all detailed layouts, all revised control schemes for all controlled components, revised button and text configurations, page flips and pop-up progression. Include final page configurations for control of system from the touch panel. Incorporate any and all changes or comments from the previous stage mentioned above.

U. 27 5123 Intercommunication Systems

1. Provide a complete bill of materials for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.

2. Provide wiring layouts for Audio, Video, Control, and power.

V. 28 2205 Access Control System

1. Submit manufacturer's data sheets including specifications, installation instructions, and general recommendation for each type of equipment specified.

2. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout on the drawings. Submit actual riser diagrams of complete system and elevations of required equipment. Typical risers are not acceptable.

3. Submit network switch port count and power requirements. Port count and POE switch requirements should be broken out per IDF/MDF closet.
4. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the install.
5. Provide the Owner the following upon project completion:
    a. A complete set of shop drawings indicating: Locations of all panels, power supplies and controllers; point-to-point wiring diagrams for all devices.
    b. A complete equipment list identifying: Type; model; manufacturer; manufacturer's data sheets.
    c. A list of IP and MAC addresses, username and passwords for network devices coordinated with door name and/or location.
    d. Serial and model numbers for all major components.
    e. Installation manuals and user manuals for all systems listed in these specifications.

W. 28 2300 IP Video Surveillance System

1. Submit dimensioned drawings and wiring layout for any changes in wiring from the layout on the drawings. Submit actual riser diagrams of complete system and elevations of required equipment. Typical risers are not acceptable.
2. Submit network switch port count and power requirements. Port count and POE switch requirements should be broken out per IDF/MDF closet.
3. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the install.
4. Mid-span power budget calculations showing power requirements for all cameras.
5. Provide the Owner the following upon project completion:
    a. A complete set of shop drawings indicating: Locations of all cameras, power supplies and controllers; point-to-point wiring diagrams for all devices.
    b. Locations of all cameras with custom painted enclosures due to wood ceilings.
    c. Contractor to provide a list of IP address for cameras coordinated with camera name and/or location.

X. 28 3111 Fire Alarm and Detection System

1. Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.
2. Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams and riser diagrams of panel. Provide dimensioned drawing of Fire Alarm Control Panel and Building Graphic. Shop drawings shall be prepared by an individual with a minimum NICET Level IV (Fire Protection Engineering/Fire Alarm Systems) certification. The individuals name and certification number shall be indicated on submittal design drawings.
3. Submit a written statement to the Architect and the state and local Fire Marshal's Office that each device of the fire alarm system will be installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72.
4. Submit a complete set of documents to the Office of the State Fire Marshal

containing the following information:

a. A complete set of shop drawings indicating:

i. Location of all alarm-initiating and alarm-signaling devices.

ii. Point-to-point wiring diagrams for all alarm-initiating and alarm-signaling devices.

b. Wiring diagrams for:

i. Alarm control panels.

ii. Auxiliary function relays and solenoids.

iii. Remote signaling equipment.

iv. Standby battery calculations, including voltage drop calculation.

c. A complete equipment list identifying:

i. Type

ii. Model

iii. Manufacturer

iv. Manufacturer catalog data sheets

v. UL Listing and/or FM approval showing compatibility of device with Fire Alarm Control Panel (FACP)

d. A complete zone list identifying all:

i. Alarm-initiating and alarm-signaling devices.

ii. Remote signaling and auxiliary function zones.

iii. Specific devices associated with each zone.

e. Sample “System Record Document”.

f. Fire Alarm Key Plan Drawing showing the location of all device addresses and/or zones.

5. Address all comments from the Fire Marshal and instigate changes to the systems as applicable. Re-submit documents indicating changes instigated for final approval.

1.4 OPERATION & MAINTENANCE MANUALS

A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.

B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones WLJ36544B). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.

C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).

D. Include the following information where applicable.

1. Identifying name and mark number.
2. Certified outline Drawings and Shop Drawings.
3. Parts lists.
4. Performance curves and data.
5. Wiring diagrams.
6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
7. Manufacturer's recommended operating and maintenance instructions.
8. Vendor's name and address for each item.

E. The engineer will review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of $1,200.00 for each review afterwards.

F. Provide high quality video and audio recording for all training sessions. All trainings shall be recorded by utilizing a pro-grade digital camera system. Utilize camera tripod and record audio directly at the presenter. Smartphone recordings are not allowed.

G. Provide Operation and Maintenance Manual information for each section listed below in addition to the general requirements listed above.

1. 26 0526 Grounding
    a. Test Results of measured resistance values
2. 26 0548 Electrical Seismic Control
    a. Certificate of Compliance from Final Inspection
3. 26 0923 Occupancy Sensors
    a. Record Drawings
        i. A complete set of ‘as-builts’ drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.
        ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:
            1. CAD drawing files of ‘as-built’ lighting control components and point to point connections.
            2. General configuration programming.
            3. Job specific configuration programming to include schedule.
            4. Tutorial file on complete programming of lighting control system.
4. 26 0943 Lighting Control Equipment
    a. Record Drawings
        i. A complete set of ‘as-builts’ drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.

ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:

1. CAD drawing files of 'as-built' lighting control components and point to point connections.
2. General configuration programming.
3. Job specific configuration programming to include schedule.
4. Tutorial file on complete programming of lighting control system.

5. 26 2913 Motor Starters

a. After installation is complete, including water and air balancing, measure voltage (L-L and L-N) and full load current of each phase of each motor. Submit report showing field readings of voltage, amperage, service factor, and thermal heater size installed for each motor.

6. 26 0943 Lighting Control Equipment

a. Record Drawings

i. A complete set of 'as-builts' drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of this equipment shall be included in the operating and maintenance manuals upon complete of the system.

ii. Provide a DIGITAL COPY to the owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the schedules themselves. The DIGITAL COPY shall contain a minimum of following:

1. CAD drawing files of 'as-built' lighting control components and point to point connections.
2. General configuration programming.
3. Job specific configuration programming to include schedule.
4. Tutorial file on complete programming of lighting control system.

7.

8. 26 5100 Interior and Exterior Building Lighting

a. The supply two complete manuals consisting of, as a minimum, general system arrangement, lighting cutsheets, schematic of System components and options, factory test reports, trouble-shooting data, parts lists, preventative maintenance information, and warranty contact information.

9. 27 1500 Telephone/Data Systems

a. Test Results and requirements as outlined in Section 27 1010

b. Manual shall include all service, installation, programming and warranty, including test results for each cable.

c. Provide laminated plans (minimum size 11 x 17) of all telecommunications record drawings (including riser diagrams) in each and every EF, ER and TR.

d. Record Drawings

i. The Owner shall provide electronic (DWG) format of telephone/data system drawings that as-built construction information can be added. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.

ii. Provide a complete set of “as built” drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment within 30 working days of completion. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.

10. 275123 Intercommunications Systems

a. Manual Requirements

i. Operating and maintenance manuals shall be submitted prior to testing of system. Manuals shall include all model numbers, service, installation, and programming information.

ii. Include all the following information:

1. Warranty
2. Network settings
3. Riser diagrams from Shop drawings
4. Training videos
5. Flash drive with programing source code and software editing programs

b. Record Drawings

i. The Owner shall provide electronic (DWG) format of intercom System system drawings that as-built construction information can be added to. These documents will be modified by the intercom contractor to denote as-built information as defined above and returned to the Owner.

ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.

11. 27 4110 Audiovisual Systems

a. Manual Requirements

i. Operating and maintenance manuals shall be submitted prior to testing of system. Manuals shall include all model numbers, service, installation, and programming information.

ii. Include all the following information:

1. Warranty
2. Network settings
3. Riser diagrams from Shop drawings
4. Training videos
5. Flash drive with programing source code and software editing programs

b. Record Drawings

i. The Owner shall provide electronic (DWG) format of AV System system drawings that as-built construction information can be added to. These documents will be modified by the AV contractor to denote as-built information as defined above and returned to the Owner.

ii. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) formats showing cabinets, racks, patch panels, wiring, specific interconnections between all equipment and internal wiring of equipment. Drawings are to include all labeling information used in denoting equipment used in the installation. Labeling, icons, and drawing conventions used shall be consistent throughout all documentation provided.

12. 28 2205 Access Control Systems

a. Manual Requirements

i. Manuals shall include all service, installation and programming information.

b. Record Drawings

i. A complete set of CAD “AS-BUILT” Drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system.

ii. A building map (2 copies) shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building security map adjacent to the security control panel. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD security drawing. Edges of the sign shall be colored to match the building interior.

iii. The USB flash drive containing the files shall be supplied to the owner. The flash drive shall include all information required to allow the district to change the security program themselves. The flash drive shall contain a minimum of the following:

1. CAD drawing files of building security map.
2. CAD drawing files of AS BUILT security components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.
5. Tutorial file on complete programming of security system.

13. 28 2301 Video Surveillance System

a. Record Drawings

i. A complete set of CAD “AS-BUILT” Drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system.

ii. A building map (2 copies) shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building security map adjacent to the security control panel. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD security drawing. Edges of the sign shall be colored to match the building interior.

iii. The USB flash drive containing the files shall be supplied to the owner. The flash drive shall include all information required to allow the district to change the security program themselves. The flash drive shall contain a minimum of the following:

1. CAD drawing files of building security map.
2. CAD drawing files of AS BUILT components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.
5. Tutorial file on complete programming of security system.

14. 28 3113 Fire Alarm and Detection System

a. Manual Requirements

i. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.

b. Record Drawings

i. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all

cost with bid.

ii. A building map shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various devices and wiring by the use of different colors (minimum of five colors).

iii. Provide a DIGITAL COPY to the Owner containing the information specified below. The DIGITAL COPY shall include all information required to allow the Owner to change the fire alarm program themselves. The DIGITAL COPY shall contain a minimum of the following:

1. CAD drawing files of building fire alarm map.
2. CAD drawing files of as-built fire alarm components and point to point connections.
3. General configuration programming.
4. Job specific configuration programming.

c. Final Submittal to the Office of the Fire Marshal

i. Record of Completion: Provide a completed System Record of Completion (NFPA 72-Figure 4.5.2.1) in accordance with Section 4.5.3.

ii. Operation Instructions and A-Built Drawings: Provide one set of instructions on operation of the Fire Alarm System and one set of As-Built drawings. Demonstrate compliance of installation of the System Record Documents at or near the fire alarm control unit.

iii. Fire Alarm Key Plan Drawing: Demonstrate compliance of installation of the fire alarm key plan drawing at the FACP.

b. TUTORIAL FILE ON COMPLETE PROGRAMMING OF FIRE ALARM SYSTEM

1.5 SPARE PARTS:

A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion. Any unused material/labor not utilized during construction shall be a credit back to the owner. Utilize Project Tracking Document to keep record of the following items.

Section	Section Name	Description	Qty. Rqrd.	Qty Rcvd	Fulfilled?
26 0532	Conduit Raceway	Provide 1000 feet of 3/4” conduit with 4 #12 conductors, 1000 feet of 3/4” conduit with 4 #10 conductors, and 1000 feet of 1” conduit with 4 #10 conductor in PVC Provide all supports, fittings, boxes, terminations, etc. as required for installation. Install only as directed by engineer.	Per description		
26 0923/26 0943	Lighting Controls/Occupancy Sensors	Spare sensors for each type used on project.	3		
		Spare wallstations for each type used on project. (RC1, RC2)	5		

26 2200	Transformers	Maintenance Stock Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every five installed units, but not less that three units of each (including ELSP fuses when specified).	Per description		
26 2726	Wiring Devices	Provide (2) switches, and (4) duplex receptacles as directed by the Engineer. Include 25' of 3/4" EMT conduit with 4 #12 THHN for each device. Provide a total of (5) spare floor boxes covers for each box type used (Attic Stock).			
26 2816	Motor and Circuit Disconnects	Spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. (Attic Stock)	Per description		
26 2913	Motor Starters	Maintenance Stock Fuses: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed, but not less than 5 units of each, for both power and control circuit fuses. (Attic Stock)	Per description		
26 5100	Interior and Exterior Building Lighting	Provide the following attic Stock Fixtures: A55: 2 A65: 5 L4HD: 2 SL2C: 2			
		Provide (3) extra type X1A for discretionary placement by fire marshal or code official. Include 150' of 3/4" EMT conduit with 3 #12 THHN for each exit sign. Provide all supports, fittings, boxes, terminations, etc. as required for installation. Install only as directed by engineer.	Per description		
27 1500	Telephone/Data Systems	Provide (5) type 2 drop data outlets, (2) WAPs. Include 30 meters of 1" EMT. Provide all supports, fittings, boxes, terminations, etc. as required for installation. Install only as directed by engineer. Credit back all unused material and labor to the Owner.	Per description		
28 3111	Fire Alarm and Detection	Thermal detectors with base	4		
		Smoke detectors with base	4		
		Strobe/horns	4		
		Manual pull stations with addressable modules	0		
		Duct smoke detectors	2		
		Carbon Monoxide Detector and Monitor Module	1		
		150 feet of conduit with wiring (completely installed and wired) for each spare device	Per description		

END OF SECTION 26 0502

SECTION 26 0507

ELECTRICAL CONNECTIONS FOR EQUIPMENT

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-23 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.

B. Refer to Division-23 sections for motor starters and controls furnished integrally with equipment; not work of this section.

C. Refer to Division-23 section for control system wiring; not work of this section.

D. Refer to Division-23 section for Snow/ice melting, Gutter and downspout snow/ice melting system wiring; not work of this section.

E. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE: Comply with applicable portions of NEC as to type products used and installation of electrical power connections.

B. UL LABELS: Provide electrical connection products and materials that have been UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GENERAL:

A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 26 0532, Conduit Raceways; Section 26 2726 Wiring Devices: and Section 26 0519 Conductors and Cables for additional requirements. Provide final connections for equipment consistent with the following:

1. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.

2. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).

3. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Verify all electrical loads (voltage, phase, horse power, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work. In summary, it is not in the Electrical Engineers scope to review the shop drawings from other trades/divisions.

E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.

F. Refer to basic materials and methods Section 26 0553 Electrical Identification, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 26 0507

SECTION 26 0519

CONDUCTORS AND CABLES (600V AND BELOW)

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.

B. Types of conductors and cables in this section include the following:

1. Copper Conductors (600V)
2. Aluminum Conductor (600V)
3. Fire Resistive Cables
4. 0-10V Class 1 Circuits

C. Applications for conductors and cables required for project include:

1. Power Distribution
2. Feeders
3. Branch Circuits
4. 0-10V Class 1 Circuits

1.3 RECORDS SUBMITTAL:

A. Submit record in triplicate of megohmmeter readings to Architect/Engineer. Please see paragraphs 3.2A AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW for testing requirements.

1.4 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables that have been UL-listed and labeled.

B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.

C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.5 SUBMITTALS:

A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 COPPER AND ALUMINUM CONDUCTORS (600V):

A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's

installation requirements and NEC standards. Provide conductors in accordance with the following:

1. Service Entrance Conductors – Copper/Aluminum conductor; see drawings for insulation type.
2. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper/Aluminum conductor; see drawings for insulation type.
3. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG.
4. Aluminum Conductors. Where aluminum conductors are specified for use, provide compact stranded Aluminum Association 8000- series alloy conductor material.
    a. Stabiloy - Alcan Cable
    b. Triple E - Southwire

B. Provide connectors and terminations for aluminum-alloy conductors of hydraulic compression type only, listed under UL 486-B, and marked "AL 7CU" for 75o rated circuits, and "AL9CU" for 90o rated circuits.

C. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer. Where phase conductors share a common neutral they must have a means to simultaneously disconnect all ungrounded conductors at the point where the branch circuits originate. The ungrounded and neutral conductors of a multi-wire branch circuit must be grouped together by wire ties at the point of origination.

D. Provide neutral and ground wire as specified elsewhere in documents.

E. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.

2.2 FIRE-RESISTIVE CABLE:

A. Mineral Insulated Copper (MI) Copper Sheathed Cable:

1. General:
    a. Provide 1/c type system 1850 sheathed power cable, conforming to current standards of UL system No. 1850.
    b. Cable shall be classified as 2-hour fire resisting cable and shall comply with NEC articles 695 and 700 as an “Electrical Circuit Protective System” with a minimum 2-hour fire rating.
    c. Construct cable with copper conductor with highly compressed magnesium oxide insulation and seamless soft-drawn copper sheath.
    d. Provide termination kits as recommended by cable manufacturer.
2. Manufacturer:
    a. Subject to compliance with requirements, provide products of one of the following:
        i. Pentair – Pyrotenex System 1850

2.3 COPPER LOW VOLTAGE CONDUCTORS (0-10V CIRCUITS):

A. 0-10V Class 1 Circuits:

1. General:
    a. Provide Class 1 circuits for all 0-10V dimming installations. Class 1

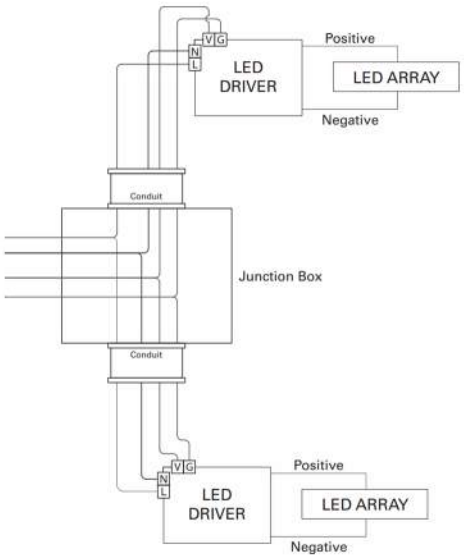
circuits shall be permitted to be installed with other circuits as specified in NEC 725.48 (A) and (B):

i. Class 1 circuits shall be permitted to occupy the same cable, cable tray, enclosure, or raceway without regard to whether the individual circuits are alternating or direct current, provided all conductors are insulated for the maximum voltage of any conductors in the cable, cable tray, enclosure or raceway.

ii. Class 1 circuits shall be permitted to be installed with power supply conductors as specified:

1. Class 1 and power supply circuits shall be permitted to occupy the same cable, enclosure, or raceway only when functionally associated.

iii. Utilize VIOLET and PINK copper conductors, with THHN/THWN insulation.



PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.

B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.

C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop that pull wires can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.

D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-

section area.

E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel. Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.

F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.

G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.

H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and that is listed by UL.

I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.

J. Support all cables in pullholes, concrete trenches, and similar locations by cable racks and secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator. In manholes, pullholes, concrete trenches, and similar locations, wrap strips of fire-proofing tape (approx. 1/16 inch thick by 3 inches wide) tightly around each cable spirally in half-lapped wrapping or in two butt-joined wrappings with the second wrapping covering the joints in the first. Apply tape with the coated side toward the cable, and extend tape one inch into the ducts. To prevent unraveling, random wrap the fireproofing tape the entire length of the fireproofing with pressure sensitive glass cloth tape. Provide fireproofing tape of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick weighing not less than 2.5 pounds per square yard. Provide tape that is noncorrosive to cable sheath, self-extinguishing, and that will not support combustion. Construct tape of materials that do not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.

K. Follow manufacturer's instructions for splicing and cable terminations.

L. Fire Protected Circuits:

1. Provide protected circuits for emergency feeders for the following occupancies:

   a. Educational occupancies with more than 300 occupants.

2. Feeders shall be protected by one of the following. Electrical contractor shall be responsible for meeting one of the following methods:

   a. Feeder is protected by a listed assembly with a minimum 2 hour fire rating.

   b. Feeder is listed a fire-resistive cable assembly.

   c. Feeder is encased in a minimum of 2” concrete.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Record all test data and provide written test report.

B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.

3.3 IDENTIFICATION OF FEEDERS: Refer to Section 26 0553 for requirements.

END OF SECTION 26 0519

SECTION 26 0526

GROUNDING

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 work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Provide grounding as specified herein, and as indicated on drawings. Provide a new grounding system as required to accommodate new service entrance and demolition of old incoming electrical service equipment.

B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.

C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.

D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.

E. Types of grounding in this section include the following:

1. Underground Metal Water Piping
2. Metal Building Frames
3. Grounding Electrodes
4. Grounding Rods
5. Separately Derived Systems
6. Service Equipment
7. Enclosures
8. Systems
9. Equipment
10. Other items indicated on drawings

F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products that have been UL listed and labeled.

B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS:

A. Submit the name of test agency to be used for testing specified in this section. Submit results of tests specified in this section. Also include test results in Operation and

Maintenance Manuals as specified.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.

C. GROUND RODS: Steel with copper welded exterior, 3/4" dia. x 10' long. Weaver or Cadweld.

D. GROUND WELL BOXES FOR GROUND RODS: Precast concrete box 9-1/2" W. x 16" L. X 18" D. with light duty concrete cover for non-traffic areas or rated steel plate for traffic areas. Provide covers with lifting holes. Engrave cover with "GROUND ROD".

E. CONCRETE ENCASED GROUNDING ELECTRODE (UFER GROUND): #2/0 AWG bare copper conductor.

F. INSULATED GROUNDING BUSHINGS: Plated malleable iron body with 150 degree Centigrade molded plastic insulating throat, lay-in grounding lug with hardened stainless steel fasteners, OZ-Gedney BLG, or Thomas & Betts #TIGB series.

G. CONNECTIONS TO PIPE: For cable to pipe, OZ-Gedney G-100B series or Thomas & Betts #390X series, or Burndy type GAR.

H. CONNECTIONS TO STRUCTURAL STEEL, GROUND RODS, OR SPLICES: For splicing and/or connecting conductors, use exothermic welds or high pressure compression type connectors. Provide exothermic weld kits manufactured by Cadweld or Thermoweld. If high compression type connectors are used for cable-to-cable, or cable-to-steel, or cable-to-ground rod connections, provide Thomas & Betts #53000 series, or Burndy Hyground series.

I. BONDING JUMPERS: OZ-Gedney Type BJ, or Thomas & Betts #3840 series, or Burndy type GG and type B braid.

J. INTERSYSTEM BONDING TERMINAL: Provide one 12” L. x 2” H x ¼” thick copper bus bar. Mount on wall adjacent to Main Electrical Service Equipment on insulating standoffs, 18” A.F.F. Furnish complete with lugs for connecting systems grounding cables. All holes shall be drilled for 2 hole compression lugs. Provide 6 spare lugs. Connect to equipment grounding bus in Main Electrical Service Equipment with No. 4 AWG copper conductor.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.

B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.

C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC. Include copper grounding conductor in all

raceway installed in suspended slabs.

D. Provide service entrance grounding by means of ground rods (quantity of two, driven exterior to building), by means of bonding to water main, and by means of bonding to building structural steel. In addition, provide a grounding electrode for not less than 30 lineal feet in concrete footing or foundation that is in direct contract with earth. Size electrode in accordance with NEC, but in no case, smaller than No. 4 AWG bare copper. Support electrode so as to be below finished grade near the bottom of the trench, and approximately three inches from the bottom or sides of the concrete. Locate a point of connection for inspection.

E. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.

3.2 GROUNDING ELECTRODES:

A. Concrete Encased Grounding Electrode (UFER Ground): Provide a #2/0 AWG minimum bare copper conductor encased along the bottom of concrete foundation or footings that are in direct contact with the earth and where there is no impervious water-proofing membrane between the footing and the soil. Extend electrode through a horizontal length of 30 feet minimum and encase with not less than 2 nor more than 5 inches of concrete separating it from surrounding soils. At point of emergence from concrete, run electrode through a protective non-metallic sleeve and extend to the main building [reference] ground bus.

B. [Supplementary Grounding Electrode (Ground Ring, Grid, and Driven Rods): Provide driven ground rod(s) installed in listed ground well box(s) and filled with gravel after connection is made. Interconnect ground rod(s) with structural steel and adjacent rods with minimum #4 AWG bare copper conductor. Locate ground rod a minimum of 10 feet from any electrode of another electrical system or from adjacent ground rod(s)].

C. Separately Derived Electrical System Grounding Electrode: Ground each separately derived system per requirements in NEC Section 250-26 unless indicated otherwise.

D. GROUNDING ELECTRODE CONDUCTOR: Provide grounding electrode conductor sized per NEC table 250-94 or as indicated.

E. POWER SYSTEM GROUNDING: Connect the following items using NEC sized copper grounding conductors to lugs on the Main Building Ground Bus

1. Grounding electrode conductor from concrete encased electrode, and from ground rods.
2. Conductor from main incoming cold water piping system.
3. Conductor from building structural steel.
4. Ground for separately derived systems.

F. Run main grounding conductors exposed or in metallic conduit if protection or concealment is required.

G. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:

1. Non-metallic conduits and ducts.
2. Distribution feeders.
3. Motor and equipment branch circuits.
4. Device and lighting branch circuits.
5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.

H. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold

water piping system.

I. Provide bonding wire in all flexible conduit.

3.3 TESTING:

A. Obtain and record ground resistance measurements both from service entrance ground bus to the ground electrode and from the ground electrode to earth. Install additional bonding and grounding electrodes as required to comply with resistance limits specified under this Section.

B. Include typewritten records of measured resistance values in the Operation and Maintenance Manual.

C. Use independent testing agency for all testing.

D. Use test equipment expressly designed for the purpose intended. Submit name of testing agency for review and approval, in writing, to the Engineer prior to the performance of any testing.

END OF SECTION 26 0526

SECTION 26 0529

SUPPORTING DEVICES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

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

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-26 sections. See Section 260532, Raceways, for additional requirements.

B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components that are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

A. GENERAL:

1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to ensure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts,

moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. Independent support wires are not allowed as indicated as per NEC 300.11(B).

E. RACEWAYS:

1. Support raceways that are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90° degree bend. Support raceway (as it is installed) in accordance with the following:

NUMBER OF RUNS	3/4" TO 1-1/4" 0	1-1/2" & LARGER 0
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

F. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers (provide neoprene vibrations isolators at anchor points), oil switches, battery packs and racks, and similar equipment furnished under Division 26, 27 and 28.

G. WIREWAYS, BUS DUCTS AND CABLE TRAYS:

1. Provide vertical and lateral support systems for all wireways, busway, and cable trays that are supported from overhead structure. See Sections 260536 and 262500 for additional requirements.

END OF SECTION 26 0529

SECTION 26 0532

CONDUIT RACEWAY

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Division-26 is responsible to provide conduit and rough-in for all thermostat controls located within walls. Coordinate with the Controls Contractor and verify exact location of all thermostats. Obtain and review submittals of Temperature Control Equipment from Controls Contractor and Divisions 21-23.

C. Types of raceways in this section include the following:

1. Electrical Metallic Tubing
2. Flexible Metal Conduit
3. Intermediate Metal Conduit
4. Liquid-tight Flexible Metal Conduit
5. Rigid Metal Conduit
6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

A. MANUFACTURERS: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.

B. STANDARDS: Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components that have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

1.4 SUBMITTALS:

A. Not Required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

A. GENERAL:

1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".

B. RIGID METAL CONDUIT (RMC): FS WW-C-0581 and ANSI C80.1.

C. INTERMEDIATE STEEL CONDUIT (IMC): FS WW-C-581.

D. PVC EXTERNALLY COATED RIGID STEEL CONDUIT: ANSI C80.1 and NEMA Std. Pub. No. RN 1.

E. ALUMINUM CONDUIT: Not acceptable.

F. ELECTRICAL NON-METALLIC TUBING (ENT) SYSTEM: Not acceptable.

G. MC CABLE: Only acceptable as indicated below.

1. MC Cable is acceptable for all branch circuits installed in gypsum wallboard walls from the home run device box to the last device box on the branch circuit and all boxes in between, from the home run device box to the branch panel, the circuit shall be installed in an approved raceway. All MC Cable shall be provided with anti-short fittings.
2. MC Cable is acceptable for all light fixture whips not longer than six feet in length. Located in removable grid ceilings. MC Cable is unacceptable to be installed from light fixture to light fixture. All MC Cable shall be provided with anti-short fittings.
    a. The use of MC-PCS cable is acceptable for light fixture whips utilizing 0-10v control schemes, not longer than 72” in length, located above removable grid ceilings. All MC cable shall be provided with anti-short fittings.
        i. Acceptable Manufacturers
            1. AFC – MC Luminary Cable
            2. Encore – MC-LED Lighting Cable
            3. Southwire – MC-PCS Duo
3. Before any rough-in of MC cable, the contractor shall conduct a on-site meeting with owner and engineer to review standards and overall rough-in requirements. Contractor shall conform to all owner and engineer requirements.
4. Contractor mock-up one classroom for review of electrical installation prior to continuing installation of MC cabling.

H. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:

1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.

I. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.

J. EMT FITTINGS:

1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.

K. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;

1. Zinc-coated steel.

L. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.

M. LIQUID TIGHT FLEXIBLE METAL CONDUIT:

1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).

N. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.

O. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

A. GENERAL:

1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".

B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:

1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.

C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:

D. ANSI/NEMA TC 9, match to duct type and material.

E. HDPE CONDUIT: Not acceptable.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, that mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 SEALING BUSHINGS:

A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.5 CABLE SUPPORTS:

A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:

1. SERVICE ENTRANCE CONDUCTORS, AND CONDUCTORS OVER 600 VOLTS:

a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct, individually encased in concrete. See duct banks.

2. FEEDERS UNDER 600 VOLTS:

a. Install in electric metallic tubing (EMT). Below concrete slab-on-grade or in earth fill, install in non-metallic plastic conduit. In areas exposed to weather, moisture, or physical damage, install in RMC or IMC. In suspended slabs, install in EMT (NOT APPROVED).

3. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:

a. Install in electric metallic tubing (EMT). Below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in RMC or IMC. In suspended slabs, install in EMT (NOT APPROVED).

4. UTILITY COMPANY COORDINATION:

a. For installation of conduits for Rocky Mountain Power (RMP) feeders provide Schedule 40 PVC with long radius sweep fiberglass elbows.

Coordination RMP standards for trench width, depth and spacing from other utilities. Provide back fill material of sand, screened backfill, etc., acceptable to RMP or as specified elsewhere in these specifications, whichever is more stringent.

B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

C. Install raceway in accordance with the following:

1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.
2. PVC conduit not allowed within CMU and block type walls.
3. The required raceway size, for any given installation, shall remain the same throughout the entire length of the run. At no point shall any conduit be reduced in size.
4. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
5. Provide a minimum of 1 ½” from nearest surface of the roof decking to raceway.
6. In open gymnasiums, auditoriums, etc; all conduit shall be installed in straight lines parallel to, or at right angles to, the structure or adjacent building elements. Separations between conduits and fastenings of conduits shall be neat and consistent. Conduit shall be installed as tight to the bottom of structural elements when parallel to joists as code will allow. Overall installation shall be accomplished in an aesthetic and workmanlike manner. No conduits shall be allowed to run perpendicular to the bottom chord and at the bottom of the joists.
7. Provide conduit from device to device in open and/or exposed ceilings. Ceilings with clouds are considered open/exposed ceiling. No exposed cables shall be seen from below.
8. Provide a maximum of three phase conductors in any one conduit or as approved by electrical engineer. Where phase conductors share a common neutral they must have a means to simultaneously disconnect all ungrounded conductors at the point where the branch circuits originate. The ungrounded and neutral conductors of a multi-wire branch circuit must be grouped together by wire ties at the point of origination.
9. Provide neutral and ground wire as specified elsewhere in documents.
10. Provide separate neutral conductor for all single phase branch circuits installed. No shared neutrals are allowed. Neutral conductor shall be the same size as the phase conductor.

D. Comply with NEC for requirements for installation of pull boxes in long runs.

E. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandrel and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.

F. Replace all crushed, wrinkled or deformed raceway before installing conductors.

G. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device that supplies uniform heat over the entire area without scorching the conduit.

H. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.

I. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall measured from interior face. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.

J. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.

K. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.

L. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.

M. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.

N. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.

O. Raceway installation below grade:

1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
2. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.
3. Utility burial depths must comply with RMP requirements or AHJ, but in no case be less than 48" minimum, unless noted otherwise on drawings, diagrams etc.

P. Raceway installation below slab-on-grade, or below grade:

1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a at top of sub-grade and a minimum of 6” below bottom of slab. Stake down conduits as required to keep conduits from floating or moving. Coordinate strictly with other trades at grade level structural members for correct installation. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
3. Mark all buried conduits that do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12"

below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.

4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

5. Do not locate utility feeds under any structure. Verify all utility power paths with RMP prior to any rough-in. Utility burial depths must comply with RMP requirements or AHJ, but in no case be less than 48" minimum, unless noted otherwise on drawings, diagrams etc.

Q. Raceway installation in suspended slabs:

1. No conduit can be installed in suspended slabs.

R. Raceway installation in hazardous locations:

1. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.

2. Engage at least five full threads on all fittings. Provide inspection fittings with explosion proof drains to prevent water accumulation in conduit runs. Install seal-offs for arcing or high temperature equipment, at housing with splices or taps and where conduits enter or leave the hazardous area. Provide seal-offs of the appropriate type for vertical or horizontal installation. Ground all metallic parts.

S. DUCTBANKS:

1. Provide ductbank construction as indicated using 3000 psi at 28 day strength concrete. Use Type II low alkali per ASTM C150. Use ASTM C-33 aggregate gradation with maximum size of 3/4". Use W/C ratio of 0.50. Install #4 reinforcing bar per ASTM 615 grade 50 in each corner of ductbank. Provide minimum 4" concrete cover on all sides of exterior conduits. Provide polypropylene pull rope in all spare duct.

T. Electrical Identification: Refer to Section 260553 for requirements.

END OF SECTION 26 0532

SECTION 26 0533

ELECTRICAL BOXES AND FITTINGS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is a part of each Division-26, 27 and 28 section making reference to electrical wiring boxes and fittings specified herein. See Section 260532, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.

B. Types of electrical boxes and fittings in this section include the following:

1. Outlet Boxes
2. Junction Boxes
3. Pull Boxes
4. Floor Boxes
5. Conduit Bodies
6. Bushings
7. Locknuts
8. Knockout Closures
9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings that have been UL-listed and labeled.

1.4 SUBMITTALS:

A. Submit manufacturer’s data including specifications, installation instruction and general recommendations for each type of floor box used on project.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

A. INTERIOR OUTLET BOXES:

1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x2-1/8".
2. Provide an ‘FS’ box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, that are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. FLOOR BOXES:

1. Single Service Floor Box: Provide leveling and fully adjustable floor service receptacle outlets and fittings of types and ratings indicated; and with finish as selected by Architect. Equip with wiring devices as specified in Section 262726. Provide boxes compatible with floor system; provide epoxy-coated stamped steel boxes or cast iron boxes for slab-on-grade construction; provide stamped steel boxes for suspended slabs. Equip with tile and/or carpet flanges to accommodate floor finish material. Boxes shall be available in one, two or three gang configurations. Boxes shall comply with UL Standard UL514A.

2. Multi-Service Floor Box: Provide leveling and fully adjustable multi compartment floor box; there shall be multiple independent wiring compartments; the floor box shall permit tunneling from end power compartment to end power compartment. Floor box shall accommodate a minimum of two duplex receptacles and two mounting plates for telecommunication devices. Equip with wiring devices as specified in Section 262726. Provide boxes compatible with floor system; with finish as selected by Architect. Provide epoxy-coated stamped steel boxes or cast-iron boxes for slab-on-grade construction; provide stamped steel boxes for suspended slabs. Equip with tile and/or carpet flanges to accommodate floor finish material. Boxes shall comply with UL Standards UL514A and/or UL514C.

3. Manufacturer: subject to compliance with requirements, provide floor boxes as indicated on the drawings.

a. Harvey Hubbell, Inc.

b. Wiremold

F. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

G. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
3. Provide coverplates for all boxes. See Section 262726, Wiring Devices.
4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
5. Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.
7. Fasten boxes rigidly to substrates or structural surfaces, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them. Set boxes on opposite sides of fire resistant walls with minimum of 24” separation.
8. Provide a minimum of 1 ½” from the nearest surface of the roof decking to the installed boxes.
9. Provide electrical connections for installed boxes.

END OF SECTION 26 0533

SECTION 26 0536

RACEWAY 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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 Section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of raceways is indicated by drawings and schedules.

B. Types of raceways in this section include the following:

1. Surface metal raceways
2. Ventilated trough systems.

1.3 QUALITY ASSURANCE:

A. STANDARDS:

1. Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components that have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.
2. Comply with the following publications and standards for construction and installation or wire basket cable tray:
   a. Comply with NEC Article 392
   b. NEMA VE-1; NEMA VE-2-2001
   c. NFPA 70B
   d. ASTM B633; ASTM A653; ASTM A510

1.4 SUBMITTALS:

A. Refer to section 26 0502 submittal requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURED RACEWAY SYSTEMS:

A. GENERAL:

1. Provide electrical raceways of types, grades, sizes, weights [wall thicknesses], and number of channels, for each service indicated. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as needed for complete system.

B. SURFACE METAL RACEWAYS:

1. Provide galvanized steel surface metal raceways of sizes and channels indicated. Provide fittings indicated that match and mate with raceway. Paint with manufacturer's standard prime coating and finish color as indicated. Provide receptacles on centers as indicated on drawings or as directed by engineer.

2. MANUFACTURER:
    a. Subject to compliance with requirements, provide surface metal raceways of one of the following:
        i. Wiremold Company AL3300

C. WIRE BASKET CABLE TRAY SYSTEMS:

1. MANUFACTURER:
    a. Subject to compliance with requirements, provide cable tray system of one of the following (OR APPROVED EQUAL):
        i. Cooper B-Line WB400 Series Systems
        ii. Cablofil, Inc.
        iii. P/W Industries
        iv. Hubbell Incorporated
        v. MonoSystems
2. Provide wire basket cable tray of types, grades, ratings, and sizes as specified and indicated meeting all requirements of NEMA VE-1. Provide complete assembly of raceway including, but not necessarily limited to, offsets, adapters, connector plates, splice plates, brackets, connector assemblies, holddown clamp assemblies, grounding clamps and other components and accessories as needed for complete system.
3. WIRE BASKET: Wire basket shall be made of high strength steel wires conforming to ASTM A510, and formed into a standard 2 inch by 4 inch wire mesh pattern with intersecting wires welded together. All wire ends along wire basket sides (flanges) shall be rounded during manufacturing for safety of cables and installers.
    a. All straight section longitudinal wires shall be straight, with no bends.
    b. Straight sections shall be furnished in standard 118 inch lengths.
    c. Wire basket shall have a 4 inch usable loading depth by 18 inches wide.
    d. Wire basket shall be electro-plated zinc in accordance with ASTM B633 SC2, with clear chromate sealer.
    e. Wire basket shall have a load capacity of 116 lbs per foot based on 5 foot spacing between supports.
4. BENDS: Horizontal and vertical bends, and horizontal tees shall be field formed. Inside radius of field bends shall be no less than 12 inches, and in no case smaller than required to comply with minimum radius requirement of cable manufacturer. Horizontal bends and tees shall be made such that the side rail of the tray is continuous with no gaps.
5. SPLICE ASSEMBLIES: Splice assemblies shall consist of splice plates and clamp/connectors furnished by the tray system manufacturer as standard components of the system. Splice assemblies shall be used to join separate horizontal sections together. Splice plates shall be approximately 2.7 inches long by 1.6 inches high, zinc-plated. Clamp/connectors shall be the bolted type consisting of welded stud plates with threaded studs and serrated flanged locknuts. Hardware shall be zinc-plated.
6. ACCESSORIES AND COMPONENTS: Support accessories shall be zinc-plated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.
7. Provide all fittings including connector plates, splice plates, clamps, supports, etc.
8. Grind all rough edges, drip concentrations, etc., to smooth finish. Apply cold zinc spray to all field cut surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.

B. Provide a minimum of (4) 4” trade size Hilti Speedsleeves (or STI EZPath) with at least one spare for each and every firewall penetration where cable tray meets the wall.

C. Provide a minimum of (4) 4” trade size conduits within cable where inaccessible ceilings that span more than 12’.

D. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.

E. Seal joints of underfloor ducts with sealing compound or tape prior to placing concrete.

F. Level and square raceway runs, and install at proper elevations/heights.

3.2 ADJUSTING AND CLEANING:

A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION 26 0536

SECTION 26 0548

ELECTRICAL SEISMIC CONTROL

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. Anchorage and seismic restraint systems for all Division 26 isolated and non-isolated equipment, cable tray, and conduit systems.

B. Equipment/cable tray/conduit to isolated and/or seismically supported shall include but not be limited to the following:

1. Conduit
2. Cable Tray
3. Light Fixtures

1.2 RELATED WORK:

A. Requirements: Provide Electrical Seismic Control in accordance with the Contract Documents.

B. Section 26 0500 – Electrical General Provisions

1.3 REFERENCES:

A. International Building Code, Current Edition in use by Jurisdictional Authority.

B. NFPA Bulletin 90A, Current Edition.

C. UL Standard 181.

1.4 SYSTEM DESCRIPTION

A. The Division 26 Contractor shall be responsible for supplying and installing equipment, vibration isolators, flexible connections, rigid steel frames, anchors, inserts, hangers and attachments, supports, seismic snubbers and bracing to comply with the following:

1. Short period design spectral response acceleration coefficient SDS=0.70.
2. One second period design spectral response acceleration coefficient SD1=0.28.
3. Site Class B.
4. Seismic Design Category D.

1.5 QUALITY ASSURANCE:

A. All supports, hangers, bases, anchorage and bracing for all isolated equipment and non-isolated equipment shall be designed by a professional engineer licensed in the state where the project is located, employed by the restraint manufacturer, qualified with seismic experience in bracing for electrical equipment. Shop drawings submitted for earthquake bracing and anchors shall bear the Engineer's signed professional seal. All calculations/design work required for the seismic anchorage and restraint of all Division 26 equipment and systems shall be provided by a single firm.

B. The above qualified seismic engineer shall determine specific requirements for equipment anchorage and restraints, locations and sizes based on shop drawings for the electrical equipment that have been submitted, reviewed and accepted by the Architect/Engineer for this project.

C. Seismic Engineer or the Engineer's Representative shall field inspect final installation and

certify that bracing and anchorage are in conformance with the Seismic Engineer's design. A certificate of compliance bearing the Seismic Engineer's signed Professional Engineer's seal shall be submitted and shall be included in each copy of the Operation and Maintenance Manuals.

D. The Division 26 Contractor shall require all equipment suppliers furnish equipment that meets the seismic code, with bases/skids/curb designed to receive seismic bracing and/or anchorage. All isolated and non-isolated electrical equipment bracing to be used in the project shall be designed from the Equipment Shop Drawings and certified correct by the equipment manufacturer for seismic description listed in Paragraph 1.4 above, with direct anchorage capability.

1.6 SUBMITTALS:

1. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 – PRODUCTS:

2.1 RESTRAINT EQUIPMENT AND SYSTEMS:

A. Acceptable Manufacturers and Suppliers for Non-Isolated Systems:

1. Mason Industries, Inc.
2. Korfund
3. Amber/Booth Company
4. Vibration Mountings and Control Company
5. Kinetics
6. International Seismic Application Technology
7. Tolco

B. Manufacture and design of restraints and anchors for isolated equipment shall be by the manufacturer of the vibration isolators furnished for the equipment.

2.2 SNUBBERS:

A. Snubbers shall be all-directional and consist of interlocking steel members restrained by replaceable shock absorbent elastomeric materials a minimum of 3/4 inch thick.

B. Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch or more than 1/4 inch.

C. Snubbers shall be Mason Industries Z -1011 or accepted equivalent.

PART 3 – EXECUTION

3.1 DESIGN AND INSTALLATION:

A. General:

1. All electrical equipment cable tray and conduit shall be braced, anchored, snubbed or supported to withstand seismic disturbances in accordance with the criteria of this specification. Provide all engineering, labor, materials, and equipment for protection against seismic disturbances as specified herein. The following electrical components are exempt from seismic restraint requirements.
   a. Components in Seismic Design Categories A and B (see 1.4 above).
   b. Components in Seismic Design Category C (see 1.4 above) that have an important factor IP of 1.0 (see 1.4 above).
   c. Components that have an importance factor IP of 1.0 (see 1.4 above), that are mounted less than four feet above the floor, that weigh less than 400 pounds, and that have flexible ductwork, piping, and conduit connections.

d. Components that have an importance factor IP of 1.0 (see 1.4 above), that weigh 20 pounds or less, and that have flexible ductwork, piping, and conduit connections.

2. Powder-actuated fasteners (shot pins) shall not be used for component anchorage in tension applications in Seismic Design Category D, E, or F.

3. Attachments and supports for electrical equipment shall meet the following provisions:

a. Attachments and supports transferring seismic loads shall be constructed of materials suitable for the application and designed and constructed in accordance with a nationally recognized structural code such as, when constructed of steel, AISC, Manual of Steel Construction (Ref. 9.8-1 or 9.8-2).

b. Friction clips shall not be used for anchorage attachment.

c. Expansion anchors shall not be used for electrical equipment rated over 10 hp (7.45 kW). Exception: Undercut expansion anchors.

d. Drilled and grouted-in-place anchors for tensile load applications shall use either expansive cement or expansive epoxy grout.

e. Supports shall be specifically evaluated if weak-axis bending of light-gauge support steel is relied on for the seismic load path.

f. Components mounted on vibration isolation systems shall have a bumper restraint or snubber in each horizontal direction. The design force shall be taken as 2Fp. The intent is to prevent excessive movement and to avoid fracture of support springs and any non- ductile components of the isolators.

g. Seismic supports shall be constructed so that support engagement is maintained.

B. Spring Isolated Equipment:

1. All vibration isolated equipment shall be mounted on rigid steel frames or concrete bases as described in the vibration control specifications unless the equipment manufacturer certified direct attachment capability. Each spring mounted base shall have a minimum of four all-directional seismic snubbers that are double acting and located as close to the vibration isolators as possible to facilitate attachment both to the base and the structure. Snubbers shall be installed with factory set clearances.

C. Non-Isolated Equipment:

1. The section 260548 (Electrical Seismic Control) Contractor shall be responsible for thoroughly reviewing all drawings and specifications to determine all equipment to be restrained. This Contractor shall be responsible for certifying that this equipment is mounted and braced such that it adheres to the system description criteria in part 1.04 of this specification section.

D. Conduit:

1. Seismic braces for conduit may be omitted when the distance from the top of the conduit to the supporting structure is 12” or less.

2. A rigid conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

3. Unbraced conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate differential displacements.

4. At the interface of adjacent structures or portions of the same structure that may move independently, utility lines shall be provided with adequate flexibility to

accommodate the anticipated differential movement between the ground and the structure.

5. Provide large enough pipe sleeves through wall or floors to allow for anticipated differential movements.

E. Cable Tray:

1. Seismic restraints are not required for cable tray with importance factor IP of 1.0, provided that the following condition is met for the full length of each cable tray.

   a. Cable trays are suspended from rod hangers and hangers that are 12” or less in length from the point rod attaches to tray, to the point rod connects to the supporting structure. Rods must be secured to both top and bottom cross angles with locking nuts above and below angle iron.

END OF SECTION 26 0548

SECTION 26 0553

ELECTRICAL IDENTIFICATION

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 work of 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. This section includes identification of electrical materials, equipment and installations. It includes requirements for electrical identification components including but not limited to the following:

1. Buried electrical line warnings.
2. Identification labels for raceways, cables and conductors.
3. Operational instruction signs.
4. Warning and caution signs.
5. Equipment labels and signs.
6. Arc-flash hazard labels

B. Related Sections: The following sections contain requirements that relate to this section:

C. Division 9 Section “Painting” for related identification requirements.

D. Refer to other Division 26 sections for additional specific electrical identification associated with specific items.

1.3 QUALITY ASSURANCE

A. Electrical Component Standard: Components and installation shall comply with NFPA 70 “National Electrical Code”

1.4 SUBMITTALS:

1. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. American Labelmark Co.
2. Calpico, Inc.
3. Cole-Flex Corp.
4. Emed Co., Inc.
5. George-Ingraham Corp.
6. Ideal Industries, Inc.
7. Kraftbilt

8. LEM Products, Inc.
9. Markal Corp
10. National Band and Tag Co.
11. Panduit Corp.
12. Radar Engineers Div., EPIC Corp.
13. Seton Name Plate Co.
14. Standard Signs, Inc.
15. W.H Brady, Co.

2.2 ELECTRICAL IDENTIFICATION PRODUCTS

A. Colored Conduit Systems for raceway identification:

1. Factory-painted conduit and/or factory-painted couplings and fittings

B. Colored paint for raceway identification:

1. Use Kwal Paint colors as specified in Part 3 – Execution.

C. Color Adhesive Marking Tape for Raceways, Wires and Cables:

1. Self-adhesive vinyl tape not less than 3 mills thick by 1” to 2” in width.

D. Underground Line Detectable Marking Tape:

1. Permanent, bright colored, continuous-printed, acid- and alkali-resistant plastic tape specifically compounded for direct-burial service. Not less than 6” wide by 4 mills thick.
2. With metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.
3. Printed legend indicative of general type of underground line below.

E. Wire/Cable Designation Tape Markers:

1. Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with pre-printed numbers and letters.

F. Brass or Aluminum Tags:

1. Metal tags with stamped legend, punched for fastener.
2. Dimensions: 2” X 2” 19 gage.

G. Engraved, Plastic Laminated Labels, Signs and Instruction Plates:

1. Engraving stock plastic laminate, 1/16” minimum thickness for signs up to 20 sq. in. or 8” in length; 1/8 “ thick for larger sizes. Engraved legend in 1/4” high white letters on black face and punched for mechanical fasteners.

H. Arc-flash Hazard Labels:

1. ANSI Z535.4 Safety Label.
2. Adhesive backed polyester with self-laminating flap. Chemical, abrasion and heat resistant.
3. Dimensions: 5” x 3.5”
4. Information contained: Arc-flash boundary; Voltage; Flash Hazard Category; Incident Energy (arc rating); checkboxes for the required Personal Protective Equipment (PPE) and the date that the calculations were performed.

I. Equipment Labels:

1. Adhesive backed polyester with self-laminating flap. Chemical, abrasion and heat resistant.
2. Dimensions: minimum 5” x 2”

3. Conductor-Identification-Means Labels:
    a. Information contained: the method utilized for identifying ungrounded conductors within switchboards, distribution panels and branch circuit panels.
4. Available-Fault-Current Labels:
    a. Information contained: maximum available fault current at the respective piece of equipment, and date of calculation of fault current.
5. Source-of-Supply Labels:
    a. Information contained: indicate the device or equipment where the power supply originates.

J. Baked Enamel Warning and Caution Signs for Interior Use:
1. Preprinted aluminum signs, punched for fasteners, with colors legend and size appropriate to location.

K. Fasteners for Plastic-Laminated and Metal Signs:
1. Self-tapping stainless steel screws or # 10/32 stainless steel machine screws with nuts, flat and lock washers.

L. Cable Ties:
1. Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18" minimum width, 50-lb. Minimum tensile strength, and suitable for a temperature range from minus 40° F. to 185° F. Provide ties for specified colors when used for color coding.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics:
1. Coordinate names, abbreviations, colors and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering and colors as approved in submittals and as required by code.

B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.

C. Sequence of Work:
1. Where identification is to be applied to surfaces that require a finish, install identification after completion of finish work.

D. Conduit Identification:
1. Identify Raceways of Certain Systems with Color Coding. Acceptable means of color identification are as follows:
    a. Colored adhesive marking tape.
    b. Field-painted colored bands.
    c. Factory-painted conduit.
    d. Color exposed or accessible raceways of the following systems for identification. Make each color band 2 inches wide, completely encircling conduit. Apply bands at changes in direction, at penetrations of walls and floors, and at 20-foot maximum intervals in straight runs. Apply the following colors:
        i. Fire Alarm System: Red
        ii. AV/Intercom: Grey

iii. Telephone/Data: Blue

iv. Security: Grey

v. Elevator Phone: Orange

vi. Legally Required Emergency Systems: Orange (Per NEC 700.10(A))

2. Identify Junction, Pull and Connection Boxes.

   a. Code-required caution sign for boxes shall be pressured-sensitive, self-adhesive label indication system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers on outside of cover with identity of contained circuits. Use pressure-sensitive plastic labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

3. Label and paint the covers of the systems junction boxes as follows:

SYSTEM	COLOR (ALL COLORS ARE KWAL PAINT)	
Fire Alarm	Red Alert	AC118R
AV/Intercom	Grey	
Data	Neon Blue	7076A
Security	Grey	
Legally Required EM System	Orange	

E. Underground Electrical Line Identification.

1. During trench backfilling, for exterior underground power, signal, and communications lines, install continuous underground line detectable marking tape, located directly above line at 6 to 8 inches below finished grade. Where multiple lines are installed in a common trench or concrete envelope, do not exceed an overall width of 16 inches; install a single line marker.

2. Install detectable marking tape for all underground wiring, both direct-buried and in raceway.

3. Provide red marker dye applied to concrete encased ductbank.

F. Conductor Color Coding.

1. Provide color coding for secondary service, feeder and branch circuit conductors throughout the project secondary electrical system as follows:

120/208 Volts	Phase	277/480 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray
Green	Ground	Green

2. Switch legs, travelers and other wiring for branch circuits shall be of colors other than those listed above.

3. Use conductors with color factory applied the entire length of the conductors except as follows:

   a. The following field-applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.

b. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1-inch-wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

c. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten for snug fit, and cut off excess length.

G. Power Circuit Identification.

1. Securely fasten identifying metal tags or aluminum wraparound marker bands to cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms with 1/4-inch steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb monofilament line or one-piece self-locking nylon cable ties.

2. Tag or label conductors as follows:

a. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicting source and circuit numbers.

b. Multiple Circuits: Where multiple branch circuits or control wiring or communications/ signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and voltage of branch circuit wiring may be indicated by mean of coded color of conductor insulation. For control and communications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

H. Apply warning, caution and instruction signs and stencils as follows:

1. Install warning, caution, or instruction signs where required by NEC, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items. Warning and caution signs shall be furnished and installed on, but not be limited to the following equipment and locations:

a. Entrances to rooms and other guarded locations that contain exposed live parts 600 volts or less; signs shall forbid unqualified personnel to enter.

b. Switch and Overcurrent device enclosures with splices, taps and feed-through conductors. Provide warning label on the enclosures that identifies the nearest disconnecting means for any feed-through conductors.

c. Entrances to buildings, vaults, rooms or enclosures containing exposed live parts or exposed conductors operating at over 600 volts: DANGER-HIGH VOLTAGE-KEEP OUT.

d. Metal-enclosed switchgear, unit substations, transformers, enclosures, pull boxes, connection boxes and similar equipment operating at over 600 volts shall have appropriate caution signs and warning labels.

e. Indoor and Outdoor substations operating over 600 volts. Provide warning signs, instructional signs and single-line diagrams in accordance with NEC 225.70.

I. Emergency Operating Signs: Install engraved laminated signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

J. Install equipment/system circuit/device identification as follows:

1. Apply equipment identification labels of engraved plastic-laminate on each major unit of electrical equipment in building, including central or master unit of each electrical system. This includes communication/signal/alarm systems, unless unit is specified with its own self-explanatory identification. Except as otherwise indicated, provide single line of text, with 1/4“-high lettering on 1-inch-high label (1 1/2-inch-high where two lines are required) white lettering in black field. White lettering in red field for Emergency Power Systems. Text shall match terminology and numbering of the Contract Documents and shop drawings. Apply labels for each unit of the following categories of electrical equipment.

a. Each service disconnect, to identify it as a service disconnect.

b. Panelboards (exterior and interior), electrical cabinets, and enclosures. For subpanels, identify feeder circuit served from.

c. Switches in fusible panelboards shall be labeled. Main switches shall be identified.

d. Access doors and panels for concealed electrical items.

e. Electrical switchgear and switchboards.

f. Motor control centers.

g. Motor starters, including circuit origination, HP, heater size, FLA, and mechanical equipment designation.

h. Disconnect switches.

i. Pushbutton stations.

j. Power transfer equipment.

k. Contactors.

l. Dimmers.

m. Control devices.

n. Transformers.

o. Power generating units, to include transfer switches.

p. Telephone switching equipment.

q. Clock/program master equipment.

r. Call system master station.

s. TV/AV equipment.

t. Fire alarm master station or control panel.

u. Variable frequency drives.

v. Lighting Control Equipment.

w. Uninterruptable Power Supply.

K. Post Conductor-Identification-Means labels at locations of switchboards, distribution panels and branch circuit panels. The labels shall identify the color-coding used on ungrounded conductors for each voltage system used on the premises.

L. Apply Available-Fault-Current labels at the service entrance equipment.

M. Apply Source-of-Supply labels on the exterior covers of equipment (except in single- or two-family dwellings) as follows:

1. Each switchboard supplied by a feeder.
2. Each branch circuit panelboard supplied by a feeder.
3. Each disconnect switch serving elevators, escalators, moving walks, chairlifts, platform lifts and dumbwaiters.
4. Each dry type transformer (or primary-side disconnect switch at transformer). If the primary-side disconnect is remote from the transformer, both the remote disconnect and the transformer shall be labeled, and the transformer label shall also indicate the location of the disconnect.
5. Each feeder disconnect, branch circuit disconnect, panelboard or switchboard in a remote building or structure.
6. Each on-site emergency power source, with sign placed at service entrance equipment to comply with NEC 700.

N. The label shall identify the device or equipment where the power supply originates, and the system voltage, phase or line and system at all termination, connection and splice points. For example: Feeder Power Supply for Panel “XX” Originates at Panel “XX” (or Switchboard “XX”, Transformer “XX”, Switch “XX”, etc.); 120/208 volts, 3-phase, Phase Color Identification (or 120/240, 277/480, etc.).

O. Install Arc-flash hazard labels on the following equipment:

1. Each piece of service entrance equipment.
2. Each power distribution switchboard or panel.
3. Each individually mounted circuit breaker.
4. Each branch circuit panelboard.
5. Each motor control center.
6. Each individually mounted motor starter.
7. Each meter socket enclosure.

P. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere.

Q. Install labels at locations indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

R. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics: Example; “208V 30A”.

S. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit that the device is connected to: Example; “CKT A-1”

T. Label circuit breaker feeding fire alarm panel “Fire Alarm Circuit”. Using plastic laminate label, white lettering on a red background.

END OF SECTION 26 0553

SECTION 26 0923

OCCUPANCY SENSORS

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of occupancy sensor work is indicated by drawings and schedules.

B. Types of occupancy sensors in this section include the following:

1. Dual Technology Wall Switch
2. Dual Technology Wall Switch with Dimming and Daylight Control.
3. Dual Technology Ceiling Sensor w/ Control Pack

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors that have been UL listed and labeled.

B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS:

A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

A. DUAL TECHNOLOGY WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:

1. Sensor shall utilize PIR (Passive Infrared) to turn on the lights and then PIR or US (Ultrasonic) technologies to keep lights on.
2. Sensor shall incorporate an inrush current limiter circuit to protect the relay contacts.
3. Sensor shall utilize single or dual dry relay contacts for control of the lighting loads. Contractor shall verify requirements in coordination with the drawings.
4. Sensor shall have a self-adjusting time delay, selectable 5, 15 and 30 minutes.
5. Sensor shall have automatic sensitivity adjustment and be microprocessor controlled.
6. Sensor shall have light level sensing 0 to 200 footcandles.
7. Sensor shall have a 180 degree field of view, coverage up to 800 square feet and shall detect 6 inches of hand movement towards the sensor up to 300 square feet; and body motion towards the sensor up to 1000 square feet.

8. Sensor shall be rated for 0 to 800 watts at 120VAC and 0 to 1200 watts at 277VAC.
9. Sensor shall be automatic on and shall have an automatic to off override switch on the unit. Switch shall be equipped with an air gap switch to disconnect power to the lighting load.
10. Sensor shall have real time motion indicator on the front of the unit.
11. Sensor shall mount to a single gang switch box.
12. Subject to compliance with the above requirements. Provide models of one of the following:
    a. Douglas
    b. Greengate ONW-D
    c. Wattstopper

B. DUAL TECHNOLOGY WALL SWITCH WITH DIMMING AND DAY-LIGHT CONTROL: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Dual technology sensors shall have one of its two technologies, not require motion to detect occupancy.
2. Sensors shall offer a minimum on timer of at least 15 minutes, in order to prevent all cycling of lamps before they have burned for the lamp manufacturers minimum recommended time period.
3. Sensors shall utilize an occupancy time delay that keeps lights on after last detected occupancy. Factory default setting of the occupancy time delay shall be 15 minutes.
4. Manual adjustment to the occupancy time delay so as to increase it shall be accommodated.
5. Sensor shall be capable of switching both 120 VAC and 277 VAC.
6. Sensor shall recess into single gang switch box and fit standard GFI opening.
7. Sensor shall meet NEC grounding requirements by providing a dedicated ground connection and intrinsically grounding through its mounting strap.
8. Line and load wire connections shall be interchangeable.
9. Wall switch sensor shall have field programmable adjustments for selecting operational modes, occupancy time delays, minimum on time, and photocell set-point.
10. Sensor shall be capable of both auto-on and manual operation.
11. Combination photocell/dimming sensors set point and deadband shall be automatically calibrated through the sensors microprocessor by initiating the automatic set point programming procedure. Min and max dim settings as well as set point may be manually entered.
12. Subject to compliance with the above requirements, provide models of one of the following:
    a. Douglas

b. Sensor-switch – N5X-PDT-D Series

c. Wattstopper – DW-311 (No Daylight Dimming, use when daylighting is not required)

C. DUAL TECHNOLOGY CEILING SENSOR: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic (microphonics) and infrared technologies in a single unit.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use internal microprocessor for motion signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm that adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour in response to recognition to false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce either PIR or ultrasonic sensitivity in response to false on condition.
9. Sensor microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
10. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
11. For airflow that is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
12. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar.
13. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
14. Sensor shall have selection settings for the following dual technology schemes:
    a. High Sensitivity and High Confidence (miser mode)
15. Sensor shall be available with either 180 degrees or 360 degrees coverage pattern.
16. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.
17. Sensor shall have a variety of mask inserts for PIR coverage rejection to prevent false tripping.
18. Transducers shall be protected from tampering.
19. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
20. Sensor shall have adjustable sensitivity from 0% to 100% for both ultrasonic and infrared.
21. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.

22. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.
23. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
24. Sensor shall have two (if 180 degree) or three (if 360 degree) real time LED motion indicators visible from the front of the unit: Red = infrared; green = ultrasonic.
25. Subject to compliance with the above requirements, provide models of one of the following:
    a. Douglas
    b. Hubbell-ATD Series
    c. Sensor Switch-CM-PDT Series
    d. Wattstopper-DT Series
    e. Mytech-Omni-DT Series
    f. Lithonia - LMTO Series
    g. Leviton – OSC UOW Series
    h. Greengate OMC – DT Series

D. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:

1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.
2. Control module shall consist of a DC power supply and a dry contact relay for HVAC control.
3. Control module shall be available in versions to accept 120, and 277 VAC line voltages.
4. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).
5. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.
6. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.
7. Relay function shall not require more than 5 mA control current to operate.
8. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.
9. Control module shall be sized to fit inside a standard 4” x 4” junction box.
10. Control module shall be equipped with a 1/2” EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
11. Control module shall be equipable with accessory 1/2” EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
12. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.
13. Subject to compliance with the above requirements, provide models of one of the following:
    a. Douglas

b. Hubbell-CU Series
c. Sensor Switch-PP-20 Series
d. Wattstopper-BEP Series
e. Mytech-MP Series
f. Lithonia - LPCS Series
g. Greengate SP20-MV Series
h. Leviton – OSC/OSA Series

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.

C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

D. Contractor shall be on site as required, to adjust lighting control units for proper operation.

E. Mount the switchpack in a standard 4" junction box. Mount sensor to a standard 4” junction boxes. Refer to manufacturer supplied mounting instructions.

F. All lighting programing shall meet the requirements of the IECC 2018 or current energy code applied to the project.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.

B. System start-up: Provide a factory authorized technician to verify the installation and test the system.

C. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

D. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 PRODUCT SUPPORT AND SERVICES:

A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:

1. The sensors have been fully installed in accordance with manufacturer’s installation instructions.
2. Low voltage wiring for overrides and sensors is completed.
3. Accurate ‘as-built’ load schedules have been prepared.
4. Proper notification of the impending start-up has been provided to the owner’s representative.
5. Programming of all switches, sensors, power packs, relays, etc. shall be

completed by factory authorized technician, prior to final and training.

B. Factory support: Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.

C. Functional Testing:

1. The owner shall hire a third party that will conduct and certify the functional testing.

2. Lighting controls devices shall be tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working conditions in accordance with the construction documents, manufacturer's instructions and code requirements. The following shall be performed:

a. Certify that sensors have been located, aimed and calibrated per manufacturer recommendations.

b. Status indicator operates properly.

c. Fixtures that are controlled by auto-on controls turn on to permitted level.

d. Fixtures that are controlled by manual on controls operate when manually activated.

e. Fixtures do not turn on incorrectly due to HVAC or movement outside the controlled area.

f. Confirm that occupancy sensors turn off after space is vacated and do not turn on unless space is occupied.

g. Simulate unoccupied conditions and confirm that vacancy sensors only turn on manually and turn off after space is vacated.

3. The party responsible for the functional testing shall provide documentation that the installed lighting controls meet or exceed all performance criteria and shall not be directly involved in the design or construction of the project.

3.4 WARRANTY:

A. Manufacturer shall provide a one (1) year limited warranty on lighting control system. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.5 RECORD DRAWINGS:

A. Refer to Section 26 0502 for electrical Record Drawings Requirements (Following Lighting Controls).

3.6 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 26 0923

SECTION 26 0943

LIGHTING CONTROL EQUIPMENT

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 work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of lighting control equipment work is indicated by drawings and schedules, and is hereby defined to include, but not by way of limitation, lighting control panels, control stations and other user interface devices, wiring and ancillary equipment.

B. Types of lighting control equipment specified in this section, includes the following:

1. Low voltage relay control panels
2. Occupancy sensors
3. Daylight sensors
4. Wallstations/Switches
5. Lighting Load Controllers (Room Controllers)
6. Emergency Lighting Control Units/Generator Transfer Devices

C. Requirements are indicated elsewhere in these specifications for work including but not limited to raceways, electrical boxes and fittings required for installation of lighting control equipment, not work of this section.

1.3 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. To ensure a uniform installation and single responsibility, all switching and dimming equipment described herein shall be supplied by a single manufacturer.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with lighting control equipment installation work similar to that required for project.

C. NEC Compliance: The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.

D. NEMA Compliance: The control system shall comply with all applicable portions of the NEMA Standard regarding the types of electrical equipment enclosure.

E. Codes and Standards: Provide units that meet the requirements of IEEE Std. 2000.1.1999.

F. Independent Testing Laboratory: Provide units that have been tested and listed under UL 916 energy management equipment.

G. Component Pre-testing: All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

1.4 SUBMITTALS:

A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide lighting control equipment of one of the following;

1. GreenGate Controls
2. Acuity nLight Controls
3. Hubbell Building Automation
4. Lutron Lighting Controls
5. Leviton Lighting Controls

B. The lighting controls as shown are based upon GreenGate lighting controls. Prior approval and commitment to being able to provide similar and equal system is required before bidding this project. Any system different from Cooper Controls that requires additional relays, etc. not shown on plans due to lack of separation of relays and dimming zones must be accounted for and provided in the bid and must function as similar to that which is required in final installation.

2.2 SYSTEM DESCRIPTION:

A. The lighting control system shall provide seamless control and monitoring of all lighting included in the scope of work regardless of whether it is relay switched or dimmed.

B. The lighting control system shall consist of low voltage relay control panels with programmable switch inputs, the panel shall be microprocessor controlled with a touchscreen interface display. The touchscreen shall provide relay status information viewable through a protected windowed enclosure. All local programming shall be permissible through the self-prompting touchscreen.

C. Programmable intelligence shall include:

1. Time of day control (64 time-of-day/holiday schedules)
2. 32 holiday dates
3. Timed inputs (adjustable from 1 to 99 minutes)
4. Timed override (from touchscreen, adjustable from 1 to 999 minutes, then resumes normal schedule)
5. Pre-set controls
6. Auto daylight savings adjust
7. Low voltage Dimming/Central Dimming Controls:
    a. 0-10V dimming capability
    b. Daylighting control via 0-10V dimming relays and programming
    c. DMX or other dimming protocols as indicated on plans
8. Astronomical clock with offsets
9. Local control (from touchscreen and local switch)
10. Digital wallstations/switches

11. Flash warning of impending off for occupants
12. Network override

D. The controller shall permit lighting to be overridden on for after-hours use or cleaning. The controller shall provide priority and masking choices to allow for customizing the functions of switch inputs, thereby enabling wallstations/switches to function differently at different times of day. These overrides shall be digital, network or hard-wired inputs.

E. The lighting control system shall be fully programmable through PC programming software. Programming shall be permitted through a direct RS-232 connection, modem or TCP/IP.

1. Shall include with user-friendly software suitable for operation on computer workstations which serve as central control stations for the selection and operation of lighting scenes.

2. All software shall be programed by the vendor and delivered ready to use. This program shall include preparation of all graphics, and displays required as a part of this project.

F. The control system shall provide networking between lighting control panels. The network shall support up to a maximum of 254 control panels. Panels shall permit data sharing for global controls. All inputs shall be transferable over the network to create any switching pattern.

G. The lighting control system shall log all control events. Log reports shall be available through the integral touchscreen or enterprise software.

H. All lighting programing shall meet the requirements of the IECC 2021 or current energy code applied to the project.

2.3 EQUIPMENT:

A. Relay Panel

1. Enclosure: Shall be NEMA 1 rated, code gauge steel cabinet. Enclosure and contents shall be designed to operate in interior spaces with temperatures of 32°f - 104°f (0°-40°c) and 0-90% non-condensing humidity. Enclosure shall be available with optional recessed mounting hardware. See drawings for mounting requirements and refer to schedules on drawings for sizes.
2. Interior: Interiors shall be sized to accept relays and will provide true on/off indication of relay status through LED’s. The system shall employ all modular connectors to avoid repeat wiring in case of component failure. The system CPU board shall be mounted on quick release hinge pins. All connections for the dry contact inputs shall incorporate modular connectors.
3. Power Supply: The control panel shall incorporate the use of a multi-tapped transformer. The panel shall not require specification of voltage for each control location. The voltage of 120 and 277 VAC shall be available with each control panel.
4. Cover: Provide surface cover with captive screws in hinged, lockable configuration. A wiring schedule directory card shall be affixed to the covers back to allow identification of circuits/relays/load controlled. Schedules must be typed and related to final room names and numbers (not bid document room names and numbers).
5. High Voltage Barrier: The controller shall provide the ability to provide for either voltage separation or emergency circuit separation.
6. Relays: The system shall utilize normally open control relays, that are rated to

20A at 120/277 VAC. The relays shall be mechanically latching, and shall permit individual override and LED configuration of relay status. The relays shall be rated for 10 million operations.

7. System Controller: The system controller shall consist of an integral touchscreen that provides access to the main programming features. The touchscreen shall permit the user to manually command any or all relays individually.
    a. Provide master on/off control of a relay group while still allowing individual relays to be overridden by their local switch.
    b. The control system shall permit up to 32 dry contact inputs for override purposes. Momentary 3 wire or 2 wire (toggle) inputs shall be supported. Any input shall be software linked to any number or relays.
    c. The controller shall provide timers for each override. Each override timer shall be capable of 0-999 minutes. Software shall enable or disable overrides based on priorities, masks or time of day scheduling.
    d. The controller shall accept either dry contact or analog ambient light sensors. The controller shall provide power for the sensor. Sensors shall provide for outdoor, indoor or skylight applications and issue a command to the controller once the threshold is reached.
    e. Each control panel shall incorporate diagnostic aids for confirmation of proper operation. The control panel shall employ both a backlit touchscreen and LED's to indicate:
        i. Power
        ii. System OK
        iii. Network communications
        iv. System clock and date
        v. Programming confirmation
        vi. Control panel subnet network communications
8. Emergency Relay Panels: Shall work in accordance with all governing codes and compliances and all local codes having jurisdiction. Emergency Relay panels shall operate as normal powered relay panels during normal non-emergency power conditions. In case of emergency or power outage emergency designated panels shall work independently and provide automatic and maintained full on power, illumination and control functioning to all designated egress luminaries throughout the building and project site.
9. Wallstations/Switches/Plates: The lighting controller shall support digitally addressable LED annunciated switches. Provide low voltage push-button switches in up to 6 button configurations. Provide factory engraved labeling for individual push-buttons. Provide in color to match wiring devices and coverplate to match devices and plates in Wiring Devices (Section 26 2726).
10. Photocells:
    a. Provide a photocontrol point that consists of an architecturally compatible sensor mounted in the appropriate location for measuring the available daylighting. Each sensor will have a separate calibration module mounted in an enclosure in the electrical closet.
        i. Exterior Lighting: Provide a hooded sensor that can be horizontally mounted on a ½" KO or threaded conduit. The unit shall employ a flat lens and work with a foot-candle range between 1-10 or 10-100 in 10% increments.

b. Control Unit shall allow for either direct control of up to three devices. These devices can be a relay, or any other device which allows control by a three wire momentary contact.

c. Control unit shall be switchable between four foot-candle measurement ranges (1- 10 FC, 10- 100 FC, 100- 1000 FC and 1000- 10,000 FC). Depending upon the sensor head and application.

d. Control unit shall have separate trip points for the high and low response settings. These settings shall be entered via dial switches. LED's shall be provided to illustrate whether the sensor is below the 'low' setting, above the 'high' setting, or in the deadband range.

e. Control unit shall allow for a momentary contact device to override the photocell relays to either an on or off state.

f. Control unit shall employ a 3-minute time delay between switching outputs to avoid nuisance tripping. It shall be possible to disable the time delay to aid in initial setup and trouble shooting.

g. Sensor devices shall be available to match application. Each sensor shall employ photodiode technology to allow a linear response to daylight in its given foot-candle range:

11. Low Voltage Dimming (0-10V):

    a. Capable of controlling any 0-10V source with the required dimming channels.

    b. 0-10V analog voltage signal.

    c. Provide isolated 0-10V output signal conforming to IEC 60929.

    d. Sink current via IEC 60929.

    e. Source current.

12. Indoor Lighting: Provide a sensor with a Fresnel lens providing for a 60° cone shape response area. The unit shall work with a range between 10-100 foot-candles.

13. Skylights: Provide a daylight sensor with a translucent dome with a 180° field of view and respond in the range of 1,000

14. Wallstations: Provide low voltage push-button type switches up to 8 button configurations to match requirements of lighting control within the room. Provide factory engraved labeling for individual push buttons. Provide in a color to match wiring devices and coverplates to match devices and plates in Wiring Devices (Section 26 2726). Wallstation shall connect to the room controller via the room controller local network. Wallstations that require user interface to allow for raise/lower control of dimming, loads shall include a slider function or similar. All wallstations shall have the ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer for re-programming.

15. Wiring:

    a. Provide manufacturer approved 18/2 AWG solid cabling (Dataline) with a topology free, polarity free wiring arrangement to connect lighting control devices.

        i. All dialog system cabling shall be white or gray.

    b. Provide Dataline cabling between centralized relay panel controller and other necessary building controllers via Dialog Network Dataline. The

Dialog Network Dataline allows a maximum single wiring run of 1000ft and a total aggregated length of 3000ft from all datalines originating from an LCU located in the Master Panel CLCP. Provide standard School Network drop at the main CLCP for connection to the Global Web Server.

i. Classrooms to be independent and not connected to the centralized system.

c. Programming: Provide a RS-232 (RJ-R Connection) to allow programming through either a local connection or remotely through a modem.

d. Provide wiring in conduit located within the walls and non-accessible ceilings. Provide wiring above accessible ceilings in conduit to system enclosure to system enclosure.

16. Systems Communicating & BACnet IP;

a. Enterprise Software: Provide a PC based interface software that provide access to the lighting control system files within a Windows® environment. The software shall allow individual or network panel programming to be executed locally, via direct connection or remotely through a TCP/IP connection or modem.

b. Ethernet Interface Module: Provide access to the control panels over a TCP/IP connection by converting sent information into RS-232 communication capable information.

c. Automation Interface Module to district wide BMS: The control panel shall provide for data protocol translation and permit systems that utilize the Modbus® N2, BACnet or LonWorks communication protocols to operate individual relays or relay groups.

d. Provide programming and training time to properly integrate into the Owner's BMS system. Program system per the owner's requirement. Train owner so as to allow them to have the ability to make changes to the system in the future.

B. Room Controllers:

1. The room controller shall provide the following functionality;

a. Provide interface with room occupancy sensor to provide lighting and receptacle control and be programmable as either manual on/automatic off. Provide interface with room wallstations to provide multi-level switching and/or variable dimming. Provide interface with daylight sensors to provide daylighting controls of lighting fixture via multi-level (step dimming) and/or variable dimming.

2. The room controller shall be a fully functional lighting control system to match the room lighting and control requirements. The controller shall provide the following features:

a. Separate compartments for line voltage, emergency voltage and low voltage connections.

b. Breakouts for direct conduit connections.

c. Dual voltage (120/277 VAC)

d. Low voltage connections using standard RJ-45 connectors.

e. Zero cross circuitry for each load.

f. Relay and 0-10V dimming zone configuration to match room requirements.

g. The ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer

for re-programming.

3. Emergency Lighting: When the room controller is provided with emergency relay, the controller shall be UL 924 Listed and monitor the normal power circuit. The UL 924 relay will track the normal power operation. Upon loss of normal power the emergency lighting will be forced on to full bright (if dimming) until normal power is restored. The following features shall be included:
   a. 120/277 VAC
   b. Push-to-test
4. Daylight sensors shall work with the room controller to provide automatic daylight dimming capabilities for loads connected to the room controller. The daylight sensor shall include the following features:
   a. An additional photodiode that measures only the visible spectrum.
   b. The sensor shall have three light level ranges;
      i. Low (3-300 LUX), high (30-3000 LUX) and direct sun (300-30,000 LUX).
   c. The sensor shall provide the capability of controlling multiple (up to three) daylight zones for dimming daylight harvesting.
   d. The sensor shall include an internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.
5. Ceiling Mounted Occupancy Sensors: Sensors shall utilize dual-technology (ultrasonic and infrared technologies) and have the following additional features:
   a. Sensor shall be class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
   b. Sensor shall have automatic self-adjustment algorithm that adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
   c. Sensor shall have 360 degree field of view.
   d. Sensor shall incorporate non-volatile memory such that all settings and parameters are saved in protected memory.
   e. Sensor shall have time delays from 10 to 30 minutes.
   f. Sensor shall provide a visual means of indication that motion is being detected via an LED.
   g. Sensors shall have readily accessible, user adjustable settings for time delay and sensitivity.
   h. Provide internal additional isolated relay with NO, NC and common outputs for use with HVAC control, data logging and other control options.
6. Wallstations: Provide low voltage push-button type switches up to 8 button configurations to match requirements of lighting control within the room. Provide factory engraved labeling for individual push buttons. Provide in a color to match wiring devices and coverplates to match devices and plates in Wiring Devices (Section 26 2726). Wallstation shall connect to the room controller via the room controller local network. Wallstations that require user interface to allow for raise/lower control of dimming, loads shall include a slider function or similar. All wallstations shall have the ability to be independently program or be re-programmed on site and without the need to replace or send the device to the manufacturer for re-programming.

C. Emergency Power Control (CEPC)/ Emergency Lighting Control Units (ELCU)/Generator Transfer Devices (Required when not built into Room Controller, Relay Panel, etc):

1. The Emergency Power Control (CEPC)/Lighting Control Unit (ELCU) shall provide all required functionality to allow any standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building. The unit shall be installed flush to the ceiling so that test switch & LED's are in plain view of room occupants as required by some local electrical codes.

2. The device shall automatically illuminate connected emergency loads upon utility power interruption, regardless of room switch position. (NEC 700.24)

3. Local room switch or lighting control shall turn both regular & emergency luminaires on at the same time (no dedicated emergency room switch required).

4. The emergency lighting control unit shall allow control of emergency lighting fixtures in tandem with normal lighting in an area while ensuring that emergency lighting will turn on immediately to full brightness upon loss of normal power supplying the control device. Emergency lighting operation shall be independent for each controlled area and shall not require a generalized power failure for proper operation.

5. The unit shall be compatible with 2-wire, 3-wire, 0-10V, & DALI dimming systems & ballasts.

6. The device shall be self-contained, measure 1.70" x 2.97" x 1.64," and provide integral one half inch pip nipple mount with snap in locking feature for mounting into a standard junction box KO.

7. The device shall have normally closed dry contacts capable of switching 20 amp emergency ballast loads @ 120-277 VAC, 60 Hz, or 10 amp tungsten loads @ 120 VAC, 60 Hz.

8. The device shall have universal rated voltage inputs provided for normal power sense and normal switched power at 120-277 VAC, 60 Hz.

9. The device shall have an integral momentary test switch. Pressing and holding this switch shall instantly force the unit into emergency mode and turn on emergency lighting. Releasing the test switch shall immediately return the unit to normal operation.

10. The unit shall provide dedicated leads and 24 VDC source for connection to remote test switch, fire alarm system, or other external system capable of providing a normally closed dry contact closure. Breaking contact between the terminals shall force and hold the emergency lighting on until the terminals are again closed. An integral LED indicator shall indicate the unit's current remote activation status.

11. The device shall provide separate LEDs to indicate the presence of normal and emergency power sources. The LEDs shall indicate the unit's current operational mode (normal or emergency).

12. The device's normal power input lead shall be connected to the line side of the control device such that any upstream fault causing a loss of power, including the tripping of the branch circuit breaker, will force the unit into the emergency mode and turn on the emergency lighting.

13. The unit shall automatically switch emergency lighting on and off as normal lighting is switched. When normal power is not available, the unit shall force and hold emergency lighting on regardless of the state of any external control device until normal power is restored.

14. The unit shall utilize zero crossing circuitry to protect relay contacts from the damaging effects of inrush current generated by switching electronic ballast loads.

15. The unit shall have UL 94-V0 or UL 94-5VA flame rating & be approved for installation above the suspended ceiling.

16. To ensure quality and reliability, the unit shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

17. The device shall not generate any objectionable electrical or mechanical noise.

18. The unit shall be UL and cUL listed and labeled for connection to both normal and emergency lighting power sources.

D. Interface and Accessories (Classroom Solatubes Controller Interface):

1. Provide serial data interface that connects to the room controllers local network to a third-party system for coordinated control of devices including lighting controls, solatube controls and user interfaces by either system.

   a. Provide manufacturer capable communication devices capable of communicating via standard protocols – RS-232, RS-485 and Ethernet (Preferred Method).

2. Program shades, per owner's requirements, to operate in accordance with the defined lighting presets within the space.

PART 3 - EXECUTION:

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturers written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

B. Comply with Requirements of NEC, and applicable portions of NECA's 'Standard of Installation' pertaining to general electrical installation practices.

C. Coordinate with other electrical work, including raceways, electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.

D. Electrical Identification: Refer to Section 26 0553 for requirements.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.3 PRODUCT SUPPORT AND SERVICES:

A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:

1. The control system has been fully installed in accordance with manufacturer's installation instructions.
2. Low voltage wiring for overrides and sensors is completed.
3. Accurate 'as-built' load schedules have been prepared for each lighting control panel.
4. Proper notification of the impending start-up has been provided to the owner's representative.
5. Programming of all wallstations/switches, relays, groups of relays and interfaces with building automation shall be completed by factory authorized technician, prior to final and training.

B. Factory support: Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.

3.4 PROGRAMMING:

A. Program of all lighting control systems as directed by the electrical engineer and/or owner. Meet with the electrical engineer at their office prior to preparation of shop drawings to discuss specific programming and zoning requirements of system(s). Each networked or standalone system shall be programmed to revert back to its normal "ON" position one hour after selecting a scene or raising or lowering a lighting zone.

B. All lighting programing shall meet the requirements of the IECC 2021 or current energy code applied to the project.

C. Integrate lighting controls into classroom or room AV touch Screen and Shade Controller. Provide interface as required. Coordinate with AV integrator to integrate with Touch Panel and GUI within the room. Lighting shall provide multiple presets and slider control options.

1. Sensors can be used to trigger automated settings for shades and projector screens based on room occupancy, ambient light level, etc.

2. Program lighting and shades, per owner's requirements, to operate in accordance with the defined lighting presets within the space.

3.5 COMMISSIONING:

A. A lighting control system requires at least one site visit for proper commissioning. If multiple site visits are required, the first ensures that the contractor is trained to install the system correctly. On the second, the factory trained engineer will start up the system, ensure that it is operating according to specification, and perform initial programming. The third visit is for the purposes of refining the programming, and training the owner/end user on the system.

B. Provide factory-certified field service engineer to ensure proper system installation and

operation under following parameters:

1. Certified by the equipment manufacturer on the system installed.

2. Site visit activities:

    a. Verify connection of power feeds and load circuits.

    b. Verify connection of controls.

    c. Verify system operation control by control, circuit by circuit.

    d. Obtain sign-off on system functions.

    e. Demonstrate system capabilities, operation and maintenance and educate Owner's representative on the foregoing.

3. At least three site visits to accomplish the following tasks:

    a. Prior to wiring:

        i. Review and provide installer with instructions to correct any errors in the following areas:

            1. Low voltage wiring requirements

            2. Separation of high and low voltage wiring runs

            3. Wire labeling

            4. Load schedule information

            5. Switching cabinet locations and installation

            6. Physical locations and network addresses of controls

            7. Ethernet connectivity

            8. Computer-to-network connections

            9. Load circuit wiring

            10. Connections to other systems and equipment

            11. Placement and adjustment of Occupancy Sensors

            12. Placement and adjustment of Photocells

    b. After system installation:

        i. Check and approve or provide correction instructions on the following:

            1. Connections of power feeds and load circuits

2. Connections and locations of controls
3. Connections of low voltage inputs
4. Connections of the data network

ii. Turn on system control processor and upload any pre-programmed system configuration

iii. Verify cabinet address(es)

iv. Upload pre-programmed system configuration and information to switching and/or dimming cabinets

v. Check load currents and remove bypass jumpers

vi. Verify that each system control is operating to specification

vii. Verify that each system circuit is operational according to specification

viii. Verify that manufacturers' interfacing equipment is operating to specification

ix. Verify that any computers and software supplied by the manufacturer are performing to specifications

x. Verify that any remote WAN (Wide Area Network) connections are operating properly

xi. Have an owner's representative sign off on the above-listed system functions

c. Before project completion and hand-off:

i. Demonstrate system capabilities and functions to owner's representative

ii. Train owner's representative on the proper operation, adjustment, and maintenance of the system.

C. Notification: Upon completion of the installation, the contractor shall notify the manufacturer that the system is ready for formal checkout. Notification shall be given in writing a minimum of 21 days prior to the time factory-trained personnel are required on site. Each field installed RJ45 connection must be tested prior to system interconnection. A test report must be furnished to manufacturer prior to scheduling commissioning activity. Manufacturer shall have the option to waive formal turn-on.

D. Turn-On: Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, Manufacturer's Certified Technician shall completely check the installation prior to energizing the system. Each installed relay system shall be tested for proper ON/OFF operations, and proper LED illumination. Each installed control cabinet shall be tested verifying that each controlled load adjusts to the selected setting and that all switch LED's illuminate properly.

E. Provide written commissioning report including space/room names and numbers indicating list of all lighting equipment and devices tested and verifying proper operation

of the system. Report shall include corrections, programming information/file, warranties, and owner's representative sign off on the above-listed system functions.

F. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

3.6 RETRO-COMMISSIONING:

A. During the one year warranty period, provide retro-commissioning services at three month, six month, nine month, and one year marks. Provide at least 4 hours of commissioning service for each of the four retro-commissioning periods. This will include meeting with the Owner to receive feedback on the system and making changes to the system including programming, task tuning.

3.7 MAINTENANCE:

A. Enable the end user to order new equipment for system expansion, replacements, and spare parts.

B. Make new replacement parts available for a minimum of ten years from the date of manufacture.

C. Manufacturing shall provide telephone technical support by factory personnel 24 hours a day, 7 days a week. Project cost overruns and delays can occur without this service. Answering services can add to frustration and delay the resolution of any problems or issues. Manufacturers who do not offer factory-direct technical support on a 24/7 basis should not be acceptable on this project.

D. Provide factory-direct technical support hotline 24 hours per day, 7 days per week.

E. Offer renewable annual service contracts, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

3.8 WARRANTY:

A. Manufacturer shall provide a one (1) year limited warranty on lighting control system. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.9 RECORD DRAWINGS:

A. Refer to Section 26 0502 for electrical O & M requirements.

3.10 TRAINING:

A. Provide four (4) hours of recorded training in two 2 hour sessions on the operation and use of the lighting control equipment, at job site, at no cost to the Owner.

B. Provide a USB Flash device to the owner containing the information specified below. The media shall include all information required to allow the Owner to change the schedules themselves. The media shall contain a minimum of following:

1. CAD drawing files of 'as-built' lighting control components and point to point connections.

2. General configuration programming.

3. Job specific configuration programming to include schedule.

C. Tutorial file on complete programming of lighting control system

END OF SECTION 26 0943

SECTION 26 2200

TRANSFORMERS

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 work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Extent of transformer work is indicated by drawings and schedules. Work includes complete installation and electrical connections.

B. Types of transformers in this section include the following:

1. Liquid-filled transformers
2. Dry-type Distribution Transformers

1.3 QUALITY ASSURANCE:

A. Comply with NEC as applicable to installation and construction of electrical power/distribution transformers; with applicable portions of NEMA Std. Pub. Nos. TR1 and TR27; and with applicable ANSI/IEEE standards pertaining to power/distribution transformers.

B. Comply with applicable portions of ANSI/UL 506; "Safety Standard for Specialty Transformers". Provide distribution transformers that have been UL listed and labeled.

C. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI/IEEE, NEMA, and Department of Energy standards.

1. C57.12.00 – IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
2. C57.12.28 – Pad-Mounted Equipment - Enclosure Integrity.
3. C57.12.34 – IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller (issued in March 2005 - combines C57.12.22 and C57.12.26).
4. C57.12.90 – IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.
5. C57.12.91 – Guide for Loading Mineral-Oil-Immersed Transformers.
6. NEMA TR 1-1993 (R2000) – Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels for Liquid-Immersed Power Transformers.
7. NEMA 260-1996 (2004) – Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas.
8. 10 CFR Part 431 – Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.
9. NEMA ST-20 - Dry-Type Transformers for General Applications

10. NEMA TP-1-2002 – Standards for transformer energy efficiency.

1.4 SUBMITTALS: Refer to Section 26 0502 for requirements.

A. MAINTENANCE STOCK FUSES: Refer to Section 26 0502 for requirements.

PART 2 -PRODUCTS

2.1 DRY -TYPE DISTRIBUTION TRANSFORMERS:

A. GENERAL: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of transformer):

1. Acme Transformer Company
2. GE/ABB
3. Cutler Hammer Products, Eaton Corp.
4. Federal Pacific
5. Hevi-Duty Electric Div., General Signal Corp.
6. Jefferson Electric
7. Schneider Electric/Square D Co.
8. Hammond Power Solutions
9. Siemens Energy & Automation, Inc.

C. DRY-TYPE DISTRIBUTION TRANSFORMERS (GENERAL PURPOSE):

1. Provide factory-assembled, general-purpose, air-cooled, copper wound dry-type distribution transformers where shown; of sizes, characteristics, and rated capacities indicated. Provide primary winding with minimum of 4 full capacity taps; each 2-1/2 percent, two above and two below full-rated voltage for de-energized tap-changing operation.
2. Insulate with 220 degree C. UL recognized insulation system for 80 degree C rise above 40o ambient at full load.
3. Limit sound levels to the following (as determined by ANSI/NEMA standards):
   a. 151-300 KVA 55 dB
4. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections. Equip terminal leads with connectors installed, suitable for copper or aluminum wiring. Cushion-mount transformer with vibration isolation supports. Provide transformers with ventilated, heavy gauge sheet steel enclosures. Apply manufacturer's standard light gray indoor enamel over cleaned and phosphatized steel enclosure. Provide transformers suitable for wall and floor mounting as indicated.
5. The percent impedance voltage, as measured on the rated voltage connection, shall be per Table 2.

Table 2
Percent Impedance Voltage (Dry-Type)

KVA Rating (Secondary Voltage < 700 V)	Impedance
0 - 75	3.00 – 5.75%

112.5 - 225	4.00 - 5.75%
300 and above	5.00 - 5.75%

PART 3 – EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

A. Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate transformer installation work with electrical raceway and wire/cable work, as necessary for proper interface.

C. Connect transformer units to electrical wiring system; comply with requirements of other Division-26 sections.

D. MOUNTING: Provide concrete pad under all floor mounted equipment and equipment mounted at grade. Secure equipment to pad. Refer to Section 26 0548 Electrical Seismic Control. Provide vertical and lateral support systems for all transformers that are supported from overhead structure. See drawings for support and attachment details. Provide neoprene vibration isolators at each anchor point.

E. GROUNDING: Provide tightly fastened equipment grounding and bonding connections for transformers.

F. TESTING: Upon completion of installation of transformers, energize primary circuit at rated voltage and frequency from normal power source and test transformers, including, but not limited to, audible sound levels, to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

END OF SECTION 26 2200

SECTION 26 2416

PANELBOARDS

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of panelboard and enclosure work, is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.3 QUALITY ASSURANCE:

A. Provide units that have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub No. 250, "Enclosures for Electrical Equipment (1000 volt maximum). Pub No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide of one of the following:

1. Square D Company (Basis of Design)
2. Cutler Hammer Products, Eaton Corp.
3. GE/ABB
4. Siemens Energy & Automation, Inc.

2.2 PANELBOARDS:

A. GENERAL:

1. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip "spaces" with hardware to receive breaker or switch of size indicated. Provide CU/AL rated lugs of proper size to accommodate conductors specified.

B. POWER DISTRIBUTION PANELBOARDS:

1. Provide dead-front safety type power distribution panelboards as indicated, with switching and protective devices in quantities, ratings, types and with arrangement shown. Equip with aluminum bus bars, full-sized neutral bus and ground bus. Provide fusible or circuit breaker branch and main devices as

indicated. Series rated systems are not acceptable. See Section 262815, Overcurrent Protection Devices.

C. LIGHTING AND APPLIANCE PANELBOARDS:

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown. Provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Series rated systems are not acceptable. Equip with aluminum bus bars, full-sized neutral bus, and ground bus.

D. PANELBOARD ENCLOSURES:

1. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage minimum 16-gage thickness. Provide door-in-door hinged fronts. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein Bolt engraved plastic laminate labels indicating panel name and voltage on the interior and exterior of panelboards.
2. Provide floor to ceiling panel extensions for all surface mounted panels located outside of mechanical and electrical rooms.

E. FINISH:

1. Coat interior and exterior of surface with manufacturer's standard color; baked on enamel finish.

F. ELECTRICAL IDENTIFICATION:

1. Refer to Section 260553 for requirements.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS:

A. GENERAL:

1. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.
2. Provide a surge protective device on each panelboard located on the emergency distribution system. Refer to section 26 4313 for requirements.

B. MOUNTING:

1. Provide 4" high concrete curb under floor standing distribution panelboards.
2. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosures firmly to walls and structural surfaces, ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Label circuit breakers to identify location of subpanel or equipment supplied using room numbers and equipment names. Include room number with equipment circuit designations. All directories to be typewritten.

END OF SECTION 26 2416

SECTION 26 2726

WIRING DEVICES

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

1. Receptacles
2. Switches
3. Timer Switches
4. 0-10V & ELV LED LAMP DIMMERS
5. Cord caps
6. Cord connectors
7. Flat Panel Display Wall Box

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices that have been UL listed and labeled.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 FABRICATED WIRING DEVICES:

A. GENERAL:

1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.

B. Provide wiring devices (of proper voltage rating) as follows:

	RECEPTACLE	SWITCHES			
MFGR		1-POLE	3-WAY	4-WAY	W-PILOT
Hubbell	BR20XTR	HBL 1221	HBL 1223	HBL 1224	HBL 1221-PL

Bryant		1221	1223	1224	1221-PL
Pass Seymour	TR63X	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	TWR20-X	1221	1223	1224	
Cooper	TR5362	1221	1273	1224	1221-PL

C. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.

D. SURGE PROTECTIVE (SPD) RECEPTACLES:

1. Provide SPD receptacles having 4 series parallel 130V MOV's capable of a minimum of 140 joules suppression. Provide units with visual (and audible) surge status indicators to monitor condition of surge circuit; visual indicator to be "on" when power present and suppression circuit is fully functional. (Audible indicator shall sound a "beep" alarm approximately every 30 seconds if suppression circuit has been damaged.) Provide NEMA 5-20R, 20 amp, 125V receptacle of one of the following manufacturers:

	MANUFACTURER	
SPECIFICATION GRADE	HUBBELL	PASS SEYMOUR
Duplex Recept-Visual only	5350	5352 XXXSP
Duplex Recept-Visual/Audible	5352	5362 XXXSP
Single Recept-Visual only	5351	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG5352S	IG5362 XXXSP
Single Recept-Isol Gnd, Visual only	IG5351S	N/A
HOSPITAL GRADE	HUBBELL	PASS SEYMOUR
Duplex Recept-Visual/Audible	8300HS	8300 XXXSP
Single Recept-Visual only	8310HS	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG8300HS	IG8300 XXXSP
Single Recept-Isol Gnd, Visual only	IG8310HS	N/A

2. Provide (1) SPD receptacle in all Flat Panel Display Wall Boxes (‘DP’ symbol)

3. Color of devices selected by Architect. Provide red devices on all emergency circuits.

E. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade where required elsewhere by specification or drawings. Provide units of one of the following:

a. P&S/Sierra

b. Hubbell

c. Leviton

d. Square D

F. USB RECEPTACLE

1. Provide duplex receptacle with two (2) USB 3.0 amps, 5VDC, 2.0 Type A charging ports.

2. Provide products of one of the following:

a. Bryant – USB20-X
b. Cooper – TR7736-X
c. Hubbell – USB20X2-X
d. Legrand – TR5362USB-X
e. Leviton – T5832-X

G. TAMPER RESISTANT RECEPTACLES:

1. Per OSD, no tamper resistant receptacles shall be provided.

H. WEATHER-RESISTANT RECEPTACLES

1. Provide weather-resistant receptacles in outdoor locations such as under roofed open porches, canopies, marquees, etc.

2. Provide products of one of the following:

a. Pass & Seymour 2095TRWRXXX.
b. Hubbell GFTR20XX

I. CORD CAPS AND CONNECTORS:

1. Provide 3, 4 and 5-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment, and as indicated otherwise on drawings.

2. Provide products of one of the following:

a. Cooper
b. General Electric
c. Hubbell
d. Leviton
e. P&S

J. TIMER SWITCH:

1. Provide a timer switch with the following features and functionalities. Provide switch that mounts in a standard wall box. Provide a Decora style cover plate that matches the other switches on the project. Provide color of switch chosen by Architect.

a. Provide Digital time switches that automatically turn lights off after a preset time. User programmable wall switch for astronomical and scheduled control. Electroluminescent back-lit LCD shows timer countdown. Compatible with all electronic ballasts, ELV, MLV, LED, and motor loads.

i. Wattstopper TS-400: 120/277VAC; 50/60 Hz

ii. Greengate

b. Provide Astronomical time switches that automatically turns lighting or other loads on and off according to user programming. Time-out settings range shall range from 5 minutes to 12 hours for flexibility. Electroluminescent back-lit LCD shows timer countdown. Compatible with all electronic ballasts, ELV, MLV, LED, and motor loads. Program schedule per the owner's requirements.

i. Wattstopper RT-200: 120/277VAC; 50/60 Hz

K. 0-10V & ELV LED LAMP DIMMERS:

1. Provide single-pole, semi-conductor modular type 0-10V control for 0-10V fluorescent ballasts/LED drivers & 3-wire fluorescent ballast/LED driver dimmers for fixtures; 60 hertz, with wattage and voltage as indicated, continuously adjustable slider control, and with electromagnetic filters to reduce noise and interference to minimum. Construct with continuously adjustable trim potentiometer for adjustment of low end dimming. Dimmer shall match lamp/ballast combination. Color as selected by Architect. Provide devices manufactured by one of the following:

a. Pass & Seymour (Titan Series)

b. Lutron (Nova Series)

c. Lutron (Diva Series)

2.2 WIRING DEVICE ACCESSORIES:

A. WALL PLATES:

1. Provide stainless steel cover plates in all finished areas. Provide galvanized steel plates in unfinished areas. Provide blank coverplates for all empty outlet boxes.

B. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 406-8 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers that provide complete protection with the cord and cap inserted into the wiring device. Provide units that mount on either single or double gang devices.

2. Provide products of one of the following extra-duty low-profile expandable in-use weatherproof covers for exterior mounted installations:

a. Intermatic:

i.	WP7000W	Single-Gang/White Cover
ii.	WP7000G	Single-Gang/Gray Cover
iii.	WP7000BR	Single-Gang/Brown Cover
iv.	WP7200W	Double-Gang/White Cover
v.	WP7200G	Double-Gang/Gray Cover
vi.	WP7200BR	Double-Gang/Brown Cover

b. TayMac:

i.	ML500W	Single-Gang/White Cover
ii.	ML500G	Single-Gang/Gray Cover
iii.	ML500Z	Double-Gang/Brown Cover

iv. ML2500G Single-Gang/Gray Cover

c. Color chosen by architect.

3. Provide products of one of the following for roof mounted installations:

a. Intermatic WP1020 or WP1030

b. P&S WIUC10C or WIUC20c

2.3 FLAT PANEL DISPLAY WALL BOX:

A. Provide a factory assembled display wall box made of 14 gauge steel. Wall box shall have provisions for a UL Listed single gang box for mounting of duplex receptacle and additional back box with a minimum of (1) 1 ¼" conduit opening to allow for low voltage terminations. Coordinate low voltage plate configuration with drawings. Provide device manufactured by one of the following:

1. Stud Walls:

a. FSR Metal Products – PWB-100

i. Provide additional PN: 54406 Low-Voltage Conduit Entry Box (as required for conduit entry from top/bottom)

b. FSR Metal Products – PWB-FR-450 (Use at fire rated walls)

2. Masonry Walls

a. FSR Metal Products – PWB-CMU8

PART 3 – EXECUTION

3.1 GENERAL

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.

C. Where stranded conductors have been utilized, provide solid pigtails to terminate at device.

D. Provide receptacles in surface raceway at 12" on center unless indicated otherwise.

E. Install wiring devices only in electrical boxes that are clean; free from excess building materials, dirt, and debris.

F. Install blank plates on all boxes without devices.

G. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.

H. Install GFI receptacles for all receptacles installed in the following locations:

1. Restrooms, locker rooms, kitchens, within 6 feet of any sink, or when serving vending machines and electric drinking fountains.

2. Indoor wet locations, non-dwelling garages, elevator rooms and pits.
3. Outdoors, and on rooftops.
4. Dwelling unit garages, crawlspaces and unfinished basements, accessory buildings, boathouses, and receptacles for boat hoists.
5. Label all receptacles (non-GFI), protected downstream of a GFI receptacle or protected by GFI circuit breaker, with an indication that it is protected.

I. Where light switches or wall box dimmers are specified, provide a separate neutral for each phase of the branch circuits that switches or dimmers are connected.

J. Electrical Identification: Refer to Section 260553 for requirements.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

A. At time of substantial completion, replace those items, that have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING:

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 26 2726

SECTION 26 2815

OVERCURRENT PROTECTIVE DEVICES

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 262413, Switchgear and Switchboards, and Section 262416, Panelboards.

B. Contractor shall verify type and cost of all overcurrent protective devices required within existing gear and panelboards. Contractor shall include the necessary cost to provide devices within their bid.

C. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:

1. Molded case thermal circuit breakers
2. Molded case solid-state circuit breakers

D. Refer to other Division-26 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE:

A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):

B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:

1. Cutler Hammer Products, Eaton Corp.
2. General Electric Co.
3. Square D Co.
4. Siemens Energy and Automation

C. MOLDED CASE THERMAL TRIP CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.
2. Circuit breakers 15 amps through 399 amps shall be molded case thermal trip circuit breakers.

D. MOLDED CASE SOLID-STATE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case solid-state circuit breakers for power distribution switchgear and switchboards. Provide breakers of amperage, voltage and RMS interrupting rating shown, and with solid-state trip mechanisms. Breakers shall be UL listed for application at 100% of their continuous ampere rating.
2. Circuit breakers 400 amps through 1199 amps shall be molded case solid-state circuit breakers.
3. Solid-state trip mechanisms shall have the following functions: Adjustable long time ampere rating; adjustable long time delay; adjustable short time pick up; adjustable short time delay and adjustable instantaneous pick up.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.

B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.

C. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.

D. After the switchgear is energized and just prior to Substantial Completion, the contractor shall ensure that the field-adjustable circuit breakers and solid-state circuit breakers and associated trip mechanisms have been set to the appropriate settings as recommended by the equipment Manufacturer (or as recommended by the electrical contractor's Protective Device Study if section 260573 has been included in the project). Time-current trip curves and trip setting information as was required in the Submittal portion of this specification shall be made available by the contractor at this time. Provide adjustments to circuit breakers and switchboard AIC ratings as deemed necessary by the analysis/report, with no additional cost to the Owner. Provide over current protection devices with larger frame sizes to ensure coordination has been achieved.

E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

F. Electrical Identification: Refer to Section 260553 for requirements.

3.2 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 26 2815

SECTION 26 2816

MOTOR AND CIRCUIT DISCONNECTS

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedule. Work includes complete installations and electrical connections.

1.3 QUALITY ASSURANCE:

A. Provide motor and circuit disconnect switches that have been UL listed and labeled. Comply with applicable requirements of NEMA Standards Pub. No. KS 1, and NEC.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

1. Cutler Hammer Products, Eaton Corp.
2. Square D Company
3. General Electric Company
4. Siemens Energy & Automation, Inc.
5. Cooper Bussmann

2.2 FABRICATED SWITCHES:

A. GENERAL: Provide disconnect and safety switches as indicated herein. Provide:

1. General duty switches on 240 Volt rated circuits.
2. Heavy duty switches on 480 volt rated circuits.
3. HP rated switches on all motor circuits.

B. GENERAL DUTY SWITCHES: Provide general-duty type, sheet-steel enclosed switches, fusible or non-fusible as indicated of types, sizes and electrical characteristics indicated; rated 240 volts, 60 hertz; incorporating spring assisted, quick-make, quick-break mechanisms. Provide single phase or three phase and with solid neutral as required by application. Equip with operating handle that is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application, unless noted. Provide fusible switches with Class R rejection fuse clip kits.

C. HEAVY-DUTY SWITCHES: Provide heavy-duty type, sheet-steel enclosed safety switches, fusible or non-fusible as indicated, of types, sizes and electrical characteristics indicated; rated 600 volts, 60 hertz; incorporating quick-make, quick-break type mechanisms. Provide single phase or 3 phase, and with solid neutral as required by application, Equip with operating handle that is capable of being padlocked in OFF position. Provide NEMA 1 or NEMA 3R as required by application unless noted. Provide fusible switches with Class R rejection fuse clip kits.

D. FUSES: Provide fuses for switches, as required of classes, types and ratings needed to fulfill electrical requirements for service indicated. Provide spare fuses amounting to one spare fuse for each 10 installed but not less than three of any one type and size. See Section 262815 Overcurrent Protective Devices for fuse types.

E. Electrical Identification: Refer to Section 260553 for requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES:

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation" and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Install disconnect switches used with motor driven appliances, and motors and controllers within sight of controller position.

D. For disconnect switches serving motors controlled by variable frequency drives, provide late-make, early-break auxiliary contacts on each disconnect switch. Provide Heavy-Duty switch. Wire auxiliary contact to VFD safety contact, such that disconnecting the motor will shut down the drive first, and closing the switch will start the drive only after power is applied to the motor.

E. For all disconnect switches serving single elevator applications, provide a Cooper Bussman Quik-Spec™ Power Module™ Switch.

1. Elevator Shutdown
2. Shunt Trip Voltage Monitoring
3. Selective Coordination
4. Fire safety signal interface
5. Auxiliary Contact (Hydraulic Elevator)
    a. Wire auxiliary contact to auxiliary power such that disconnecting the motor will disconnect the auxiliary power.

END OF SECTION 26 2816

SECTION 26 2913

MOTOR STARTERS

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 work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of Division-26 sections making reference to motor starters specified herein.

1.2 DESCRIPTION OF WORK:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Types of motor starters in this section include the following:

1. AC Fraction Horsepower Manual Starters
2. AC Line Voltage Manual Starters
3. AC Non-Reversing Magnetic Starters
4. AC Combination Non-Reversing Magnetic Starters

1.3 QUALITY ASSURANCE:

A. Comply with NEC and NEMA Standards as applicable to wiring methods, construction and installation of motor starters. Comply with applicable requirements of UL 508, "Electric Industrial Control Equipment", pertaining to electrical motor starters. Provide units that have been UL-listed and labeled.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

1. Allen-Bradley Co.
2. Appleton Electric Co.
3. Crouse-Hinds Co.
4. Eaton Corp., Cutler Hammer Products
5. General Electric Co.
6. Siemens Energy & Automation, Inc.
7. Square D Co.

B. MAINTENANCE STOCK, FUSES: For types and ratings required, furnish additional fuses, amounting to one unit for every 10 installed units, but not less than 5 units of each, for both power and control circuit fuses.

2.2 MOTOR STARTERS:

A. GENERAL: Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated that comply with manufacturer's standard materials, design and construction in accordance with published information and as required for complete installations.

B. THERMAL OVERLOAD UNITS: Provide thermal overload units, sized to actual running full load current, not to motor plate current. Size heaters for mechanical equipment after air and water balancing have been completed.

C. AC FRACTIONAL HP MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide manual, single-phase, 1 and 2 pole, 300 volt AC max, fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with one piece thermal overload relay with field adjustment capability of plus or minus 10 percent of nominal overload heater rating; for protection of AC motors of 1 HP and less. (For manually controlled motors in excess of 1 HP, see Line Voltage Manual Starters specified herein). Provide starter with quick-make, quick-break trip free toggle mechanisms, green pilot lights, and with lock-off toggle operated handle. Mount surface units in NEMA 1 enclosures, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location unless noted otherwise. Provide flush mounted units with coverplate to match wiring device coverplates.

D. AC LINE VOLTAGE MANUAL STARTERS (EQUAL TO SQUARE D CLASS 2510): Provide line voltage manual starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt AC max; equip with pushbutton operator, low voltage protection feature, and green pilot light. Provide starters with trip free mechanism such that contacts will open under load and remain open until thermal element has cooled, and unit is reset. Mount surface units in NEMA 1 enclosure, unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Provide overlapping trim for flush mounted units.

E. AC NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8536): Provide line voltage magnetic starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volt max, with thermal overload protection in all phases and inherent under voltage release. Equip units with holding contact, 2 normally open, and 2 normally closed auxiliary contacts, unless noted otherwise. Provide fused control transformer in each starter and 120V control coil. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide NEMA 1 enclosure unless noted otherwise. Provide NEMA 3R enclosure in exterior or damp location, unless noted otherwise. Equip all spare starters complete with items as specified herein.

F. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8539): Provide line voltage combination starters, of types, ratings and electrical characteristics indicated; 2 or 3 pole, 600 volts max with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with motor circuit protector. Provide motor circuit protector, instantaneous trip circuit breaker as indicated and adjust to comply with manufacturer's recommendations. Mount hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide combination starters for individual mounting, or for group mounting in motor control center as indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise. Provide NEMA 1 enclosures unless otherwise indicated.

G. AC COMBINATION NON-REVERSING MAGNETIC STARTERS (EQUAL TO SQUARE D CLASS 8538): Provide line voltage combination starters, of types, ratings, and electrical characteristics; 2 or 3 pole, 600 volt maximum with non-reversing magnetic starters as specified herein; in common cubicle or enclosure with fusible disconnect switch. Provide quick-make, quick-break, disconnect for NEMA sizes 1, 2, 3, and 4; and visible blade, automatic circuit interrupters with push-to-trip feature and separate fuse clips for larger NEMA sizes. Fuse all starters with dual-element (time-delay) fuses equal to Bussman FRN/FRS-R. Equip disconnect switch with Class R rejection fuse kits. Mount

hand-off-auto switch, red pilot light, and reset button in face of enclosure. Provide combination starters for individual mounting, or for group mounting in motor control centers as indicated. Provide NEMA 1 enclosures unless otherwise indicated. Provide NEMA 3R enclosure in exterior or damp locations, unless noted otherwise.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS:

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA standards, and NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install fuses in fusible disconnects, if any. Mount chart inside each starter indicating heater type, size, and ampere ratings available.

C. Electrical Identification: Refer to Section 260553 for requirements.

3.2 ADJUST AND CLEAN:

A. Inspect operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL:

A. Subsequent to wire/cable hook-up, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION 26 2913

SECTION 26 4119

DEMOLITION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2 Specification sections, apply to work of this section.

B. This section is a Division-26 Basic Materials and Methods section, and is part of each Division-26 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.

B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.

C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.

D. Refer to sections of other Divisions for applicable requirements affecting demolition work.

E. Refer to Section 260500 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

A. NEC COMPLIANCE:

1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL:

A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

3.2 PATCHING AND REPAIR

A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.

B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, roofing, etc.

C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

3.3 EXISTING EQUIPMENT

A. The following is a part of this project and all costs pertaining thereto shall be included in

the base bid.

B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.

C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.

D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.

E. When installing equipment in the existing building, it shall be concealed.

F. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.

G. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.

H. Existing raceways may be used where possible in place, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated. Re-used raceway shall meet all requirements for new installations.

I. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.

J. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 26 4119

SECTION 26 5100

INTERIOR AND EXTERIOR BUILDING LIGHTING

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 work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Types of lighting fixtures in this section are indicated by schedule and include the following:

1. LED (Light Emitting Diode)

1.3 QUALITY ASSURANCE:

A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Provide lighting fixtures that have been UL-listed and labeled.

B. Components and fixtures shall be listed and approved for the intended use by a National Recognized Testing Laboratory (NRTL) including: UL, ETL, and CSA or equivalent

C. All led products shall comply with the latest version of Illuminating Engineer Society (IES) publications LM-79 and LM-80.

1.4 SUBMITTALS:

A. Refer to Section 260502 for electrical submittal requirements.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):

1. LED:

a. Cree

b. Nichia

c. Samsung

d. Philips Lumiled

e. Osram

f. Xicato

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, LED drivers, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with

damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.

C. LIGHT EMITTING DIODE (LED) LUMINAIRES:

1. LED luminaires that can be serviced in place shall have a disconnecting means internal to the luminaries to disconnect simultaneously from the source of supply all conductors of the driver, including the grounded conductor. Disconnects shall not be required under the following exceptions:

   a. Luminaries located in hazardous locations.

   b. Luminaries used for egress lighting.

   c. Cord-and-plug luminaries.

   d. In industrial establishments with restricted public access where conditions of maintenance and supervision ensure that only qualified persons service the installation.

   e. Where more than one luminaire is installed in a space and where disconnecting the supply conductors to the luminaire will not leave the space in total darkness.

   f. Provide LED luminaires which are tested in accordance with IES LM-79, diodes tested in accordance with IES LM-80, and provide a minimum R9 rating of ≥ 50 (unless specified differently), a CRI rating of ≥ than 80 and L70 (6K) = 50,000 hours (IES TM-21). Provide with 0-10V dimming drivers as standard.

   g. The fixture manufacturer(s) shall warrant the luminaires, in their entirety, to be free from defects in material or workmanship for at least 5 years from date of manufacture. Provide warranty in accordance with other sections of this specification and include a certificate of warranty from the fixture manufacturer with extended warranty information and proper forms and procedure description.

D. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

E. ACOUSTICAL CEILING BAFFLES (LIT & UNLIT):

1. LIT Version:

   a. Modular LED tray assembly comprising reflector and light engine with quick disconnect wire-harness for ease of installation and maintenance over the life of the luminaire.

   b. Offered with our next generation Neo-Ray light engine delivering industry leading efficacy and long-life

   c. 0-10V Dimming Driver

2. Surface Texture: Medium.

3. Composition: Polyester (PET) felt.

4. Color: Custom and as selected by architect from full-range of wood-inspired textures.

5. Size: 3” X 8” (lengths per plan)
    a. See Architectural for UNLIT Baffles
    b. See Electrical for LIT Baffles
6. Spacing 12” O.C.
    a. Suspended from ceiling and/or deck. Match architectural details for suspension heights.
7. Connection: Feltlock connection to Unistrut -P1000 series.
8. Basis-of-Design-Product Product: “Define LED Acoustic Luminaire”, as manufactured by Neo-Ray

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.

B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.

C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

D. FIXTURE WHIPS:
    1. Provide each lay-in light fixture with at least 36" (Not to exceed 72") of 3/8" steel flexible conduit.
    2. With-in spaces utilizing 0-10v control schemes ie: Room Controllers, the fixture whip shall be comprised of a MC-PCS Cable (see Section 26 0532 Conduit raceways) with at least 36” and not to exceed 72” in length located above removable grid ceilings.

E. Coordinate lighting in mechanical room with duct and equipment locations to avoid obstruction of illumination.

F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to ensure fire rating of each ceiling that the fixtures are installed in.

G. COORDINATION MEETINGS:
    1. Meet at least twice with the architect and ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.
        a. Coordinate mounting height of pendant and wall mounted fixtures.
        b. Coordinate conduit layout in all open ceiling spaces e.g. Gym, Commons, Auditorium, etc. with architect prior to rough-in.

2. Meet at least twice with the AV/Intercom systems Installer. Hold first meeting before submittal of shop drawings to coordinate each AV equipment, speaker mounting condition with ceiling type. During second meeting, coordinate AV equipment, speaker layout in each area.

3. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.

H. ADJUST AND CLEAN:

1. Clean lighting fixtures of dirt and debris upon completion of installation.

2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.

3.2 FIELD QUALITY CONTROL:

A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.

B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.

C. At the time of Substantial Completion, replace lamps in interior lighting fixtures that are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.

D. GROUNDING:

1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 26 5100

SECTION 27 1500

TELEPHONE/DATA SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF DOCUMENT:

A. The following are project specifications that all cabling systems must adhere to. These specifications apply to all installers (hereinafter referred to as “the Contractor”) for all sites, that require, standards-compliant structured cabling systems and shall be used for all the installation, testing, and acceptance of the information transport systems as described in the attached specifications. Prices quoted of the installation facilities shall be all-inclusive and represent a complete installation at such sites as prescribed in this specification and contract documents. The Contractor shall be solely responsible for all parts, labor, testing, acceptance and all other associated processes and physical apparatus necessary to turn-over a completed system fully warranted and operational for acceptance by the Customer. Final acceptance of the installation shall be in writing by the Architect and Engineer.

B. In all instances where Standards are cited, it is assumed Installer will have familiarity with and implicitly follow the recommendations of the most current version of the Standard referenced at the time of installation. Compliance with most current Standards is the sole responsibility of the Contractor.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Division-7 Firestopping, apply to work of this section.

C. Division-26 Basic Materials and Methods sections apply to work specified in this section.

D. Refer to and coordinate with specification 27 4100 for any audiovisual equipment requiring UTP based category and/or optical fiber cabling and connectivity. Division 27 1500 shall provide installation and execution requirements for all category and/or optical fiber cabling and connectivity required within the audiovisual system.

E. Specification 26 0500 Part 1.3 Phasing and Sequencing of Work.

1.3 SCOPE OF WORK:

A. Expansion of existing on-premise structured cabling system as required for this project. Provide one new TR as indicated on plans and to support the new addition. Refer to plans and specifications for

B. Contractor shall provide complete cable and outlet system as indicated on the drawings and described herein. Work shall include all associated infrastructure transmission components and support appliances including, but not be limited to cable, jacks, terminal blocks, racks, cabinets, wire management, labeling, transient voltage surge suppression, patch cords, telecommunications grounding system and all terminations as specified herein.

C. Contractor shall provide system testing as described herein using up-to-date and industry accepted Level IIIe, IV, V test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. All testers used shall be factory calibrated within one year of use with references set daily prior to testing.

D. All active equipment (electronics) will be owner furnished and owner installed.

E. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other associated processes and physical apparatus necessary to turn-over the completed system fully warranted and operational for acceptance by Owner and Engineer.

F. Contractor shall provide all labor, materials, tools and equipment required for the complete installation of work called for in the Construction Documents.

G. Copper solution must match optical fiber solution and be provided by the same manufacturer. No two separate warranties are acceptable for the copper connectivity and optical fiber connectivity.

H. Contractor shall provide a minimum size of 1-1" EMT conduit from telecommunications outlet/connector to accessible ceiling space, then utilize non-continuous cable support devices to ventilated trough/cable tray.

1.4 CONTRACTOR QUALIFICATIONS

A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to voice and data network systems. The Contractor shall at a minimum possess the following qualifications:

1. Must have at a minimum (1) RCDD certified individual employed full time at the time of bidding and throughout entire project. **PROVIDE PROOF OF RCDD CERTIFICATION IMMEDIATELY UPON JOB AWARD**.

2. Approved and certified by connectivity manufacturer. Provide proof of certification immediately upon job award.

3. BICSI Certified Installers or equivalent.

4. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

5. Have a minimum of 5 years in the communications structured cabling business and be able to provide three owner references for the type of installation described in this specification for projects within the last 18 months.

6. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must own not rent a light meter or fiber test adapter head, and OTDR and shall be factory certified by the manufacturer of the products being installed.

7. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

8. 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.

9. Be factory certified by the manufacturer used in installation of all transmission components of all copper and fiber links and able to provide the manufacturer warranty.

1.5 QUALITY ASSURANCE

A. Required Pre-Telecommunications Construction Meeting with Communications Engineer: Electrical contractor/representative AND Communications Contractor will be required to attend a pre-communications construction meeting (approximately 30-60 minutes) with Communications representative in the electrical engineer's office prior to communications construction commencement. This meeting will address any questions on the part of the contractor and the expectations of the Engineer with regard to specifications, plans and site visits for both rough and finish electrical work.

B. Owner IT Contact:

1. **Jordan Rogers; jordan@millardk12.org**

C. BNA IT Contact:

1. **Eric Skinkis; eskinkis@bnaconsulting.com, 801-532-2196**
2. **Drayton Bailey; drayton@bnaconsulting.com, 801-532-2196**

1.6 APPLICABLE CODES AND STANDARDS

A. Contractor is responsible for compliance with all applicable portions of the NEC code as to type of products used and installation of components. All materials used shall be products and materials that have been UL-listed and labeled. All installed products shall comply with applicable NEMA standards for low loss extended frequency cable.

B. In addition, installation shall adhere to the following Standards:

1. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises, or most recent edition at the time of installation
2. ANSI/TIA-568-C.1 – Commercial Building Telecommunications Cabling Standards, or most recent edition at the time of installation
3. ANSI/TIA-568-C.2 - Balance Twisted Pair Communications and Components Standards, or most recent edition at the time of installation
4. ANSI/TIA –942 -Telecommunications Infrastructure for Data Centers, or most recent edition at the time of installation
5. TIA-569-B - Commercial Building Standard for Telecom Pathways and Spaces, or most recent edition at the time of installation
6. ANSI/TIA-606-A – Administration Standard for the Telecommunications Infrastructure of Commercial Buildings, or most recent edition at the time of installation
7. ANSI/NECA/BICSI-607 - Commercial Building Grounding/Bonding Requirements, or most recent edition at the time of installation
8. ANSI/TIA 1152 – Testing of Copper Links
9. BICSI Telecommunications Distribution Methods Manual, 13th edition or most recent edition at the time of installation.
10. TIA 758-A - Customer owned Outside Plant Telecommunications Infrastructure Standard (2004), including all applicable addenda and the most recent revision at the time of installation.
11. BICSI Information Transport Systems Installation Manual - 5th edition or most recent edition at the time of installation.
12. ANSI/NFPA-70 - 2017 National Electrical Code, revision, or most recent revision at the time of installation.
13. ANSI/IEEE C-2 - 2017 National Electrical Safety Code or most recent revision at the time of installation.
14. OSHA Standards and Regulations All applicable
15. Local Codes and Standards All applicable

C. Note: Anywhere cabling standards conflict with electrical or safety codes, Contractor shall defer to NEC and any applicable local codes or ordinances, or default to the most stringent requirements listed by either. Knowledge and execution of applicable codes is the sole responsibility of the Installer. Any code violations shall be remedied at the Contractor's expense.

1.7 ACCEPTABLE MANUFACTURERS:

A. General:

1. Unapproved product substitutions are not allowed. Contractor wishing to substitute any products for those expressly specified shall submit three samples of the alternate product to Engineer no less than two weeks prior to the last addendum accompanied by all engineering documents, drawings and third party test data proving mechanical and transmission equivalency. Acceptance of substitutions shall be received from Engineer in writing. All unapproved substitutions installed shall be removed by Contractor who shall assume all costs for removal and replacement with approved products. Such costs shall include, but not be limited to labor, materials, as well as any penalties or fees for late completion.

B. APPROVED MANUFACTURERS:

1. Contractor shall select only one line item in the each section of Parts 2, 3, and 4. Contractor shall NOT utilize multiple line items for the project within each Part. For example, if Panduit / General Cable is selected to be used for the project, all copper cabling and connectivity shall be by Panduit or General Cable. No other manufacturer or combination of manufacturers may be used for the copper cabling or connectivity equipment.

2. Copper Cabling / Connectivity Approved Manufacturers:

a. Match existing manufacturer

3. Non-Cabling / Connectivity Approved Manufacturers:

a. Same manufacturer from Part 2.

b. Chatsworth

1.8 SUBMITTALS: Refer to Section 26 0502 for requirements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. All products shall be in new condition and UL listed.

B. Provide complete raceway, outlet boxes and miscellaneous items. All conduit utilized shall be EMT grade.

C. Provide 5” x 2.875" (or 4-11/16” x 3.25” square) deep square outlet box at each outlet location with single gang plaster or tile ring. Provide wall board adapters / accessories as necessary.

1. Approved solutions:

a. RANDL 5 Square Telecommunications Outlet Box Model TX-550-YY where “X” could be a bracket box and “YY” could be knockout arrangements.

b. Hubbell Large Capacity Wall Box Model HBL260. If a 2” knockout is required for installation purposes, provide this box.

D. Communication grounding and bonding shall be constructed and installed to meet or exceed the requirements of the National Electrical Code (NEC), IEC 1000-5-2 and ANSI/J-STD--607-A throughout the entire grounding system.

E. All termination hardware shall be rated to meet specified cabling specifications.

2.2 ENTRANCE FACILITY (EF) / EQUIPMENT ROOM (ER) / TELECOMMUNICATIONS ROOM (TR)

A. General:

1. Contractor shall be responsible for the adequate and appropriate design of all racking systems, paying particular attention to sizing of all cable management

troughs and supports both horizontal and vertical installation of patch panels and wire management into rack.

2. Provide line surge suppressors at main telephone board in ER for all incoming phone lines if not provided by service provider. Provide ground connection to TMGB.

3. School District Specific Backbone Requirements:

   a. Provide 12 Strand Armored Single mode OS2 Fiber from the ER/MDF to each TR/IDF. Provide (2) Cat6A from the ER/MDF to each TR/IDF.

B. Provide the following, see specifications for each item in this document:

1. Wall Linings in each EF, ER, and TR:

   a. In addition to the architectural walls, provide plywood wall lining that mounts at 8" A.F.F that shall:

      i. Be fire-rated or treated on all sides with at least two coats of fire-resistant light-colored paint. Fire-retardant plywood is also acceptable. Leave fire rated stamp on plywood unpainted.

      ii. Have walls lined with A/C grade or better, void-free plywood, 8 feet high with a minimum thickness of ¾". See plans for additional wall locations.

      iii. Install the plywood with grade A surface exposed. Plywood shall be securely fastened to wall-framing members to ensure that it can support attached equipment.

      iv. Use flush hardware and supports to mount plywood.

      v. Plywood shall be void free and kiln-dried to a maximum moisture content of 15 percent to avoid warping.

2. Main Cross Connect (MC) / Horizontal Cross Connects (HC):

   a. Copper Patch Panels:

      i. Provide flush mount patch panels of required number and size to accommodate shown telecommunications outlets on plans.

      ii. Size panels to provide minimum 25% spare capacity. Fill all available space in remaining patch panels so that panels are fully populated.

      iii. Support Category 6A or higher applications.

      iv. Provide keystones or inserts to match School District specific cable system colors/identifiers.

      v. Shall accommodate 8-Pin 8-Contact (8P8C) ports.

      vi. Mount to standard EIA 19" rack.

      vii. Each patch panel shall include mounted behind it one "towel rack" style cable support bar for each 24 connections that the Contractor shall dress cables using hook and loop type cable ties.

      viii. Approved Equipment

Manufacturer	**Model Name**	**Angled Patch Panel**
CommScope	Uniprise	UNPA-6A-DM-2U-48
Panduit	NetKey	NKA6XPPG48Y

Leviton	Leviton	6A587-U48
Siemon	Z-Max	Z6A-PNLA-U48K
Belden	Rev	RVAPPA2U48BK

Manufacturer	**Model Name**	**"Towel Rack" cable support bar**
Hubbell	NextSpeed	HPRCMB

2.3 CABLING DISTRIBUTION SYSTEMS AND MISCELLANEOUS EQUIPMENT

A. General:

1. Provide plenum rated cable/connectors if required, cabling/connectors must be appropriate for the environment that it is installed in. Provide wet rated cable for all wet locations, including any conduit in or below slab on grade.
2. Contractor shall be responsible for sizing all pathways such that newly installed cable represents not more than a 35% fill as per manufacturer's directions. Overfilled pathways are the sole responsibility of the Contractor who shall remove and reinstall at Contractors expense.
3. Provide products rated for the environment that it is installed in (i.e. riser, plenum, outdoor). All cabling installed in wet locations (i.e. underground conduit, conduit in slab on grade) shall be listed for use in wet locations. Cabling rated for wet location/OSP to be ran entirely in conduit to within 50' of IDF/MDF room. OSP cabling may not be free-aired or utilize ventilated trough due to lack of plenum rating.
4. Primary Protection (Surge Protection)
    a. General
        i. Provide surge protection for each pair of copper cabling between buildings and any end point devices that are located outside. For example, if a camera is mounted or located on the exterior of the building—surge protection is required.
        ii. Surge suppressions shall be achieved through 5-pin, solid state, plug-in type modules for each conductor pair.
        iii. Provide necessary grounding of equipment to building electrical ground. Size all grounding conductor based on distance to electrical ground according to the requirements of this section.
        iv. Provide 25% spare modules.
        v. Approved Equipment
            1. For data outlets where POE is present
                a. ITWLinx 1Gb CAT6A-POE.
            2. For outlets where no POE is present
                a. ITWLinx 1Gb CAT6A-LAN
            3. For copper multi-pair backbones
                a. ITWLinx ML25-CAT5-75
            4. If power is required on all four pairs. (Note: If Cisco

switches are connected via a copper backbone, this product is required.)

a. ITWLinx 1Gb CAT6A-75

B. Horizontal Cabling Distribution System – Balanced Twisted Pair

1. General:

a. Provide appropriate number of Category 6A horizontal cables, patch cables, work area cables, for all terminated data drops, between switches, etc. so that building-wide networking will be operational once all installation is complete.

2. Horizontal Cabling

a. Provide Cat 6A UTP, min-compliant, 4-Pair 100Ω Balanced Twisted Pair Cable to all locations shown on plans.

b. Provide cabling rated for the environment that it is installed in (i.e underground conduit, conduit in slab on grade). All cabling installed in wet locations shall be listed for use in wet locations.

c. Provide a minimum of (2) cables, unless otherwise noted, to each location shown on plans.

i. Provide (2) Category 6A Shielded cables to each wireless access point (WAP).

a. Locate drops in near center of classroom in biscuit jack above ceiling grid, label on ceiling grid on locations that biscuit is used instead of faceplate.

b. WAPs should be provided at a minimum of the following locations: Lecture Hall, Cafeteria, Commons Office Areas, Counseling office, Reception Office Common Area where kids would be sitting. See plans for additional locations and provide accordingly.

c. Wireless access points to be owner furnished, owner installed (OFOI)

d. Horizontal cable colors (Verify with owner prior to ordering cable):

i. Telephone/Data = Blue

ii. Wireless Access Point (WAP) = Orange

iii. IP Surveillance Cameras = Green

iv. AV = White

v. Intercom = Purple

vi. Elevator = Black

vii. Access Control = Yellow

viii. Intrusion = Gray

e. Approved Equipment

Cat 6A				
Manufacturer	**Model**	**Riser**	**Plenum**	**WAP**
General Cable	GenSPEED 6 10,000	7133819	7131819	Shieled Cat 6A
CommScope	Uniprise	UN884031014/10	UN874035114/10	Shieled Cat 6A

Berk-Tek	LANMark-10G2	10137700 (Blue, CMR)	10130484 (Blue, CMP)	Shieled Cat 6A
Siemon		9C6R4-A5-06AR1A	9C6P4-A5-06AR1A	Shieled Cat 6A
Belden		10GXS12	10GXS13	Shieled Cat 6A

f. Field Terminable Plug (FTP)

i. Provide an FTP for each Camera. Provide two FTPs for each WAP. Confirm FTPs are compatible with WAPs.

g. Approved Equipment

WAP/Camera Field Terminable Plug	
Manufacturer	**Model**
Panduit	FP6X88MTG
Leviton	6APLG-S6A
Siemon	ZP1—6AS-01S
Belden	RVAFPUBK-S1

3. Patch and Work Area Cables:

a. Patch Cables shall match colors specified above.

b. Provide and install (1) 7-foot-long patch cable for each workstation, except for classroom locations where (1) 15-foot-long patch cable is to be provided, and (1) 5 foot or 7 foot patch cable for each patch panel port in the TR/TC. Provide half of the TR/TC patch cables in 5 foot lengths and the remaining half in 7 foot lengths. Verify final patch cable lengths with owner prior to ordering.

c. No patch or work area cords shall in any case exceed in total 10 meters as per TIA Standard unless design includes Standards compliant MUTOA (multi-user termination outlet) and work area cord adjustments are made according to recommendations for zone cabling contained within TIA 568-C or most recent revision at the time of installation. Coordinate with owner for preferred patch cord lengths at patch panel and work area.

d. Copper patch cord and work area outlet cabling must be provided by the same manufacturer and meet the same performance standards as the horizontal cabling.

e. Patch cord and work area cables shall be blue.

f. Provide (1) 6 foot, 2-strand optical fiber patch cable for each patch panel, utilizing same performance standards and connector types as specified for the backbone. The cable shall be provided by the same manufacturer and meets the same performance standards as the backbone optical fiber. Verify final patch cable lengths with owner prior to ordering.

4. Telecommunications Outlets/Connectors (See Plans for Locations):

a. Flat Faceplates:

i. Provide modular type information outlets with flat telephone jack or data outlet. Provide single gang faceplate kits to allow up to six data or voice jacks as shown on plans. Provide faceplate kits for wall outlets in colors and materials that match power wiring device plates. Provide faceplate kits that allow labeling schemes

described herein. Faceplates shall accept STP, UTP, fiber optic or audio/video modules as an option.

ii. Provide keystones or inserts to match School District specific cable system colors/identifiers.

iii. Blank off all unused ports.

iv. Color: Stainless Steel Faceplates

b. Flat Connector:

i. Color: Standard color as selected by owner/architect.

c. Approved equipment

Connector		
Manufacturer	**Model**	**Connector Cat 6A**
CommScope	GigaSPEED XL	MGS600-xxx
Panduit	NetKey	NK6X88Mxx
Leviton	QuickPort, eXtreme	6110G-Rx6
Siemon		Z6A-(xx)
Belden		RVAMJKUxx-S1

Flat Plate			
Manufacturer	**Manufacturer**	**Manufacturer**	**Manufacturer**
CommScope	GigaSPEED XL	M1XI-262	M1xSP
Panduit	Netkey	NK3FNE	NKFxs
Leviton	QuickPort, eXtreme	42080-xxL	43080-xLx
Siemon		MX-FP-S-(xx)-(xx)	MX-FP-S-(xx)-SS-L
Beldon		AX102249	AX104232

PART 3 – EXECUTION

3.1 GENERAL

A. Prior to pathway rough-in, low voltage contractor shall meet with electrical contractor to review pathway installation requirements.

B. Pathway Requirements:

1. General:

a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.

b. 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. Field coordinate alternate pathway requirements with other trades onsite. New pathways shall not exceed distance limitations defined within this

specification. Notify the Engineer of the changes for final approval prior to proceeding with the change.

c. Paint all electrical boxes and their covers for the telephone and data system matte white. See specification 26 0553 for additional identification information.

2. Ventilated Trough Within EF/ER/TR:

a. Wrapped around room (wall support is acceptable)

b. Along equipment rows leading to cross-connects.

c. Ground Trough to TGB or TMGB (whichever is closer) utilizing #6CU bare wire.

d. Coordinate tough locations with lighting, air-handling systems, and fire extinguishing systems so that fully loaded trough s will not obstruct or impede their operation.

i. Install Ventilated Trough under mechanical components for access for future cabling needs; coordinate the mounting height of the ventilated trough with Owner IT Representative prior to installation. Do not install ventilated trough at the top of a ceiling which is inaccessible due to the excessive height.

3. Racks / Cabinets:

a. Racks shall be securely attached to the concrete floor using minimum 3/8” hardware or as required by local codes.

b. Racks shall be placed with a 36-inch (minimum) clearance from the walls on all sides of the rack. When mounted in a row, maintain a minimum of 36 inches from the wall behind and in front of the row of racks and from the wall at each end of the row.

4. Conduits:

a. For any interior/exterior conduit 4” and larger, provide (3) 1.25” plenum-rated corrugated innerducts.

b. Flexible conduit is not acceptable as cable tends to creep, shift, or have sheath damage.

c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.

d. Conduit runs shall not have continuous sections longer than 100 feet without a pull box and may only be filled to 35% capacity.

e. Ream all conduit ends and fit with an insulated throat nylon bushing with non-indenter type malleable steel fittings to eliminate sharp edges.

f. Telecommunications conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.

g. Conduits that enter an EF/ER/TR must terminate near the corners to allow for proper cable racking. Terminate these conduits as close as possible to the wall where the backboard is mounted to minimize the cable route.

h. Terminate conduits that protrude through the structural floor 1” to 3” above the surface within an EF/ER/TR.

i. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.

j. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.

k. When the number of conduits requires more than one row, restrict the number of rows to two wherever practicable.

5. Open Top Cable Support Requirements:

a. Provide wide surface area open-top cable supports spaced 5 feet apart at the maximum to adequately support and distribute cable's weight. Follow manufacturer specifications for cable loading. Provide supports that have a galvanized finish with wide base specifically for telecommunications cabling.

b. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables

c. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

d. Multi-tiered non-continuous cable support assemblies shall be used where separate cabling compartments are required. Assemblies shall consist of a steel angled hanger bracket holding up to six non-continuous cable supports.

e. Approved Equipment

i. Erico Caddy-Cat HP

6. Pull Box Requirements:

a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.

b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90-degree bends, or contain a reverse bend.

c. Conduits that enter the pull box from opposite ends should be aligned.

d. Pull boxes shall have a length 12 times the diameter of the largest conduit.

e. All pull boxes must be accessible.

C. Cabling System:

1. Follow T568B scheme for copper cabling terminations.

2. Life Safety Related Cabling:

a. Provide the specified category cabling in 1" conduit from elevators and or lifts. Cabling shall terminate at telephone service demarcation point.

b. Provide the specified category cabling in 1" conduit for two phone lines to the fire alarm control panel back to telephone service demarcation point.

c. Provide the specified category cabling in 1" conduit for the two-way communication system Main Control Panel back to telephone service demarcation point.

3. Miscellaneous Related Cabling:

a. Provide the specified category cabling in 1" conduit for two data connections to Intrusion Detection System head-end back to EF or demarcation room. Refer plans for exact locations.

b. Provide the specified category cabling in 1" conduit for two data connections to Access Controls System head-end back to closest data rack. Refer to plans for exact locations.

c. Provide the specified category cabling in 1" conduit for one data connection to Intercom head-end back to closest data rack. Refer to plans for exact locations. Provide specified category cabling and conduit between intercom head-end and access control panel.

d. Provide the specified category cabling in 1" conduit for Main Building Management System (ATC Panels, etc) back to nearest ER/TR room. Refer to Mechanical plans for exact location.

e. Provide the specified category cabling in 1" conduit for one data connection to each lighting controller/relay panel back to nearest ER/TR room. Refer to plans for exact locations.

f. Provide the specified category cabling in 1" conduit for one data connection to each irrigation controller back to nearest ER/TR room. Refer to plans for exact locations.

g. Provide the specified category cabling in 1" conduit for two data connections to Advanced Energy & Power Metering System back to Main Building Management System Panel. Refer to plans for main switchboard location.

h. Provide the specified category cabling in 1" conduit for one data connection to each classroom/building CSA system to nearest ER/TR room. Refer to plans for exact locations.

i. Provide the specified category cabling in 1" conduit for one data connection to each classroom/building POE Audio Enhancement camera to nearest ER/TR room. Refer to plans for exact locations.

4. Backbone cables shall be installed separately from horizontal distribution cables. Provide plenum rated innerduct if required, innerduct must be appropriate for the environment that it is installed in.

5. It is acceptable to install innerduct within ventilated trough as long as the fill ratio is not exceeded.

6. Fiber slack shall be neatly coiled within the fiber enclosure or ventilated trough . No slack loops shall be allowed external to the fiber panel. Each cable shall be individually attached to the respective fiber enclosure by mechanical means.

7. Provide a minimum of one balanced twisted pair cable to each voice outlet and one balanced twisted pair cable to each data outlet shown on the drawings unless noted otherwise on the drawings.

8. Service Loop Requirements

a. Provide a minimum 6" service loop in each communications system junction box for balanced twisted pair. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.

b. Provide a minimum 10' service loop in each EF/ER/TR/TE.

c. Provide a minimum 2' service loop at each stub-up or at each transition from conduit to ventilated trough .

d. Provide a 5' service loop in the ceiling before the conduit travels down the wall and terminates into the communications junction box.

e. Provide a 15' loop at all wireless access point (WAP) locations above the ceiling.

i. Provide cable in biscuit box.

f. Provide a 15’ loop at all IP surveillance camera locations above the ceiling.

i. Provide cable in biscuit box.

9. Provide modular jacks for each installed cable at outlets shown on drawings. Blank off all unused ports on faceplate.

10. Provide Velcro type ties for all cables and install in a neat and workmanlike manner. Where applicable, use plenum rated Velcro. Where cable is installed in ventilated trough , bundle a maximum of 25 cables in each Velcro tie. No zip ties are permitted whatsoever, even for temporarily hanging cables during the installation process

11. The bending radius and pulling strength requirements of all backbone and horizontal cables shall be observed during handling and after installation. Use pulling compound as recommended by manufacturer.

12. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.

13. The combined length of all patch cords in the EF/ER/TR and the work area shall not exceed 10m (33 ft)

14. No splices are allowed.

15. In a false ceiling environment, a minimum of 3 inches shall be observed between cable supports and false ceiling. At no point shall cable(s) rest on acoustic ceiling grids or panels.

16. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

17. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for horizontal cable is required, the contractor shall install appropriate carriers to support the cabling.

18. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

19. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.

20. Pair untwist at the termination shall not exceed 0.125”. The cable jacket shall be maintained as close as possible to the termination point.

21. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

22. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

23. Copper Backbone Terminations:

a. Terminate one single pair on pins 4, 5 at each patch panel port. Terminate all pairs on patch panel located on rack.

D. Grounding System:

1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

2. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

3. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.

4. All active equipment from owner shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.

5. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.

6. Patch panels shall be bonded to racks using the appropriate bonding screws. Mounting rails may utilize cage nuts, threaded holes or thru hole mounting fasteners to secure patch panels to the rails.

7. Bond ventilated trough , raceway system, structural steel and all other metal equipment located within EF/ER/TR to the grounding bus bar utilizing copper conductors per the following schedule:

   a. ≤25’ - #34

   b. ≤50’ - #2

   c. ≤66’ - #2/0

   d. ≥67’ - #3/0

8. Provide 4” X 12” X ¼” CU Telecommunication Main Grounding Bus Bar (TMGB) with bonding conductor per schedule above to Intersystem Bonding Terminal (IBT) in each telecommunication room (EF/ER/TR) with a main cross-connect (MC). Provide 20% spare termination spaces on bus bar, provide additional bus bars as necessary to accommodate spare.

9. Provide 2” X 12” X ¼” CU Telecommunication Grounding Bus Bar (TGB) with bonding conductor per schedule above to TMGB in each room with a horizontal cross-connect (HC).

10. Refer to electrical diagrams for additional ground connection requirements.

E. Electromagnetic Compatibility:

1. General:

   a. Do not install power feeders above or within the telecommunications room. Do not install telecommunications conduits above electrical panelboards, switchboards, transformers, motor control centers, etc.

   b. Where telecommunication cable is installed in grounded, metallic conduit near power cables, the power cables shall be kept physically separated from telecommunications cables:

      i. Circuits Under 5kVA: 2” minimum separation.

      ii. Circuits Over 5kVA: 6” minimum separation.

      iii. Electrical motors/transformers: 48” minimum separation.

      iv. Lighting ballasts: 6” minimum separation.

   c. Where telecommunication cable is installed in ventilated trough or underground in non-metallic conduit near power cables, the power cables

shall be kept physically separated from telecommunications cables by a minimum of 12”

F. EF/ER/TR Power Requirements:

1. General: Regardless of what is shown on drawings, the minimum requirements for providing power in the EF/ER/TR are as follows and shall be included in bid:

a. Provide (1) dedicated, nonswitched 120V/20A 4-plex receptacles, per each 2 post data rack, each on individual branch circuits. Outlet to be located near the top of the data rack.

b. Provide (1) dedicated 120V/30A Nema 5-30R receptacle to each 4 post rack. Outlet to be located near the top of the data rack.

c. 120V/20A Duplex receptacles located +18” A.F.F. placed at 6 foot intervals around perimeter walls. Up to 10 receptacles may be placed on a single circuit.

G. Firestopping and Smoke/Acoustical Pathways(See Also Division 7):

1. Provide firestop/smoke barrier solution equivalent to the wall/ceiling/floor rating.

2. Provide firestop labels next to each penetration with written date. Label both sides of the penetration.

3. Firestop systems shall be UL Classified to ASTM E814 (UL 1479). A drawing showing the proposed firestop system shall be provided to the Engineer prior to installing the Firestop system(s).

4. Utilize firestop pass-through type devices for medium to large penetrations into fire walls/floors.

5. Provide a minimum of (4) 4” trade size Hilti Speedsleeves (or STI EZPath) with at least one spare for each and every firewall penetration where ventilated trough meets the wall.

6. Provide the following products:

a. Fire Rated; STI EZ-Path Fire-Rated Pathways Series (or Hilti Speed Sleeve CP 653 BA)

b. Smoke/Acoustical Rated; STI EZ-Path Smoke & Acoustical Pathway Series (or Hilti Smoke and Acoustic Sleeve CS-SL SA)

H. Miscellaneous Equipment:

1. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.

2. Provide patch cords and cross connect cables as necessary for a complete operational telephone and data network system. Consult with owner to determine any special needs such as dedicated phone lines.

PART 4 – LABELING

4.1 GENERAL

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

B. All telecommunications spaces, pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.

C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.

4.2 TELECOMMUNICATION PATHWAYS

A. Identify each dedicated pathway (including inner ducts) for the voice and data system.

B. Label pathways at regular intervals and wherever they are accessible.

4.3 TELECOMMUNICATION CABLES

A. Identify cables at each end with a permanent label or physical/electronic tag.

1. The same alphanumeric identifiers should be used at both ends of the cable.
2. Identify cables at regular intervals throughout and wherever they are accessible.
3. Cables shall be identified in accordance with the System Documentation Section of this specification and ANSI/TIA/EIA-606-A. The cable label shall be applied to the cable behind the faceplate that can be accessed by removing the cover plate and to the cable behind the patch panel on a section of cable that can be viewed without removing the bundle support ties. Cables labeled within the bundle where the label is obscured from view shall not be acceptable.

4.4 CONNECTING HARDWARE

A. Identify connecting hardware items (termination blocks, cross-connects, racks, cabinets, patch panels, telecommunications outlet/connectors, ports) using alphanumeric identification such as the following three-level scheme:

1. First level—Termination field or patch panel. Color-coding or other labeling should be used to uniquely identify each termination field (e.g., voice and data) on a common mechanical assembly.
2. Second level—Terminal block within a given field or patch panel that could be a row of insulation displacement connectors (IDCs), optical fiber connectors, or modular jacks.
3. Third level—Defines the individual position within a given terminal block or patch panel.

4.5 TELECOMMUNICATIONS GROUNDING SYSTEM

A. Identify each telecommunications grounding bus bar (TGB) and telecommunications main grounding bus bar (TMGB).

B. Identify each grounding conductor relating to the telecommunications system, including those connecting building steel, grounding electrodes, water pipes, and telecommunications structural components.

PART 5 - MISCELLANEOUS

5.1 TESTING:

A. General

1. Provide testing within 10 days of completion for all copper and fiber optic cable according to TIA/EIA standards and any other requirements of the manufacturer who will provide warranty.

2. Submit copy of current calibration of all testing equipment. Submit all test reports electronically to architect/engineer and include in O&M manuals to include test reports. Meter shall have been calibrated within the past 12 months.
3. Correct any malfunctions. Contractor shall re-terminate/replace any cable, connection, or equipment found to be defective or non-compliant with these specifications and referenced standards.
4. Invite Owner IT representative and Engineer to witness and/or review field testing. Notify five business days prior to commencing testing.

B. Copper Cable

1. Utilize Level IIIe, IV, V Tester to test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of industry accepted verification tests for the Category of cable installed and shall meet latest requirements of EIA/TIA cabling Standards.
2. UTP Cable and Links: All UTP cabling channel must be tested at swept frequencies up to 250MHz for internal channel performance parameters as defined in IEEE 802.3an and ANSI/TIA/EIA-568C. Certifications shall include the following parameters for each pair of each cable installed:
    a. Wire map (pin to pin connectivity)
    b. Length
    c. Insertion Loss
    d. Near End Crosstalk (NEXT)
    e. Attenuation to Crosstalk Ratio Far End (ACRF)
    f. Return Loss
    g. Propagation Delay
    h. Delay Skew
    i. DC Loop Resistance
    j. DC Resistance Unbalance
    k. Power Sum Near-End Crosstalk (PS-NEXT)
    l. Attenuation to Crosstalk Ratio Near-End (ACR-N)
    m. Power Sum Attenuation to Crosstalk Ratio Near-End (PS-ACR-N)
    n. Attenuation to Crosstalk Ratio Far-End (ACR-F)
    o. Power Sum Attenuation to Crosstalk Ratio Far-End (PS-ACR-F)
    p. Transverse Conversion Loss (TCL)
    q. Equal Level Transverse Conversion Transfer Loss (ELTCTL)
3. All channels that fail testing parameters will be replaced at the Contractor's expense until all channels pass the performance parameters.
4. Provide Modular Plug Terminated Link (MPTL) test for all field terminated plugs (standard for cameras and WAPs).
    a. All installed cabling modular plug terminated links (MPTL) shall comply with the permanent link transmission requirements of the ANSI/TIA-568-2.D standard.
    b. The MPTL shall be tested with a Permanent Link Adapter on the Main Unit and a Patch Cord Adapter Suitable for Category 6A testing on the Far End or Remote Test Equipment.

c. Modular plug terminated link test results, including the individual frequency measurements from the tester, shall be recorded in the test instrument upon completion of each test for subsequent uploading for reports to be generated.

5. Sampling is not acceptable. MPTL testing shall be performed on each cabling segment (connector to connector).

C. Fiber Optic Cable

1. Provide test results using an OTDR of all installed fiber optic links to demonstrate compliance with requirements. Testing shall consist of industry accepted verification tests for the type of cable installed and shall meet the latest requirements of EIA/TIA 455-53A standards. Test setup and performance shall be conducted in accordance with ANSI/TIA/EIA 526-14 Standard Method B.

2. Provide inspection of fiber end faces by using scope and test according to IEC 61300-3-35 standards. Correct scratched, pitted, or dirty connectors.

3. Provide bi-directional testing of cable for both cable rated wavelengths. Results shall show compliance of cable and shall include the following parameters:

a. Attenuation

b. Length

c. Verification of Polarity

D. Owner reserves the right to hire an independent testing company to spot check the test results. If the results vary more than 10% from the results provided by the Contractor, the Contractor will be required to prove his results are correct or retest the entire system.

5.2 WARRANTY:

A. Register installation with cable/connectivity manufacturer.

B. Provide and submit all test results to owner, engineer, and manufacturer and meet all other manufacturer requirements in order to provide minimum 20-year extended product link warranty for complete cabling/connectivity installation, including all copper and optical fiber utilized on the entire channel. The channel warranty shall be provided by the connectivity manufacturer. Include replacement material and installation for any defective product.

5.3 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

5.4 TRAINING:

A. Provide four hours training on the operation and installation of the structured cabling system at job site, at no cost to owner.

5.5 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 1500

SECTION 27 4100

AUDIOVISUAL 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 work of this section.

B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.

C. Refer to specification 26 0553 for conduit and junction box color requirements.

D. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications.

1. Refer to and coordinate with specification 27 4100 for any audiovisual equipment requiring UTP based category and/or optical fiber cabling and connectivity. Division 27 1500 shall provide installation and execution requirements for all category and/or optical fiber cabling and connectivity required within the audiovisual system

2. Category cables used for transporting video, audio and controls simultaneously from transmitters to receivers and/or switchers shall follow the Manufacturer's recommended cabling specifications.

1.2 ADMINISTRATIVE REQUIREMENTS:

A. BNA Project Contact:

1. Joe Morris, CTS-D
   a. Phone: 801-532-2196
   b. Email: jmorris@bnaconsulting.com
2. Jaime Verhaal, CTS-D
   a. Phone: 801-532-2196
   b. Email: jverhaal@bnaconsulting.com
3. Zac Behunin, CTS
   a. Phone: 801-532-2196
   b. Email: zbehunin@bnaconsulting.com

B. Bid Submittal:

1. Equipment Costs: Breakout cost of material and labor as different line items. Refer to bid form for breakout cost requirements.

C. Coordination:

1. Coordinate final inspection of the systems installed, with Audiovisual (AV) Consultant, three (3) weeks in advance.
2. Obtain GANTT chart for construction time frame from the General Contractor.
3. Coordinate with Electrical contractor to meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate the mounting condition of all ceiling-mounted AV equipment with ceiling type. During second meeting, coordinate the location of all ceiling-mounted AV equipment in each area.
4. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all loudspeaker and duct work in all areas.
5. Meet with Electrical contractor prior to pathway rough-in to coordinate AV system requirements in each area.

6. Meet at least once, prior to rough-in, with horizontal cabling installer to verify all AV network requirements. Coordinate cable color according to specification 26 0553.
7. Meet at least twice with owner and programmer to coordinate AV network requirements. Hold the first meeting after submittal of shop drawings to coordinate network protocols, including but not limited to: IP address schedules, MAC address schedules, patchbay schedules, security requirements, and VLANs. Hold the second meeting prior to AV system deployment.
8. Coordinate color and finish of all AV system components with Architect or Electrical contractor as appropriate.
9. Coordinate all AV system components within millwork/furniture with millwork shop drawings prior to rough-in.
10. Coordinate color (including custom color) and finish of all AV system components with Architect prior to ordering. Architect may require custom color of grills, face plates, etc. AV contractor shall paint or have devices painted by others. The cost for custom colors shall be within the AV Contractors Bid.
11. Notify AV Consultant when rough-in is complete and ready to inspect. AV Consultant and Electrical Engineer to sign off on rough-in prior to rough-in resuming rough-in for typical rooms.

D. Contractor is responsible for coordinating with all other trades for equipment locations, mounting requirements, supports and plenum space requirements.

E. AV contractor shall participate in a mandatory pre-construction meeting no more than sixty (60) days prior to ordering equipment, and before work can begin. Contractor is responsible for coordinating the meeting. The meeting will be held at the AV Consultant's office. All submittals, shop drawings and bills of materials shall be completed and submitted to AV Consultant for review eight (8) working days prior to this meeting.

F. AV contractor shall attend the electrical pre-construction meeting per specification 26 0500.

1.3 DESCRIPTION OF WORK:

A. Provide the specified systems in a complete and operating condition with all necessary materials and labor to fulfill the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components. Contractor shall furnish all cables, materials and equipment, whether specifically mentioned herein or not, to ensure a complete and functional system.

B. Master quotes do not relieve contractor from preforming due diligence for equipment type, equipment quantity, and quantity of room types. Any errors, conflicts, or omissions between the drawings and/or specifications and master quotes shall be the responsibility of the contractor to resolve.

C. Bidders wishing to provide equipment other than the equipment specified shall submit proposed substitute equipment to AV Consultant eight (8) working days prior to bidding. Submittals for prior approval shall include description of equipment, design intent, complete riser diagrams for proposed equipment, equipment specifications, cut sheets of proposed equipment, reason for alternate equipment. AV Consultant may request physical equipment to test and demo. Acceptance of proposed equipment by AV Consultant shall not relieve AV contractor from responsibility to provide audio-visual systems equal to those specified in this Section. Contractor shall be ultimately responsible for providing complete and working audio-visual systems that function, control and operate in the same manner as the specified equipment. AV Consultant has final say if proposed equipment is equal to the specified equipment. Equipment that AV Consultant is not familiar with will require the contractor to provide manufacturer training at manufacturer's facility and have a manufacturer representative present at time of commissioning.

1. Refer to section 2.2 for approved equals of basis of design equipment.

D. Equipment submitted in the bid proposal that has not been approved by AV Consultant in writing will not be accepted and shall be replaced by approved equipment at contractor's expense. Equipment not listed within this specification, or contract documents, that is required for a complete and working system, shall be of professional grade, new and used in the same manner as needed for a complete and working system.

E. Input plates shall match the color and style being used throughout the project.

F. All control processors and controllers are to be on an unswitched power connection and connected to an uninterrupted power supply if indicated within the design.

1.4 DEFINITION OF TERMS:

A. Approve: The term "approved," where used in conjunction with the Engineer's action on the Contractor's applications and requests, is limited to the Engineer's duties and responsibilities as stated in General and Supplementary Conditions.

B. Configure: The term "Configures" or "Configuration" is used to describe set up of components which includes menu based settings, image alignment, dip switches, setup wizards, EDID, etc. required for standard functionality.

C. Contractor: the term "Contractor" refers to the company contracted to perform the work within this specification and associated documents.

D. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Engineer," "requested by the Engineer," and similar phrases.

E. Furnish, Install, and Provide: Refer to 26 0500 for definition.

F. General: Basic Contract definitions are included in the General Conditions.

G. Graphical User Interface (GUI): The term "Graphical User Interface (GUI)" is used to describe the user interface from a touch screen. This is a custom interface provided with the programming of the system.

H. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

I. Installer: An "Installer" is the Contractor, or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

J. Programming: The term "Programming" is used to describe writing computer code or a sequence of logic to perform an operation from a triggering event. Programming will be installed on a control processor or similar platform identified within the documents.

K. Programmer: the term "Programmer" is the company or entity engaged by the programming company, either as an employee, subcontractor, or sub-subcontractor, for providing the programming services.

L. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

M. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions."

1.5 QUALITY ASSURANCE:

A. Installer:

1. Integrating firm shall have worked satisfactorily for a minimum of five (5) years of completing systems equal to this scope, quality, type and complexity.
2. Key personnel assigned to the project shall each have minimum of ten (10) years of experience in completing systems equal to this scope, quality, type and complexity.
3. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
4. Contractor shall maintain complete installation and service facilities for the duration of the project contract.
5. Contractor shall have current manufacturer certificates for all AV systems and equipment listed within this specification.
6. Contractor shall be in good standing with the owner.
7. Contractors that do not meet the above requirements cannot bid on this project.

B. Contractor must follow the standards described within:

1. BICSI/AVIXA AV Design Reference manual.
2. ANSI/AVIXA 2M-2010 Standard guide for Audiovisual Systems Design and Coordination Processes.
3. ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Guide.

C. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.

D. PRE-APPROVED INSTALLERS:

1. AVI-SPL
2. Cache Valley Electric
3. Ford AV
4. GenComm
5. Hunt Electric
6. LINX
7. Marshall Industries
8. Performance Audio
9. Poll Sound
10. Wasatch Electric
11. WEBB AV
12. Bids submitted by non-approved installers will not be accepted.
13. Bidders not pre-approved shall submit in writing the following for review at least eight (8) working days prior to bid:
    a. List of qualifications including:
        i. Industries certifications including manufacturers.
        ii. Approved resale manufacturers.
    b. Past and current projects within the last five (5) years similar in scope and size.
    c. Three (3) Different referrals from the owners of three (3) different projects within the last five (5) years.

1.6 SUBMITTALS: Refer to specification 26 0502 for shop drawing submittal requirements.

1.7 WARRANTY:

A. Systems shall be guaranteed for a period of one (1) year from the date of substantial completion against defective materials, inferior workmanship or improper installation adjustment. Guarantee shall cover all parts and labor, etc. required to maintain the functionality at the time of system completion.

1. System completion shall be signed off by the programmer, contractor, and the owner. At that time, the system will be considered complete.

B. If system failure causes the audiovisual system to be inoperative or unusable for its intended purpose, contractor, when notified of the problem, shall repair the system to be operational and usable within three (3) business days. If defective components cannot be repaired in time, provide temporary equipment as required.

C. The contractor shall utilize their existing service department for warranty calls. Trouble shooting of system components shall be performed before adjustment to the programing is required.

1. Programming changes resulting in rewiring, modifying, or adding new system components will result in a charge, based on Time and Materials required for correcting the system changes.

2. Programming changes will be from a local PC within the main equipment rack running the necessary software to make changes. The local PC will require internet access, and the coordination of the internet access will be through the programmer. Access to the PC will be through remote software.

a. Local PC and software will be provided by the contractor. PC requirements are indicated in section 2.3.

3. Acknowledgment of the notification will be within one (1) business day and a response to the warranty notification will be provided within two (2) business days of the acknowledgement.

4. Manufacturer defected equipment will be reprogrammed as needed. Prior to replacement of the equipment the contractor shall coordinate the installation date and time with the programmer. The programmer response time is indicated above.

a. If temporary equipment is needed in the interim, it will be programmed by the programmer. This may require additional time and coordination between the installer and programmer.

D. Programming warranty includes the following:

1. Lighting control: limited to 1 change after completion sign off. AV system integration is limited to only recalling presets. Refer to section 3.1.K for lighting integration requirements.

2. GUI: limited to button rearrangement.

E. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.

PART 2 – PRODUCTS

2.1 GENERAL:

A. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications, or the drawings, shall be submitted in writing to the AV Consultant for clarification.

B. Equipment lists are provided to identify quality and functional expectations. They may not

be complete. Coordinate with devices shown on drawings, system risers and equipment lists for system intent. Provide a complete and functional system as described within the construction documents.

2.2 MANUFACTURER APPROVED EQUALS:

A. The Manufacturers listed below have the potential to be considered equals, as it relates to the system design intent and the equipment specified herein. Refer to section 1.3.C. for substitution requirements. Any equipment chosen as equal to what has been specified in section 2.4 will be the responsibilities of the AV Integrator to coordinate all resulting changes and guarantee a complete and functional system e.g. rough-in requirements, programming, etc. Please note that some components have been chosen over others for features and/or size limitations. Equipment listed below with an asterisk have feature and/or size limitations and may not be substituted.

1. Amplifiers – Ashly, Crestron, Crown, Extron, Lab Gruppen, LEA Professional, Powersoft, QSC and StewartAudio
2. Cables – Belden, Crestron, Extron, Gepco/General, Ice, Kramer, Liberty, and Westpenn cables
3. Controls – AMX, Crestron and Extron
4. Displays – LG, NEC, Planar, Panasonic, Samsung, Sharp, and Sony
5. Equipment racks – AtlasIED, Chief, Lowell and Middle Atlantic
6. Loudspeakers – AtlasIED, Bose, Community, JBL and SoundTube
7. Mounts – Chief and Premier mounts
8. Video Equipment – AMX, Crestron, and Extron
9. Wall plates – Attero tech (QSC), Crestron, Extron, RCI Custom, Liberty Panelcrafters and RDL

2.3 GENERAL EQUIPMENT REQUIREMENTS:

A. The equipment specified in this document aims to fulfill the intended functional requirements by precisely identifying the necessary equipment. Depending on the timing of component orders and the project timeline, there may be instances where certain equipment needs to be replaced with newer models. In the event that the indicated equipment is unavailable or has been replaced, the supplier or contractor shall provide a new model that offers comparable functionality.

B. Loudspeakers:

1. Provide applicable mounting equipment as needed, including but not limited to; back boxes, mounting hardware, safety equipment, and seismic restraints.

C. Video Signal:

1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.
    a. Cable Equalizer for cable lengths exceeding 30’ but no more than 75’ or that have more than two (2) union connections. Connect to external power supply and do not use the 5 volts within the HDMI cable.
        i. Extron – HD 4K 101 Plus or Kramer – PT-3H2
    b. Point to point HDBaseT extension, 18 Gbps, 4k60 4:4:4 at 100 Meters:
        i. Crestron – DM-TX-4KZ-100-C-1G with DM-RMC-4KZ-100-C. or Extron – DTP2 T 211 with DTP2 R 211.
    c. HDMI cables intended for client device connection and that are less than 15’ shall be a flexible cable and support 18 Gbps, 4k60 4:4:4 for the entire

length of the cable.

d. Equipment that is not preapproved by the AV Consultant in writing will not be accepted and will be replaced with the approved equipment at no cost to the Owner.

D. Audio Signal:

1. The equipment listed below is considered to be equal replacement parts for a point-to-point video solution as it relates to the system design intent. Equipment listed in section 2.4 override the equipment listed below.

a. Passive or Active audio summing adapter. Extron – ASA 131 or RDL – STA-1

b. Isolation transformer: RDL – EZ-HK1

E. Cables grouped together shall be dressed in expandable nylon loom, similar to Techflex - Flexo

F. Provide virtual touch panel for windows, and/or Mac, controller for full control of the system.

1. Virtual touch panel shall be able to mimic every Touch Panel in the system, and give full control over the touch panel in each room.

2. Virtual touch panel shall be password protected and used for tech support only within the company.

G. Equipment Racks:

1. All AV equipment racks within this specification shall have the following accessories and/or features, either rack mountable or built into the rack, depending on the model of the rack. Refer to bid documents for all rack mounted equipment. Provide the following accessories as referred to in elevations. RUs are indicated in the elevations and noted with a # symbol in the part number.

2. General Equipment

a. Shelving: Middle Atlantic – SS; 1RU shelf.

b. Drawers:

i. Nonlocking: Middle Atlantic – D#

ii. Locking: Middle Atlantic – D#LK

c. Header panel, located at the top of the rack, AV contractor to submit their logo to RCI for inclusion in the Header panel. If AV contractor has another company that makes the Header panel, provide that information to the AV Consultant.

i. RCI Custom – BNA001-200120MM-01

d. Blank plates: Middle Atlantic – EB#

e. Surge protection for all devices located within the rack. Surge protector shall be: 20 AMPs, rack mountable or mount to a side rail and at least 1,000 joules of protection.

i. Recommended Surge protector is Middle Atlantic – PD-920R-SP. Additional acceptable manufacturers are: Furman, Juice Goose, Tripplite and SurgeX.

f. Horizontal, vertical, and entry cable management.

i. All cabling shall be straight off of the back of equipment to horizontal supports connected to equipment rack. Cabling shall follow support to vertical supports when going into other components and/or out of the equipment rack.

ii. Cabling secured to other cabling and supported from the connector is not acceptable.

iii. Separate AC power and other signal types from each other.

g. Provide 20 Amp rated power strips, as necessary.

h. Sequencers

i. Provide a Middle Atlantic – PDS-620R or Furman – CN-2400S Sequencer.

ii. All equipment racks with the following equipment shall have a sequencer within the equipment rack. AV integrator to follow industry standards when using sequencers.

1. Amplifiers

2. Video processors without control processors

i. Passive Thermal Management

i. Vented rear door with no less than 60% open area.

ii. Solid blank panels on the front of the rack in all unused rack spaces.

iii. Stack power amplifiers without open rack space between.

iv. Top of equipment cabinet to be open or vented.

v. Provide passive thermal management in all racks unless noted above.

2.4 EQUIPMENT REQUIRED PER ROOM TYPE

AV SYSTEMS PROGRAMMING			
TYPE	**DESCRIPTION**	**MANFR.**	**MODEL NO.**
	AV SYSTEMS PROGRAMMING ALLOWANCE REFER TO SECTION 3.3 FOR SCOPE OF PROGRAMMING	BNA CONSULTING	$4,400.00 SYSTEMS PROGRAMMING ALLOWANCE
END OF SCHEDULE			

CLASSROOM EQUIPMENT SCHEDULE			
TYPE	**DESCRIPTION**	**MANFR.**	**MODEL NO.**
HDU	HDMI, 3.5MM AUDIO AND USB PASS THROUGH SINGLE GANG WALL PLATE	AUDIO ENHANCEMENT	AV CONNECT 2
CSA	CLASSROOM RF MICROPHONE SYSTEM, RF RECEIVER, TEACHER LANYARD MICROPHONE, HANDHELD MIC, LOUDSPEAKERS	AUDIO ENHANCEMENT	MS-700 SYSTEM WITH XD RECEIVER
C1	LOUDSPEAKER, 4", CEILING 120 DEGREE COVERAGE	AUDIO ENHANCEMENT	FS-22
TP3	TOUCH PANEL, 3" DIAGONAL	AUDIO ENHANCEMENT	ITC-2
T	FLAT PANEL TILT MOUNT, 14°, MAX 250LBS LOAD, 1070 X 600 mm VESA, LANDSCAPE	CHIEF	XTM1U
S86	LCD, INTERACTIVE 20-POINTS, 86" DIAGONAL, UHD, ANDRIOD 8+ OS, 350 NIT, 2-12W SPK, IN: 3-HD 2.0, 1-VGA, 1-3.5mm, OUT:1-HD, 1-3.5mm, 1-SPDIF, 8-USB, LAN, RS-232	BOXLIGHT	PROCOLOR 863
END OF SCHEDULE			

DIVISIBLE CLASSROOM EQUIPMENT SCHEDULE			
TYPE	**DESCRIPTION**	**MANFR.**	**MODEL NO.**
R1	2X2 EQUIPMENT RACK, ABOVE CEILING 2 RU, RECESSED	CHIEF	CMS492
TxH	HDMI INPUT, WALL PLATE WITH DTP3 TRANSMITTER	EXTRON	DTP3 T 101 D
Rx	VIDEO RECEIVER, DTP3	EXTRON	DTP3 R 201
CSA	CLASSROOM RF MICROPHONE SYSTEM, RF RECEIVER, TEACHER LANYARD MICROPHONE, HANDHELD MIC, LOUDSPEAKERS	AUDIO ENHANCEMENT	MS-700 SYSTEM WITH XD RECEIVER
C1	LOUDSPEAKER, 4", CEILING 120 DEGREE COVERAGE	AUDIO ENHANCEMENT	FS-22
	NETWORK SWITCH, MANAGED, PoE+, 125W (8) 1GB POE+ AND 2X1G +2SFP PORTS	NETGEAR	M4250-10G2F-POE+
KP2	KEYPAD, 4 BUTTONS WITH VOLUME KNOB	EXTRON	MLC PLUS 100
	VIDEO SWITCHER, DTP3 6 IN 2 OUT WITH CONTROL PROCESSOR	EXTRON	DTP3 CROSSPOINT 622 IPCP A
T	FLAT PANEL TILT MOUNT, 14°, MAX 250LBS LOAD, 1070 X 600 mm VESA, LANDSCAPE	CHIEF	XTM1U
S86	LCD, INTERACTIVE 20-POINTS, 86" DIAGONAL, UHD, ANDRIOD 8+ OS, 350 NIT, 2-12W SPK, IN: 3-HD 2.0, 1-VGA, 1-3.5mm, OUT:1-HD, 1- 3.5mm, 1-SPDIF, 8-USB, LAN, RS-232	BOXLIGHT	PROCOLOR 863
END OF SCHEDULE			

PART 3 EXECUTION

3.1 INSTALLATION OF AV SYSTEMS:

A. Provide AV systems and ancillary equipment as indicated on drawings and in accordance with equipment manufacturer's written instructions, the NEC, and with industry best practices.

B. Coordinate all work performed by other contractors pertaining to the AV system, including raceways, electrical boxes and fittings.

C. Video systems.

1. HDCP:

   a. All equipment within the signal path must be capable of processing HDCP-compliant material.

   b. All switcher, scalers, transmitters, and receivers shall reflect the HDCP compliance of the endpoint/display(s).

   c. HDCP shall be disabled in the switcher/scaler when a non-HDCP-compliant endpoint/display is used.

2. EDID Strategy:

   a. Permanent video sources shall be set manually within the equipment to output their native resolution. Video properties shall not rely on EDID.

   b. Portable video sources and wall plates shall use EDID tables within the switcher/scaler for preferred video properties. The EDID table shall be set with the following settings:

i. Most common resolutions within the display's aspect ratio.

1. 3840 x 2160 (UHD) 60Hz, 4:4:4 Chroma sample
2. 3840 x 2160 (UHD) 60Hz, 4:2:0 Chroma sample
3. 3840 x 2160 (UHD) 30Hz, 4:4:4 Chroma sample
4. 1920 x 1200 (WUXGA) 60Hz
5. 1920 x 1080 (HDTV), 120Hz

ii. 1280 x 800 (WXGA), 60Hz, and RGB Color Space

iii. Audio: refer to control section for audio requirements. This will include mono, Stereo, Surround sound, etc. All audio will be 44,100 Hz, 16-bit unless otherwise noted.

D. Pathway Requirements:

1. General:

a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.

b. 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. Field coordinate alternate pathway requirements with other trades onsite. New pathways shall not exceed distance limitations defined within this specification. Notify the Engineer of the changes for final approval prior to proceeding with the change.

2. Conduits:

a. Contractor shall provide a minimum of 1-1" EMT conduit from device to accessible ceiling space unless otherwise noted. Then utilize non-continuous cable support from devices to connecting device. Refer to AV symbol schedule for specific conduit requirements.

i. Provide non-continuous open top cable supports every 5' above accessible ceiling.

b. Provide conduit from device to device in open and/or exposed ceilings. Ceilings with clouds are considered open/exposed ceiling.

c. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.

d. Provide large radius elbows on all bends.

e. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.

f. AV conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.

g. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.

h. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.

3. Open Top Cable Support Requirements:

a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables.

b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.

4. Pull Box Requirements:

a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.

b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90-degree bends, or contain a reverse bend.

c. Conduits that enter a pull box from opposite ends should be aligned.

d. Pull boxes shall have a length 12 times the diameter of the largest conduit.

e. All pull boxes must be accessible.

E. Cabling System:

1. Follow T568B scheme for copper category cabling terminations.

2. Provide a minimum 6” service loop in each AV system junction box. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.

3. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.

4. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

5. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for AV cable is required, the contractor shall install appropriate carriers to support the cabling.

6. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

7. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.

8. Pair untwist at the termination shall not exceed 0.125”. The cable jacket shall be maintained as close as possible to the termination point.

9. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

10. Group multiple cabling together with expandable nylon loom, similar to Techflex - Flexo, when cabling exists a cavity and connects to a device. Cabling within a lectern, podium or millwork shall have expandable nylon loom sleeve as well.

F. Grounding System:

1. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

2. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

3. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.

4. All active equipment shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.

5. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.

6. Refer to electrical diagrams for additional ground connection requirements.

G. Cabling groups and conduit separation:

1. Refer to “CABLING GROUPS AND CONDUIT SEPARATION SCHEDULE”, located on the drawings.

H. Firmly secure all equipment in place that is not intended for portability.

I. Mount projectors permanently and provide mechanical index ensuring precise alignment of the projected image.

J. Provide adequate structural support for AV system components. Provide fastenings and supports with a safety load factor of at least five.

3.2 LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and wall plates. The labeling system shall designate the cables’ origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

B. All AV pathways, cables, connecting hardware, equipment, racks, patch panels, outlet/connectors, and grounding system shall be labeled in accordance with TIA/EIA 606-A.

C. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten, Ink, or Laser Printing labels are not allowed. Labels shall be uniform in physical size and text height with minimal blank space. Provide labels using thermal transfer print. Heat shrinking or wraparound labels are required, flag style labels are not allowed.

D. Provide laminated plans (minimum size 11x17) of all AV as-built plans (including one-line diagrams) in each and every AV Rack.

E. Label each equipment with the date (month/year) that it was installed along with the IP address, if applicable, and equipment type.

3.3 CONTROL SYSTEM FUNCTIONALITY:

A. GENERAL:

1. The control processing and digital signal processing programming required for AV sub-systems as defined in section 2.4 of this specification shall be completed by BNA Consulting.

a. The General AV sub-systems require configuration and are not included in BNA’s programming scope of work.

b. Configuring of system components will be part of the Contractors scope of

work. Contractor shall provide IP address, MAC address, Serial numbers, etc. to BNA for coordination with the program.

c. IP address will be coordinated by the programmer and shared with contractor for implementation into specific devices.

d. If the contractor chooses to provide their own programming services, it must match the functional intent as defined by BNA Consulting exactly. No exceptions.

2. The successful bidder for this specification section (27 4100) shall contract BNA Consulting for performance AV programming services.

a. The allowance defined in section 2.4 for the performance AV systems programming services shall be included in the bid as a line item.

b. Contracting shall take place once shop drawings are submitted. The Programming phase shall begin upon final review of AV contractor shop drawings.

3. Control programs & DSP configuration programs shall be designed to match the schematic system wiring as shown in approved shop drawings.

4. The AV contractor must field wire each system in accordance with the final reviewed shop drawings.

a. Any deviations made to shop approved shop drawings will be subject to additional programming service fees.

5. Before programming services commence, the AV contractor shall confirm that all connections are complete, and all equipment is powered up and functional.

a. Written documentation including site progress photos shall be provided to BNA Consulting prior to commencement of the programming phase.

3.4 CYBER SECURITY

A. Contractor shall change all default username and passwords for all network devices provided. A Strong Password should include at a minimum the following:

1. Be at least 12 characters in length.

2. Contain both upper and lowercase alphabetic characters (e.g., A-Z, a-z)

3. Have at least one numerical character (e.g., 0-9)

4. Have at least one special character (e.g. ~!@#$%^&*()_-+=)

5. Cannot contain full words.

B. No written username or passwords shall be located in any areas of installation.

C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization.

D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

3.5 FIELD QUALITY CONTROL:

A. TESTING:

1. Refer To Section 27 4101 For Additional Requirements.

B. At the time of final commissioning, if the AV consultant determines that the systems are not sufficiently complete to do a final punch list, and was not notified at least three (3) days prior to the visit, then a return visit will be required. The AV Consultant's return visit will be paid for in advance by the AV integrator at a flat rate of $1,600 per person, at no cost to the owner.

3.6 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

3.7 TRAINING:

A. Provide two (2) sessions of two (2) hours each of training on the operation of each system, at job site, at no cost to owner. Systems shall be complete and have been finalized by the AV Consultant prior to training.

B. Training shall be recorded using a video recording device that support a minimum resolution of 1080P/60 with an integrated microphone connection for an external microphone and a camera tri-pod mount. Presenter shall be wearing a lapel microphone that connects to the recording device and a Tripod shall be used for stabilizing the recording device. Recordings that are shaky, poor audio and/or video quality, incomplete, or other issues will not be accepted, and the contractor will be responsible for providing a new recording and training within five (5) business days of notification. Provide a digital copy, in MP4 format, on a USB flash drive to the Owner and AV Consultant. Also locate a USB flash drive with the training videos, programing, etc. in the as-built drawer of the main equipment rack. Digital copies sent as a link are not acceptable. identify within the Operating and Maintenance manuals, in the first section, where the flash drive is stored. Clearly label the flash drive as training videos. The second training shall take place within a month of the first training and all questions shall be answered.

3.8 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 4100

SECTION 27 4101

AUDIOVISUAL SYSTEM INTEGRATOR VERIFICATION CHECKLIST

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 work of this section.

B. Division-27 4100 section apply to work specified in this section.

1.2 ADMINISTRATIVE REQUIREMENTS:

A. This Document is intended to be completed and supplied to the AV Consultant prior to the final punch visit. Refer to specification 27 4100 for system components.

B. Installing contractor shall make copies of this document for large systems. Include all copies in the O & Ms and provide all copies to the AV Consultant.

1.3 DESCRIPTION OF WORK:

A. Refer to “INTEGRATOR VERIFICATION CHECKLIST” at the end of this section, for system verification requirements. Fill out the form and return to the AV Consultant prior to the final punch.

B. Upon completion of installation of each system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units on site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.

C. Before inspection by owner and AV Consultant, and after completion of the installation, conduct system tests and make necessary corrections for proper system operation.

D. Adjust, balance and align equipment for optimum quality and to meet the manufacturer’s published specifications.

E. All limiters and/or compressors shall be set to prevent operators from over-adjusting sound levels and damaging system components, while maintaining the highest amount of gain possible.

F. System shall have no audible hum, noise, RFI, or distortion when operating under normal conditions. System shall reproduce material at the loudspeakers rated output level without audible distortion. All input levels shall be pre-set so system may be operated without causing unstable feedback under normal use.

G. System shall have no image distortion, hum bars, color shift, or any other picture distortion while operating under normal conditions. Provide cable equalizers or an HDBaseT video solution. Cable equalizer shall be located near display and powered, on all cables that are more than 30 feet in length or with more than four (4) connection points. Refer to section 2.3.B in this specification for a list of pre-approved equipment. Adjust gain controls for optimum signal-to-noise with 0 dBu at a line-level input.

H. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.

I. Loose parts and poor workmanship or soldering shall be replaced.

J. Sweep Loudspeaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to Loudspeakers or enclosures. Notify owner of external causes of buzzes or rattles.

K. Equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and

8000 Hz (+/- 3 dB).

L. Contractor shall provide system testing as described herein using up-to-date and industry accepted test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1. AV Contractor shall own and have access to a handheld Quantum Data 780C tester to allow for on-site verification testing and troubleshooting of HDMI and digital video networks and analog video displays. All test equipment used shall be factory calibrated within one year of use with references set daily prior to testing.

M. Contractor shall provide HDCP compliant device with digital cables, and digital HDCP content for testing of routing and HDCP compliant distribution and switching. Also provide analog VGA output equipment for testing of video switching, scaling, and distribution if analog is included with this project.

N. Horizontal cabling contractor shall test all twisted pair cabling used within the AV system following the standards in specification 27 1500 under the testing section. Provide documentation of testing to AV Consultant prior to final walk through.

PART 2 – PRODUCTS

2.1 SECTION NOT USED

PART 3 – EXECUTION

3.1 AUDIOVISUAL SYSTEMS INTEGRATOR VERIFICATION CHECKLIST

Project Title		Date	
City, State		Integrator	
Room/Area			

Audio/Video Signal Processors/Switchers					
Location	Rack #	Manufacturer & Model #	Serial #	Total Channels (In, Out)	Unused Channels (In, Out)

Power Amplifiers						
Location	Rack #	Amp #	Manufacturer & Model #	Serial #	Total Channels	Watts/Channel

Loudspeakers Zones							
Location	Rack #	Amp #	Amp Chan	Manufacturer & Model #	Serial #	Calculated Impedance	Measured Impedance

Wireless Microphone Receivers					
Location	Rack #	Manufacturer & Model #	Serial #	Usable Frequency Range	Chosen Frequency

Portable & Miscellaneous Equipment			
Description	Location	Quantity	Manufacturer & Model #.

Sign below to confirm you have received portable & miscellaneous equipment listed above.

Owner Signature: _____
Date:_____

Title:_____

Personal Delivering Equipment: _____

General Items

Title	Description	Initial	Notes
Labeling	Verify that all cabling, equipment, and wall plates are labeled per specifications and as noted on drawings		
Cable management	Verify that proper cable management has been provided and that everything looks well-ordered.		
Power	Verify that power supplies are secured and in an accessible area.		
Sequencer	Verify that the sequencer(s) are setup correctly for industry standard power on/off function.		
Cyber Security	Verify that all default passwords have been changed. Provide all login information to the owner representative		
System testing	Verify that all systems have been tested and are in working order.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		
Cabling	Verify that all cabling on the project meets the document requirements.		
Network	Verify that the owner has all of the needed information for all devices on the network. Provide this information to the owner via a spread sheet.		
Network	Verify that all IP address are within the owner's network scheme.		
Network	Verify that VLANS are setup as indicated in drawings and within owner's network infrastructure		
System One-lines	Verify that each equipment rack contains a set of one-lines diagrams for system installed. Refer to specifications for one-line requirements.		
Thermal Management	Verify active thermal management is setup correctly and working properly.		
Training	Verify training has been scheduled with the owner representative.		

Audio Performance

Title	Description	Initial	Notes
Audio Signal Distribution	Verify that audio signal is being transported and distributed according to project documentation.		
Phantom Power	Verify that the correct phantom power is provided at the correct locations according to project documentation.		

Gain Before Feedback	Verify that the audio system is capable of reproducing speech above nominal operating levels without audible distortion or feedback.		
Rough Balance (input)	Verify that all inputs have the same nominal level.		
Gain Structure	Verify that proper gain structure has been followed from each input to output		
Rough EQ	In systems with equalization capability, equalize the loudspeakers to produce less than 6 dB total variation between 500 Hz and 8000 Hz (+/- 3 dB).		
DSP Programming	Verify that DSP systems have been programmed to allow signal routing, balance, and EQ. DSP programming should be saved in editable form prior to final commissioning visit.		
Rough Balance (output)	Verify that loudspeaker zones reproduce program content at the same level (+/- 1 dB).		
Emergency Muting	Verify that any required muting or operational changes are in accordance with location regulations in the event of a life safety or similar emergency.		
Assistive Listening	Verify that the assistive listening system functions as a complete personal listening system at specified levels without distortion or excessive background noise.		
Loudspeakers	Verify that there is no hum, noise, RFI, or distortion when operating under normal conditions.		
Loudspeakers	Verify that there are no rattles or buzzes with a high-level sign wave or 1/3 octave pink noise.		
Loudspeaker Zoning	Verify that loudspeaker zones are assigned correctly according to project drawings and specifications.		
Loudspeaker Impedance	Verify that all loudspeaker circuits have correct impedance as defined in the project drawings and specifications. Note measured impedance on previous page.		
Loudspeaker Alignment	Verify that loudspeakers are mounted and aligned as shown in project documentation.		
Loudspeaker Polarity	Verify that all loudspeakers in a given space are wired with the same polarity.		
Loudspeaker Tap Settings	Verify the tap settings on all constant voltage loudspeakers.		

Loudspeaker Delays	Verify that loudspeakers are set with the proper delay. Refer to drawings and specifications for requirements		

Control System Performance

Title	Description	Initial	Notes
Functionality	Verify that the control system functions according to project documents.		
Automatic controls	Verify that the automatic features work ie: room combining, video detection, etc..		
Lighting controls	Verify that the lighting system presents are correctly recalled by the control system as indicated in project documents.		
Shade controls	Verify that the shade controls are correctly recalled by the control system as indicated in project documents.		
Sequencer	Verify the sequencer is controlled as noted in project documents. If no specific requirements are noted, sequencer will be powered on/of from the front panel.		

Video Performance

Title	Description	Initial	Notes
Video Routing & Switching	Verify that all video signals are properly routed, switched, scaled, and displayed according to project documents.		
Projector Alignment	Verify that projectors and screens provide a projected image that is properly aligned and fills the projection area.		
Projector Alignment	Verify that projector and screen are in the correct locations, correctly aligned and keystone correction is not in use.		
Projector Interactivity	Verify that projector touch sensors are calibrated and working per manufacture instructions. Provide offset hardware as needed.		
Image Scaling	Verify that all displayed images are scaled to the full native resolution of displays and projectors in all cases where scaling hardware is specified.		
Image Quality	Verify that all displayed images are correctly focused and are free from distortion.		
Aspect Ratio	Verify that all displayed images maintain the proper aspect ratio and image geometry. Key-stoning and stretching should not be used. Any exceptions to this should be noted.		
Display Image setting	Displays are set to dot to dot or full. Images shall fill the screen without cropping.		

Signal Bandwidth	Verify that all equipment from endpoint to endpoint supports the resolution/data rate as indicated in the documents.		
System Certification	Verify system has been tested with industry standard testing equipment including the use of Quantum Data 780C		

3.2 OPERATING AND MAINTENANCE MANUALS: Include a copy of this document within the Operation and Maintenance Manuals.

END OF SECTION 27 4101

SECTION 27 5123

INTERCOMMUNICATION 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 work of this section.

B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.

C. Refer to specification 26 0553 conduit and junction box color requirements.

D. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications and color requirements.

1. Fiber Optic Cable: Fiber optic cable is the designated media cabling for school backbone inter-building and intra-building wiring. This includes all MDF to IDF or IDF to IDF and vertical riser applications.
2. Copper Cable: Unshielded Twisted Pair (UTP) with the specified category cabling must be used for the horizontal wiring from the MDF, IDF, or CP to the individual communications outlets.
3. Rack and PoE Switches Requirement: low voltage contractor is responsible for equipment racks, and/or communications cabinets unless specifically noted withing the drawings.
    a. The racks must be installed in the MDF and IDFs to support communications systems equipment and the communications distribution system and must match the current School District Standard. Communications distribution cables must be terminated in jackfields and punch-down blocks mounted in the equipment racks or communications cabinets.

1.2 ADMINISTRATIVE REQUIREMENTS:

A. Bid Submittal:

1. Equipment Costs: Breakout cost of material and labor as different line items.
2. Provide separate line items for each section that you are being bid on.
    a. Contractor shall not provide a single number with all the sections/scopes combined.
3. System is intended to be an addition to the existing intercom system. Contractor to field verify existing conditions, location of headend and other system component locations as required for a complete and working system.

B. Coordination:

1. Coordinate final inspection of the systems installed, with Audiovisual (AV) Consultant, three (3) weeks in advance.
2. Obtain GANTT chart for construction time frame from the General Contractor.
3. Coordinate with Electrical contractor to meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate the mounting condition of all ceiling-mounted AV equipment with ceiling type. During second meeting, coordinate the location of all ceiling-mounted AV equipment in each area.

4. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all loudspeaker and duct work in all areas.
5. Meet with Electrical contractor prior to pathway rough-in to coordinate Intercom system requirements in each area.
6. Meet at least once, prior to rough-in, with horizontal cabling installer to verify all required drop points are accounted for. Coordinate cable color according to specification 27 1500.
7. Meet at least twice with owner to coordinate network requirements. Hold the first meeting before submittal of shop drawings to coordinate network protocols, including but not limited to: IP address schedules, MAC address schedules, patchbay schedules, security requirements, and VLANs. Hold the second meeting prior to system deployment.
8. Coordinate color and finish of all system components with Architect or Electrical contractor as appropriate.
9. Coordinate all system components within millwork/furniture with millwork shop drawings prior to rough-in.
10. Intercom contractor shall participate in a mandatory pre-construction meeting no more than sixty (60) days prior to ordering equipment, and before work can begin. Contractor is responsible for coordinating meeting. The meeting will be held at AV Consultant's office. All submittals, shop drawings, and bill of materials shall be completed and submitted to AV Consultant for review eight (8) working days prior to this meeting.
    a. Intercom contractor shall attend the electrical pre-construction meeting per specification 26 0500.

1.3 DESCRIPTION OF WORK:

A. This specification establishes a minimum level of quality, features, and performance for individual components as well as the integrated system.

B. This section includes an expansion of the existing fully operational IP platform for school internal communications system incorporating school safety notifications and general communications. System is intended to provide 2-way communication within specific areas, mass notification, zone announcements, and more as indicated within this document.

1. Contractor wanting to bid on IP intercom alternate shall submit eight (8) working days prior to bid the system they intend to provide. System shall meet all requirements listed below with no exceptions.
    a. Telecor

C. Equipment submitted in bid proposal that has not been approved by intercom Consultant in writing will not be accepted and shall be replaced by approved equipment at contractor's expense. Equipment not listed within this specification, or contract documents, that are required for a complete and working system, shall be of professional grade and used in the same manner as needed for a complete and working system.

D. The platform shall provide complete internal communications employing IP Technology including the minimum functions listed.

1. Two-way Loud Speaking Internal Intercommunications.
    a. Paging and two-way loud speaking features shall be accessible from any system console or SIP connected telephone.
2. Bell Event announcement
    a. Bell Schedules shall be easily assigned to days and changed simply with authenticated access to the system through any browser-based device.
    b. Provide a simple calendar-based scheduling system for bells. It shall provide the ability to have an unlimited number of bell schedules.

c. Provide a calendar-based scheduling up to four years in advance. The system shall be capable of displaying a fully year calendar and differentiating which bell program is scheduled to run on each day in an easy-to-read format. The calendar shall be based on a standard school year and provide a selectable start month.

d. Provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.

3. Emergency announcement that will override any pre-programmed zones assuring that all Emergency/Lockdown etc., are heard at each and every loudspeaker location.

   a. The system shall automatically broadcast emergency instructions throughout the entire school when an alarm (e.g. lockdown, lockout, security, fire) is tripped or manually activated. The emergency instructions shall be preprogrammed and require no user intervention. The system shall provide a redundant alarm annunciation over intercom/paging speakers and is not meant to replace primary fire alarm or security systems.

   b. The system shall have the capability of maintaining a record of all alerts that are received and provide appropriate school personnel the capability to enter information about the alert, which shall be maintained in the systems database. That information shall also be made available to appropriate school personnel in the form of a report that shows all alerts that have occurred, their date, time, and the end alert information.

   c. Capability of prerecording emergency announcements that can be activated by a Soft Key or via a dedicated call-switch.

   d. Shall provide ability to clear status by individual location, region, or global.

   e. Shall provide pop up alarms on Lockdown, Shelter, or Evacuation events.

4. The system shall provide two I/O Ports on each classroom network interface, and common zone network interface which can be used as programmable inputs or outputs to control contact closures. Contact closures can be activated manually to turn on cameras, unlock doors, emergency lockdown, etc.

   a. Connect two (2) ports to the classroom sound amplification system (CSAS) for emergency notifications to and from the classrooms. The CSAS system shall notify the system and the system shall provide feedback to the CSAS indicating the notification went through.

5. Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone.

6. The system shall be a software-controlled system, whose primary interface is a web-based portal, accessible from any authorized computer, and with assignable permission levels for each user.

7. Classroom systems and common zone network interfaces shall be capable of utilizing standard Category based infrastructure, Category 6 or better, for installation from the intermediate distribution frames only to the classroom and/or zone, allowing for only one type of wiring infrastructure within the school. Distribution of all voice signaling shall utilize a shared or dedicated IP network.

8. The platform shall provide complete internal communications employing SIP (Session Initiation Protocol) including the minimum functions listed.

   a. Integration with any VoIP telephone system using SIP type integration. It shall allow the school(s) to upgrade or replace their telephone system without requiring the owner to replace, or lose any feature of, their internal communications (intercom) system.

b. Support a SIP trunk from the building's VOIP phone system to provide hands free two-way communication from all administrative telephones to any location equipped with a talkback speaker or audio system with room microphone

c. Provide its own SIP environment, and in the case of a failure of the schools VoIP telephone system, be capable of operating completely independently for all functions, except access from the handsets connected to the schools VoIP system.

d. Access remote classrooms (trailers, temporary classrooms etc.) via IP interface or room audio system with room microphone. Integration with any VoIP telephone system using SIP type integration.

e. It shall allow the school(s) to upgrade or replace their telephone system without requiring the owner to replace, or lose any feature of, their internal communications (intercom) system.

f. Any authorized administrator shall be able to call from outside the school into any classroom, zone or entire school directly via the School District supplied SIP enabled Telephone Network. This shall allow remote monitoring, call-in annunciation and two-way conversation from outside the facility as well as paging into the system. (Compliance with NEMA Standard SB-40 for emergency communications in K-12 Schools)

9. The system shall utilize a shared data network (VLAN enabled) or dedicated network as means of distribution for all voice overhead paging, emergency paging, emergency tones, intercom, and class change tones.

E. The system shall support receiving multiple levels of priority, which shall be user definable, that is appropriate for the size of the project. Each end point to place a minimum of a; normal. emergency, ok, and help level priority call depending on the system state at the time of the notification.

F. Authorized system users shall be able to create a minimum of twenty (20) automated sequences with emergency instructions, emails and relay activations and replay them. Automated message strings shall be, manually played from a single-button access on the console, on a SIP connected telephone, a panic button or from the web interface.

G. The platform shall synchronize its system time to the network timeserver or a web-based time server.

H. Installation shall be locally survivable for intercom, paging bells, and emergencies such as lockdown, even when the district connection is unavailable.

I. Input plates shall match the color and style being used throughout the project.

J. Contractor is responsible for coordinating with all other trades for equipment locations, mounting requirements, supports and plenum space requirements.

K. Interconnect the Fire Alarm system to the intercommunications system such that upon activation of any initiating device, a preset audible alarm will be sent to all intercom speakers. In addition, the contractor shall provide all controls necessary between the two systems such that upon silencing the alarm on the fire alarm panel, it automatically silences the audio file in the intercom system.

L. Interconnect the Access Control system to the intercommunications system such that upon activation of an Emergency Lockdown or Preventative Lockdown from the administrative console, web browser, app, etc, a communication protocol will be sent from the intercom system to the access control system that will allow for all controlled doors to be locked, a designated campus wide communication throughout the building, emails, SMS text, etc. A minimum of two types of initiations process shall be programmed e.g. "Emergency Lockdown or "Preventative Lockdown" In addition, the contractor shall provide all controls necessary between the two systems such that the system can easily be reprogrammed to meet the needs of the School District.

M. AV contractor shall participate in a mandatory pre-construction meeting no more than (60) days prior to ordering equipment, and before work can begin. Contractor is responsible for coordinating meeting. The meeting will be held at AV Consultant's office. All submittals, shop drawings, and bill of materials shall be completed and submitted to AV Consultant for review (8) working days prior to this meeting.

1. AV contractor shall attend the electrical pre-construction meeting per specification 26 0500.

1.4 QUALITY ASSURANCE:

A. MANUFACTURERS:

1. Firms regularly engaged in manufacturing of; sound equipment, components and accessories, of types, capacities and characteristics required, whose products have been in satisfactory use in similar service for not less than five (5) years. Equipment supplier shall be authorized representative of the manufacturer of each major piece of equipment and be currently authorized by the manufacturer to furnish, install and service that particular equipment.

B. INSTALLER:

1. Qualified with at least 5 years of successful installation experience with similar systems.
2. Integrating firm shall have worked satisfactorily for a minimum of (5) years of completing systems equal to this scope, quality, type and complexity.
3. Key personnel assigned to the project shall each have minimum of (10) years of experience in completing systems equal to this scope, quality, type and complexity.
4. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
5. Contractor shall maintain complete installation and service facilities for the duration of the project contract.
6. Contractor shall have current manufacturer certificates for system and equipment listed within this specification.
7. All contractors biding on this project must have local representation that is within 4 hours of the job site.
8. Any contractor that cannot meet this requirement shall not bid on this project.

C. Contractor must follow the standards described within:

1. BICSI/AVIXA AV Design Reference manual.
2. ANSI/AVIXA 2M-2010 Standard guide for Audiovisual Systems Design and Coordination Processes.
3. ANSI/AVIXA 10:2013 Audiovisual Systems Performance Verification Guide.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Comply with NFPA 70 and with NEMA Standard SB-40 for Emergency Communications in K-12 schools.

F. Comply with UL 60950.

1.5 SUBMITTALS: Refer to Section 26 0502 for requirements.

A. The following items shall be included in the shop drawings submittal.

1. All submittals shall be submitted in a digital format with bookmarks for each section of equipment. Any submittals that are partial or incomplete shall be rejected and count as one submittal against the submittal allowance.

2. Project manager to provide written proof, signed and dated, that shop drawings and/or brochure has been checked for accuracy prior to submittal. Shop drawings to comply in all respects with the requirements of the contract drawings and specifications for this project.
3. Provide a complete bill of materials for all components, accessories and hardware to be provided in order to assemble a complete and working system as described within the contract documents.
4. Submit manufacturer's data and installation details for all devices, plates, cables and similar equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options, products and/or models being provided.
5. Submit dimensioned drawings and device wiring layouts for Audio, Video, Control, and power.
6. Submit equipment rack elevation diagrams.
7. Submit all manufacturer training, 3rd party and/or organization certificates for each equipment and/or systems required for the implementation of this specification.

1.6 WARRANTY:

A. Systems shall be guaranteed for a period of one (1) year from the date of substantial completion against defective materials, inferior workmanship or improper installation adjustment. Guarantee shall cover all parts and labor.

B. If system failure causes audiovisual system to be inoperative or unusable for its intended purpose, contractor, when notified of the problem, shall repair system so it will be operational and usable within three (3) business days. If defective components cannot be repaired in time, provide temporary equipment as required.

C. Contractor shall supply a one (1) year warranty on all system programming from the date of substantial completion. During this time period, upon owner request, the contractor shall provide programming changes up to four (4) times free of charge. During this time the programs shall be password protected. At any time during the (1) year, the owner can terminate the warranty and request the programming of each system. At this time the programs are to be turned over to the owner and all passwords are to be removed. The owner shall own all rights to the programming after this time, to be used in this facility.

D. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.

E. Prior to the end of the 1-year warranty. The Intercom Integrator shall preform the following:

1. Three (3) months prior to end of warranty remind the owner and design consultant that the end of the warranty is approaching. At this time coordinate the events below with the owner and notify the design consultant of the time of the walk through(s).
2. One (1) month prior to end of warranty, walk through campus and verify all components are working. Supply list of components with location, type equipment and status to the design consultant and Owner. Correct any and all malfunctions as necessary.

PART 2 - PRODUCTS

2.1 GENERAL:

A. The platform shall utilize state of the art IP Technology, Call-in Notification, School Safety Paging and Evacuation tones, IP infrastructure, Atomic Time Synchronization with Class Change Tones utilizing multiple, programmable schedules for each zone, Two-way

hands-free Internal Intercommunications and Paging, and Program Distribution. The system shall be easy to learn and operate. All standard programming shall be web based and user friendly to allow the system administrator the ability to easily program system features.

B. Provide complete and satisfactorily operating school communications and school safety as described herein, 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 all materials and equipment so they form an integrated system, with components and interconnections matched for optimum performance of specified functions.

C. Intercom paging system power and network intercom interface:

1. Shall allow users to install intercom paging systems spanning multiple building or facilities connected through a VLAN. Provide a 100/1000 Ethernet switch port configured on a dedicated VLAN.
2. All Network interfaces used in the classroom and for the common zones shall be powered via PoE+ from the network switches.
    a. PoE+ switches and network cabling from MDF (Main Distribution Frame) and IDF (Intermediate Distribution Frame) to devices.

D. All network switches shall include an uninterruptable power source to provide adequate runtime. In the event the school has a generator the UPS systems shall hold the switches long enough until generator power can be provided.

E. The platform shall be a single electronic system consisting of intercom channels, (classroom) IP loudspeakers, corridor loudspeakers, inside and outside horns, call-in switches, and SIP phone integration.

F. Call-ins shall:

1. Be automatically annunciate (display of priority and location) to administrative consoles, SIP enabled phones and outside phones.
2. Be programmed to automatically change priority and annunciation route based on age of call-in and original priority.
3. Have priority and annunciation routing changed by user action from a console or SIP enabled phone.
4. Be annunciation routing shall include playing pre-recorded audio over speakers, sending a pre-configured e-mail and/or activating relays.

G. The platform shall lend itself to expansion by simple addition of hardware modules.

H. The platform shall directly connect to the WAN/LAN without the need for a separate server at each school location. Configuration, including bell schedules, calendars, and emergency sequences can remotely be created, changed, stored and downloaded to the system by an authorized user from a browser-based interface.

I. The platform shall provide the ability to initiate school safety paging announcements, evacuation tones and take cover tones from any telephone within the facility or outside the facility to any other location within the facility or district.

J. The platform shall provide the ability to selectively communicate or monitor individual classrooms in emergency situations from any telephone within the facility or outside the facility to any other location within the facility; all communication within the classroom shall be hands free and will not require any interaction by the classroom user.

K. IP addressable loudspeaker modules for individual rooms shall be system programmable and may be assigned any two, three, four, five or six digit number as well as name and description. Any extension may be reassigned at any time.

L. IP-enabled two way voice communication shall be available from any provided telephone or administrative console through any IP loudspeaker in the system. This shall allow hands free communication to any classroom or any individual loudspeaker unit. A programmable pre-announce tone shall sound immediately before the intercom path is opened and a supervisory tone shall continue to sound at regular intervals when loudspeaker monitoring is active, complying fully with all privacy legislation. Pre announce tone and supervisory tones shall be disabled during designated emergencies automatically.

M. Integrated Master Clock with unlimited schedules, unlimited events, and automatic Daylight Savings time correct. Up to 5 schedules may be active on any given day for each school. User shall be able to select from 25 standard included tones or unlimited user created and uploaded audio files for class change signaling and messaging. In addition scheduled events shall include relay actions and email notifications. The platform shall allow control of the bell schedules via the district WAN/LAN without the need for a separate computer at the school location. Bell schedules can remotely be created, changed, stored and downloaded to the system by an authorized user from a browser-based interface.

2.2 AMPLIFIER AND LOUDSPEAKERS:

A. Audio Paging/Program Amplifiers: Atlas Sound – CP400, Powersoft – Mezzo 322 A, Stewart Audio – CVA25-1 70V, and/or Manufacturer's equivalent.

1. Power amplifier(s) shall be provided to provide a minimum of 2 watts of power to all paging loudspeakers, and 15 watts of power to all paging horns.
2. The maximum load on the paging/program amplifiers shall be 80% of the rated maximum output of the amplifiers.
3. Provide 25 or 70 volt transformer output for all zones that connect more than 3 loudspeaker together and/or the distance from amplifier to the loudspeaker is greater than 25'.
4. Any exterior zone shall be connected to a minimum of 200 watt amplifier channel.

B. Loudspeakers:

1. AtlasIED and Quam loudspeaker assemblies are the basis of design. Intercom manufacturer equivalent loudspeakers are allowed if they meet the function and form of the loudspeakers listed below.
2. Loudspeaker cabling for common zones shall use a 16 AWG 2-pair stranded conductor cable assembly unless otherwise noted. Refer to Audiovisual Cable and Conduit Schedule on the drawings for approved cabling manufacturer.
3. Type 'IC1' - loudspeaker assembly:
   a. Quam – System 12 or equal
   b. 2'x2' ceiling tile replacement loudspeaker with 5 oz. magnet and 5 watt 24/70V transformer. 92dB SPL 1W/1M with 99dB max SPL at maximum tap. 65Hz – 17kHz frequency response ±3dB and 100-degree dispersion angle.
4. Type 'IC2' - loudspeaker assembly:
   a. Atlas – SD72W w/ 76-8 mounting ring and BMTT95-8 enclosure
   b. Quam – C10X/BU/WS w/ SSB-7 mounting ring and ERD-8U enclosure
   c. Manufacturer equivalent
   d. Gyp loudspeaker with 10 oz. magnet and 5 watt 24/70V transformer. 95dB SPL 1W/1M with 102dB max SPL at maximum tap. 60Hz – 8kHz frequency response ±3dB and 90-degree dispersion angle.
5. Type 'IC3' - loudspeaker assembly:
   a. Atlas – SD72W w/ BMTT95-8 enclosure
   b. Quam – C10X/BU/WS w/ ERD-8U enclosure

c. Manufacturer equivalent
d. Open ceiling direct mount to structure loudspeaker with 10 oz. magnet and 5 watt 24/70V transformer. 95dB SPL 1W/1M with 102dB max SPL at maximum tap. 60Hz – 8kHz frequency response ±3dB and 90-degree dispersion angle.

6. Type 'IC4' - loudspeaker assembly (lay-in tile IP);
   a. Intercom Manufacturer specific assembly with an IP Addressable module and loudspeaker.
7. Type 'IW1' - loudspeaker assembly:
   a. Quam – 8C5PAX/TBLU w/ ES-8 enclosure and BS8W grill
   b. Indoor recessed wall 8" loudspeaker with 5 oz. magnet and 5 watt 24/70V transformer. 92dB SPL 1W/1M with 99dB max SPL at maximum tap. 65Hz – 17kHz frequency response ±3dB and 100-degree dispersion angle.
8. Type 'IW2' - loudspeaker assembly:
   a. Atlas – VTF-152UCN or VTF-157UCN w/ AR Adapter Ring
   b. Exterior recessed wall 4" loudspeaker with 5 watt 24/70V transformer. 96dB SPL 1W/1M with 107dB max SPL at maximum tap. 600Hz – 5.5kHz frequency response ±5dB and 170-degree dispersion angle.
9. Type 'IW3' loudspeaker assembly:
   a. Atlas – AP-15T
   b. Exterior Horn with compression driver and 15 watt 24/70/100V transformer. 106dB SPL 1W/1M with 120dB max SPL at maximum tap. 400Hz – 14kHz frequency response ±5dB and 70-degree dispersion angle.

C. UPS – Juice Goose – SCV-30001 or equal
   1. Contractor to verify UPS load requirements prior to purchase of UPS. Intercom system shall maintain power for 30 minutes after building loses power.

D. Cabling:
   1. Provide and install appropriate number of analog and horizontal cables, patch cables, for all terminated data drops, between switches, etc. so that building-wide networking will be operational once all installation is complete.
      a. Provide manufacturer recommended cabling for all locations shown on plans.
         i. Horizontal/Category provided per specification 27 1500 (i.e. IP addressable Speakers, Classroom Modules, Call Switches, Zone Modules, Console, Controller, etc.)
         ii. Loudspeaker cabling shall be 18 gauge or better. Refer to drawings for cable types and requirements.
      b. Provide cabling rated for the environment that it is installed in (i.e underground conduit, conduit in slab on grade). All cabling installed in wet locations shall be listed for use in wet locations.
   2. All associated intercom wiring cable shall be yellow.

E. Clocks:
   1. Clocks shall be battery powered. The contractor shall provide a fresh battery and install each clock set to the correct local time. Room types will have different size requirements.
   2. 12" clock – American Time and signal – E56BAQD304BF
      a. Provide 1 clock per the following room types:
         i. Learning Studio/Classrooms
         ii. Collaboration Area
         iii. Offices
         iv. Work rooms

v. Conference rooms

3. 15" clock – American Time and signal – E66BAQD304BF (Recreational Space Clock)
   a. Provide 1 clock per the following room types:
      i. Gymnasiums (provide 1 on each side of the dividing curtain)
      ii. Music rooms
      iii. Shops
      iv. Kitchen
      v. Commons/learning stairs
      vi. Media center
4. Provide wire guard on all clocks in locations where other devices are protected. Coordinate with fire alarm plans for locations requiring wire guards.

2.3 ZONES, PROGRAM DISTRIBUTION, CLOCK/TIME SIGNALING SYSTEM

A. Separately addressable paging zones shall be provided as indicated on the drawings. Zones shall be capable of being grouped for various call scenarios as defined or requested by the owner.

B. Refer to the intercom drawings for identification of zones, zone types, and ceiling construction type.
   1. Individual zones are designated with “Z-ID”.
   2. Common and exterior distributed zones are identified with a unique zone number “Z-#X#”.
   3. Intercom drawings are intended to be printed in color in addition to having the zone information under the room tag.

C. Space requirements:
   1. Classrooms/Teaching spaces.
      a. The IP module/loudspeakers for each space shall be utilized for the intercommunication system.
      b. One (1) Call switch shall be provided in each room near the CSA antenna location. Refer to drawings for location of devices.
      c. One (1) Clock located above the entrance door.
   2. Shared spaces between Classrooms/Teaching spaces.
      a. The IP module/loudspeakers for each space shall be utilized for the intercommunication system.
      b. One (1) Call switch shall be provided on the wall adjacent to the main hallway.
      c. One (1) Clock located above the entrance door.
      d. These rooms will be used as shelter in place rooms for adjoining classrooms.
   3. Specialty Teaching spaces with high ambient noise floor (Wood/Metal/AG shops, Band/Choral/Orchestra rooms, etc).
      a. Distributed ceiling recessed loudspeakers (Qty. as required) at 14’ by 14’ minimum spacing, type as required for ceiling construction.
      b. Visual strobe located in a highly visible area.
      c. One (1) Call switch shall be provided at the primary teaching station. Coordinate location of primary teaching location with drawings.
      d. One (1) Clock located above the entrance door
   4. Private Offices, Conference rooms, Faculty Lounges & Work Rooms (outside of the main office/administration suite)
      a. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
      b. Connect to adjacent corridor zone you enter the office from.

c. Offices off of a classroom shall be on the same zone as the classroom.
d. Refer to floor plans for offices that require an individual zone.

5. Gymnasium
   a. Wall mounted horn type loudspeaker above the entrance door. If there is a dividable curtain provide a loudspeaker for each side along with one on the stage, if applicable.
   b. Additional loudspeakers may be required as needed to maintain adequate coverage (< 6dB level variation).
   c. One (1) Call switch shall be provided co-located with any light switches adjacent to each entrance from within the school.
6. Cafeteria/Commons/Dining
   a. Ceiling mounted loudspeakers, Qty. and type as required for ceiling construction and adequate coverage (< 6dB level variation).
7. Kitchen
   a. Ceiling mounted loudspeakers, Qty. and type as required for ceiling construction and adequate coverage (< 6dB level variation).
   b. One (1) Call switch shall be provided co-located with any light switches adjacent to main entrance.
   c. Within the Kitchen office provide a two-way system with call button and loudspeaker.
8. Corridors, Vestibules & Open Collaboration/Circulation areas
   a. Distributed ceiling recessed loudspeakers (Qty. as required) at 20' minimum spacing, type as required for ceiling construction.
   b. Rooms that are wider than 25' shall require an additional row of loudspeakers and located on a maximum of a 20' x 20' spacing centered in the room.
   c. Coordinate with ceiling devices and locate adjacent to smoke detectors when within few feet of one. Loudspeakers shall be in line with any lighting within the space
   d. Provide a minimum of one (1) loudspeaker for each space type
9. Stairwells
   a. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
   b. Connect to the adjacent corridor zone unless otherwise specified.
10. Restrooms
   a. One (1) ceiling mounted loudspeaker, type as required for ceiling construction.
   b. Connect to the adjacent corridor zone
   c. Do not provide loudspeakers in single use restrooms adjacent to a corridor zone. Locate corridor loudspeakers within 10 to 12 feet of the door.
11. Administration Suite (Private offices, Conference rooms, Nurse areas, work rooms, reception, etc. within the main administration suite)
   a. Distributed ceiling recessed loudspeakers (Qty. as required) at 20' minimum spacing down corridors and 14' x 14' in open areas, type as required for ceiling construction.
   b. Provide a minimum of one (1) loudspeaker for each space type.
   c. Provide a minimum of one (1) loudspeaker on an individual zone in the reception area and adjacent areas where it would be heard in the reception area. General pages from the reception area shall not play over this zone, it shall only be used for prerecorded messages.
12. Building Exterior
   a. Distributed recessed loudspeakers (Qty. as required) to cover all sides of the building and all entrances.

b. Coordinate and co-locate loudspeaker rough-in with exterior fire alarm horn strobe locations.
c. Provide unique zone for each side of the building (North/South/East/West)
d. Provide 'IW3' type loudspeakers on areas with:
i. Playground equipment
ii. Fields
iii. Other play surfaces
e. Provide 'IW2' type loudspeakers on the front of the building and in locations where the property line is less than 30' from the building.

13. Rooms smaller than 100 sqft and that are adjacent to a corridor/hallway will not require a loudspeaker when an announcement is audible within the room. Audible within the room shall be defined as 15 dB above the ambient noise within the room.
a. Vestibules are excluded from small rooms and will require a loudspeaker tied to the adjacent corridor zone.

14. Field coordinate the tap setting on each loudspeaker to be 15dB above the ambient noise floor. The ambient noise floor shall be measured when the area is fully occupied. The following areas have the anticipated noise floor:
a. Hallways – 80 dB
b. Classrooms – 70 dB
c. Offices/conference rooms – 60 dB
d. Gym/multipurpose rooms – 85 dB
e. Exterior areas – Max tap setting

D. All class-change bell signaling shall be sounded over the intercommunication system.

1. Each dialing administrative console in the system shall be programmable for the following options:
a. Allow zone paging.
b. Allow All-Page announcements.
c. Allow Executive Override.
d. Allow Emergency paging.
e. Allow activation of Time Zone tones.
f. Set the priority level and target display of "normal" calls.
g. Set the priority level and target display of "emergency" calls.
h. Assignment of architectural number.
i. Class of Service.
j. Assignment of associated speaker to paging zone.
k. Automatic Call-Back-Busy.
l. Call Forward-No Answer.
m. Call Forward-Busy.
n. Allow activation of security monitoring functions on a per room and per zone basis.

E. All class-change signaling shall be sounded over system loudspeakers as programmed.

PART 3 - EXECUTION

3.1 GENERAL

A. Wiring shall be installed in metallic conduit to cable trays and provided with necessary junction and pull boxes. All wiring shall be color coded and in accordance with the manufacturer's instructions, local and national codes. Care shall be exercised in wiring to avoid damage to the cables. All boxes shall be plumb and square. Cables shall be pulled continuous without splicing, leaving ends in lengths as directed by the manufacturer's representative.

B. After all circuits and cables have been pulled and completed from one extremity to the

other, the electrical contractor shall check all circuits free of opens, shorts and grounds. The electrical contractor shall identify and tag all cables at the head end.

C. Provide all equipment, wiring, conduit, boxes, rough-in, etc., according to the plans and specifications.

D. The manufacturer’s representative shall make all final connections to the equipment, shall test and adjust the systems, and shall instruct the proper parties as to care and operation.

E. Any additional equipment required for a fully functional system to meet the intent of the specifications shall be provided whether or not specifically listed herein.

F. Mount punch down block for system terminations, within the equipment rack.

G. Test the reception at each clock location, per manufacturer’s instruction, to determine the actual location with the Architect.

3.2 INSTALLATION OF SOUND SYSTEMS:

A. Install sound systems as indicated, in accordance with equipment manufacturer's instructions, and with recognized industry practices, to ensure that system equipment complies with requirements. Comply with requirements of NEC and applicable portions of NECA's "Standard of Installation" practices.

B. Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.

C. Coordinate with other electrical work, including cable/wire, raceways, electrical boxes and fittings, as appropriate to interface installation of clock and program systems work with other work.

D. Control Circuit Wiring:

1. Install control circuits in accordance with NFPA 70 and as indicated. Provide number of conductors as recommended by system manufacturer to provide control functions indicated or specified.
2. The contractor shall mount a main distribution frame behind the Integrated Electronic Communications Network console. All wires shall be laid down on terminal punch blocks and identified by the actual room location it serves. All the communications points shall be wired into this main distribution frame, laid down in sequence, and identified by which line it is on and the point position it serves.
3. All housings are to be located as specified and shown on drawings.
4. Make installation in strict accordance with approved manufacturer's drawings and instructions.
5. The contractor shall provide necessary transient protection on the AC power feed, all station lines leaving or entering the building, and all central office trunks. All protection shall be as recommended by the equipment supplier and referenced to earth ground.

E. Wiring Within Enclosures:

1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars.
2. Provide physical isolation from each other for speaker-microphone, line-level, speaker-level, and power wiring. Run in separate raceways, or where exposed or in same enclosure, provide 12 inch minimum separation between conductors to speaker-microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other Integrated Electronic Communications Network system conductors.

F. Weatherproofing:

1. Provide weatherproof enclosures for items to be mounted outdoors or exposed to weather.

G. Repairs:

1. Wherever walls, ceilings, floors, or other building finishes are cut for installation, repair, restore, and refinish to original appearance.

H. Equalize systems using industry recognized practices and equipment.

I. Pathway Requirements:

1. General:
   a. All pathways shall be designed, constructed, grounded and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942.
   b. 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. Arrangements to remove any major obstructions not identified on plans need to be determined at that time with the Engineer.
2. Conduits:
   a. Contractor shall provide a minimum of 1-1” EMT conduit from device to cable tray, unless otherwise noted, for device connections exiting the room. Refer to symbol schedule for specific conduit requirements.
   b. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
   c. Provide large radius elbows on all bends.
   d. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.
   e. AV conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.
   f. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed and fitted with bushings.
   g. A 200lb pull cord (nylon, 1/8” minimum) shall be installed in any empty conduit.
3. Open Top Cable Support Requirements:
   a. Non-continuous cable supports shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables
   b. Non-continuous cable supports shall have flared edges to prevent damage while installing cables.
4. Pull Box Requirements:
   a. NEC sized pull boxes are not acceptable. Follow BICSI and EIA/TIA 569-B guidelines for pull box sizing.
   b. Provide pull boxes in sections of conduit that are 100 feet or longer, contain more than two 90 degree bends, or contain a reverse bend.
   c. Conduits that enter a pull box from opposite ends should be aligned.
   d. Pull boxes shall have a length 12 times the diameter of the largest conduit.
   e. All pull boxes must be accessible.

J. Cabling System:

1. Follow T568B scheme for copper category cabling terminations.

2. Provide a minimum 6” service loop in each AV system junction box. Cables shall be coiled in the in-wall boxes if adequate space is present to house the cable coil without exceeding manufacturers bend radius.
3. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.
4. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
5. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for AV cable is required, the contractor shall install appropriate carriers to support the cabling.
6. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
7. Pulling tension for balanced twisted pair shall not exceed 25lbf and for optical fiber shall not exceed 50lbf.
8. Pair untwist at the termination shall not exceed 0.125”. The cable jacket shall be maintained as close as possible to the termination point.
9. Cable shall not be draped on, tied or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

K. Cabling groups and conduit separation:

1. Refer to “CABLING GROUPS AND CONDUIT SEPARATION SCHEDULE”.

L. Firmly secure all equipment in place that is not intended for portability.

M. Mount projectors permanently and provide mechanical index ensuring precise alignment of the projected image.

N. Provide adequate structural support for AV system components. Provide fastenings and supports with a safety load factor of at least five.

3.3 GROUNDING:

A. All grounding and bonding shall be done according to ANSI J-STD-607-A, TIA 942, and NEC.

B. All cabinets/racks shall utilize paint piercing grounding washers, to be used where rack sections bolt together, on both sides, under the head of the bolt and between the nut and rack.

C. All racks shall further utilize a full-length rack ground strip attached to the rear of the side rail with the thread-forming screws provided to ensure metal-to-metal contact. Similar to Panduit RGS.

D. All active equipment shall be bonded to ground. If the equipment manufacturer provides a location for mounting a grounding connection, that connection shall be utilized. All active equipment shall be bonded using the appropriate jumper for the equipment being installed using the thread-forming screws. Similar to Panduit RG.

E. Racks shall have individual, appropriately sized conductors bonded to the grounding backbone. Do not bond racks or cabinets serially – daisy-chained rack grounds will not be accepted.

F. Refer to electrical diagrams for additional ground connection requirements.

3.4 LABELING

A. The contractor shall develop and submit for approval a labeling system for the cable installation. The Owner will negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels and wall plates. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

B. All labels shall meet UL 969 requirements for legibility, defacement and adhesion requirements. Handwritten labels are not allowed. All labels shall maintain consistent typeface, size and color.

C. Provide laminated plans (minimum size 11x17) of all AV as-built plans (including riser diagrams) intercom rack. Contractor shall be responsible for providing a 1RU drawer.

D. Label each equipment with the date (month/year) that it was installed along with the IP address, if applicable, and equipment type.

3.5 CYBER SECURITY

A. Contractor shall change all default username and passwords for all network devices provided. A Strong Password should include at a minimum the following:

1. Be at least 12 characters in length
2. Contain both upper and lowercase alphabetic characters (e.g. A-Z, a-z)
3. Have at least one numerical character (e.g. 0-9)
4. Have at least one special character (e.g. ~!@#$%^&*()_-+=)
5. Cannot contain full words

B. No written username or passwords shall be located in any areas of installation.

C. Network devices to be set up on a separate network other than owner’s LAN ensuring no internal or external users can access system without authorization.

D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:

1. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Inspection:

1. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
2. The installation technician from the installer / manufacturer shall perform all system tests as specified. Perform all tests in the presence of the Owner, Architect / Engineer and any designated personnel as deemed necessary by the Owner or Architect / Engineer. This test shall be performed with the devices at their operational location and under normal operational conditions. Bench or default settings for devices are not acceptable. All test and test report costs shall be included in the contractors bid. A checkout report shall be generated by the installation technician and submitted to the Owner and Architect. The report shall include but not be limited to the following:

a. A complete list of all equipment installed with corresponding serial numbers.
b. Indication that all equipment is properly installed, functions and conforms to the specifications.
c. Serial numbers, locations by device and model number for each installed device.
d. Technician's name, specified certification credentials and date of system test.
e. Any additional information as deemed necessary by the Owner and or Architect / Engineer.

C. TESTING:

1. Upon completion of installation of each system and after electrical circuitry has been energized, demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units on site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with testing.
2. Before inspection by owner and AV Consultant, and after completion of the installation, conduct system tests and make necessary corrections for proper system operation.
3. Adjust, balance and align equipment for optimum quality and to meet the manufacturer's published specifications.
4. All limiters and/or compressors shall be set to prevent operators from over-adjusting sound levels and damaging system components.
5. System shall have no audible hum, noise, RFI, or distortion when operating under normal conditions. System shall reproduce material at the loudspeakers rated output level without audible distortion. All input levels shall be pre-set so system may be operated without causing unstable feedback under normal use.
6. System shall have no image distortion, hum bars, color shift, or any other picture distortion while operating under normal conditions. Provide cable equalizers, located near displays, on all cables that are more than 30 feet in length and/or have more than 4 connection points.
7. Adjust gain controls for optimum signal-to-noise with 0 dBu at a line-level input.
8. Perform polarity checks of loudspeaker lines by means of a polarity tester or use DC source at one end of each line and a voltmeter at the other end. Loudspeaker lines shall be identically polarized with respect to color coding.
9. Loose parts and poor workmanship or soldering shall be replaced.
10. Sweep Loudspeaker systems with high-level sine wave or 1/3 octave pink noise source. Correct causes of buzzes or rattles related to Loudspeakers or enclosures. Notify owner of external causes of buzzes or rattles.
11. Contractor shall provide system testing as described herein using up-to-date and industry accepted test equipment appropriate to the types of links being tested and in accordance with the latest edition of IEC 61935-1.
12. Horizontal cabling contractor shall test all twisted pair cabling used within the system following the standards in specification 27 1500 under the testing section. Provide documentation of testing to Intercom Consultant prior to final walk through.

D. At the time of final commissioning, if the Intercom consultant determines that the systems are not sufficiently complete to do a final punch list, and was not notified at least three (3) days prior to the visit, then a return visit will be required. The Intercom Consultant's return visit will be paid for in advance by the Intercom integrator at a flat rate of $1000 per person, at no cost to the owner.

3.7 OCCUPANCY ADJUSTMENTS:

A. When requested by the Architect 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.

3.8 TRAINING

A. The contractor shall provide and implement a complete and comprehensive staff training program for all administrators, facility staff members and teachers. This mandatory training program will provide school staff a complete understanding of how to utilize and properly operate all functions.

B. The training program shall be implemented by a staff member/trainer employed by the contractor. The trainer must be factory certified to provide training on their product.

C. All staff development training is to be coordinated through the owner's designated representative. As training sessions are completed, the trainer will provide the school's administrative staff and school district's staff a document listing all of the staff and faculty members who attended, received and completed the training program.

D. Provide a minimum of two (2) two (2) hour sessions of in-service training with this system. These sessions shall be broken into segments that will facilitate the training of individuals in the operation of this system. Operators Manuals and Users Guides shall be provided at the time of this training.

E. Schedule training with Owner through the Architect, with at least fourteen (14) days advance notice.

F. Training shall be recorded using a video recording device that support a minimum resolution of 1080P/60 with an integrated microphone connection for an external microphone and a camera tri-pod mount. Presenter shall be wearing a lapel microphone that connects to the recording device and a Tri-pod shall be used for stabilizing the recording device. Recordings that are shaky, poor audio and/or video quality, incomplete, or other issues will not be accepted and the contractor will be responsible for providing a new recording and training within five (5) business days of notification. Provide a digital copy to the Owner and Intercom Consultant. If Digital copy is sent in a link, verification of end user download shall be provided to the owner and Intercom Consultant showing IP address or user that download and what date. The link cannot have an expiration date and will be the responsibility of the contractor to maintain. Links shall be included in the Operating and Maintenance manuals in the first section. Video files shall also be provided on a flash drive within the intercom equipment rack adjacent to the server location. Flash drive shall be clearly labeled.

3.9 CLEANING AND PROTECTION

A. Prior to final acceptance, the contractor shall vacuum and clean all system components and protect them from damage and deterioration. All general areas within and around all equipment rack/cabinets in the facility will be swept, vacuumed, and cleaned up.

3.10 OPERATING AND MAINTENANCE MANUALS: Refer to Section 26 0502 for requirements.

3.11 RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

END OF SECTION 27 5123

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SECTION 28 2205

ACCESS CONTROL SYSTEM

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 work of this section.

B. Division-26, 27 & 28 basic materials and methods sections apply to work specified in this section.

C. Refer to specification 26 0553 for cabling, conduit, and junction box color requirements.

D. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications and installation standards.

E. Specification 26 0500 Part 1.3 Phasing and Sequencing of Work.

F. Definitions:

1. ACS: Access Control System
2. CSA: Client Software Application
3. SDK: Software Development Kit
4. UI: User Interface
5. OSDP: Open Supervised Device Protocol
6. UPS: Uninterruptible Power Supply
7. CR: Credential Card Reader
8. REX: Request to Exit
9. DPS: Door Position Switch
10. PTE: Push to Exit Button
11. LDAP: Lightweight Directory Access Protocol
12. AD: Active Directory

1.2 ADMINISTRATIVE REQUIREMENTS:

A. BNA Project Contacts:

1. Riley Richards
   Phone: 801-532-2196
   Email: RRichards@bnaconsulting.com

2. Dan Varney
   Phone: 801-532-2196
   Email: DVarney@BNAConsulting.com

1.3 DESCRIPTION OF WORK:

A. Provide a complete and operating access control system to expand onto the existing access control system as indicated in the drawings and plans, and is hereby defined to include, but not be limited to: access control operating software, licenses, head-end control panels, blades, power supplies, back up batteries, credential card readers, door/garage/roof position contacts, request to exit motions, access control cabling, door release and school lockdown buttons, IP two-way audio video intercom door station and answering base station, integration with other systems, protective enclosures, and all wiring that is normally and reasonably required.

B. Expand onto the existing access control system as required to accommodate project.

C. Provide the specified system in a complete and operating condition with all necessary materials and labor to fulfill all the requirements and the intent of the drawings and specifications. Except as otherwise indicated, provide manufacturer's standard system components.

D. The contractor shall furnish all cables, materials, and equipment, whether specifically mentioned herein or not, to ensure a complete and functional system.

E. The contractor is responsible for coordinating & verifying with other trades, the owner, for equipment locations, mounting requirements, supports, and plenum space requirements.
F. Refer to other Division 26 sections for requirements for raceways, trays, boxes, and fittings, and supporting devices, and other sections, as applicable.
G. Connect the access control system to the intercommunications system such that upon activation of an emergency from the administrative console, web browser, or app a communication protocol will be sent from the intercom system to the access control system that will allow for all controlled doors to be locked, a designated campus wide communication throughout the building, emails, SMS text, etc. A minimum of two types of initiations process shall be programmed e.g., “Emergency Lockdown or “Preventative Lockdown” In addition, the contractor shall provide all controls necessary between the two systems such that the system can easily be reprogrammed to meet the needs of the owner.

1.4 BID SUBMITTAL:

A. Submittals shall be submitted in a digital format with bookmarks for each section of equipment. Any submittals that are partial or incomplete shall be rejected and count as one submittal against the submittal allowance. No handwritten documentation is allowed.
B. Provide a complete bill of materials for all components, accessories, and hardware to be provided in order to assemble a complete and fully functioning access control system as described within the contract documents.
C. Provide a breakout cost of material and labor as different line items. Bids must include line-item pricing for major parts and components of the system.
D. Submit manufacturer’s data sheets and installation details for all devices, panels, cables, and head-end equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options, products and/or models being provided.
E. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the installation.
F. All change orders will be required to have the same discounts on equipment than original bid. And follow the above information for all change orders.

1.5 COORDINATION:

A. Coordinate final inspection of the systems installed, with Security Consultant, three weeks in advance.
B. Obtain GANTT chart for construction time frame from the General Contractor.
C. Coordinate with owner, Div.8 contractor, and electrical contractor PRIOR to rough-in to coordinate exact location of end devices and door functionality.
D. Meet with electrical contractor prior to pathway rough-in to coordinate access control system requirements in each area.
E. Coordinate meetings with owner’s IT Department prior to ordering equipment to verify IT requirements and standards.
F. Meet at least once, prior to rough-in, with horizontal cabling installer to verify all AV network requirements. Coordinate cable color according to specification 26 0553.
G. Coordinate color and finish of all access control components with architect or electrical contractor as appropriate.
H. Division 26, 27, and 28 contractors shall verify electrical service provided prior to ordering any electrical equipment serving electronic door hardware equipment and has the final responsibility for properly coordinating the electrical work, including the exact location of the electrical connection(s).
I. Obtain submittals of all door hardware equipment from door hardware specification and Division 8 and 28 contractor(s). Carefully review door hardware submittal and advise in writing of any discrepancies.
J. Notify engineer of any modifications between contract documents and submittals. It is the contractor’s responsibility to ensure compliance with the documents.
K. The contractor shall include necessary wiring and programming for fire-alarm panel tie-in and door release based upon the requirements and direction of the owner and/or AHJ.

Contractor is responsible to schedule and coordinate with the fire alarm contractor.

L. Coordinate all interfaces between door hardware and electrical contractor.

M. Provide dedicated 20-amp circuits for the access control panels, equipment, and the electrified door hardware power supplies.

N. Coordinate with the electrical contractor and owner and review what electrical circuits the active access control head end control panels and the electrified door hardware power supplies will need to be connected to (i.e., emergency backup power circuits, or standard power circuits).

O. A licensed and insured Electrical Contractor to provide 120VAC power to all locations requiring power.

1.6 QUALITY ASSURANCE:

A. Manufactures: Firms regularly engaged in manufacture of security system equipment and components of the types described herein and whose products have been in satisfactory use in similar applications for not less than five years.

B. Installation Contractor:

1. Integrating firm shall have worked satisfactorily for a minimum of five years of completing systems equal to this scope, quality, type, and complexity.
2. Key personnel assigned to the project shall each have minimum of five years of experience in completing systems equal to this scope, quality, type, and complexity.
3. Contractor shall be a factory authorized installer of all equipment specified for the geographical area of the project.
4. The contractor shall maintain complete installation and service facilities for the duration of the project contract.
5. The contractor shall have current manufacturer certifications for all security systems and equipment listed within this specification. Certifications must be from local office providing the installation.

C. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.

D. All technicians are required to have proper state licensing to perform work within this specification.

E. Pre-Approved Installation Contractor(s):

1. Open to all LenelS2 NetBox Certified and State Licensed Contractors

F. Bidders not pre-approved: Bidders that are not on this pre-approved list shall submit in writing the following for review at least (8) working days prior to bid.

List of qualifications include:

1. Industries certifications including manufacturers.
2. Past and current projects within the last 5 years are similar in scope and size.
3. (3) Different referrals from the owners of (3) different projects within the last 5 years.

1.7 SUBMITTALS:

A. Refer to specification 26 0500 for shop drawing submittal requirements. The following items shall be included in the shop drawings submittal. Submittals to be reviewed and approved prior to ordering equipment.

1. All submittals shall be submitted in a digital format with bookmarks for each section of equipment. Any submittals that are partial or incomplete shall be rejected and count as one submittal against the submittal allowance. No handwritten documentation is allowed.
2. Provide a complete bill of materials for all components, accessories, and hardware to be provided in order to assemble a complete working system as described within the contract documents.
3. Submit manufacturer's data and installation details for all devices, panels, cables, and head-end equipment. Product data showing multiple options, products and/or models shall be clearly marked identifying the specific options,

products and/or models being provided.
4. Submit dimensioned drawings and device wiring layouts for all equipment.
5. Submit equipment rack elevation diagrams (if applicable).
6. Submit network switch port count and power requirements. Port count and POE switch requirements should be broken out per EF/ER/TR closet.
7. Submit manufacturer certifications for all systems provided. Certifications must be from local office providing the installation.

B. With this submittal, the contractor shall provide a concise narrative of their understanding of the project.

C. Provide the Owner the following upon project completion:
1. A complete set of shop drawings indicating: Locations of all panels, power supplies and controllers; point-to-point wiring diagrams for all devices.
2. A complete equipment list identifying: Type; model; manufacturer; manufacturer's data sheets.
3. A list of IP and MAC addresses, username and passwords for network devices coordinated with door name and/or location.
4. Serial and model numbers for all major components.
5. Installation manuals and user manuals for all systems listed in these specifications.

1.8 WARRANTY:

A. Systems shall be guaranteed for a period of one year from the date of substantial completion against defective materials, inferior workmanship, or improper installation adjustment. The guarantee shall cover all parts and labor.

B. If system failure causes the access control system to be inoperative or unusable for its intended purpose, the contractor, when notified of the problem, shall repair system so it will be operational and usable within three business days. If defective components cannot be repaired in time, provide temporary equipment as required.

C. Systems designed for 24/7 operation shall be repaired and/or replaced within 24 hours of time of notification. If defective components cannot be repaired in time, provide temporary equipment as required.

D. The contractor shall supply a one-year warranty on all system programming from the date of substantial completion. During this time period, upon owner request, the contractor shall provide programming changes up to four times or four hours free of charge.

E. Contractor shall honor equipment warranties for term established by manufacturer if greater than warranty time frame mentioned above.

PART 2 – PRODUCTS

2.1 GENERAL REQUIRMENTS:

A. Provide a complete and operable LenelS2 NetBox appliance base/proprietary access control system that meets the owner's requirements, operates to the manufacture specifications, and maintains building security.

B. The access control operating software is S2 NetBox software.

C. The ACS shall be scalable to support configurations consisting of thousands of doors with facilities spanning multiple geographic areas.

D. The network appliance shall be capable of running on an existing TCP/IP network and shall be accessible, configurable, and manageable from any network-connected PC with a browser and/or client.

E. The ACS shall support a variety of access control functionalities, including but not limited to:
1. Elevator management
2. Cardholder and cardholder group management, credential management, and access rule management.
3. Badge printing and template creation.
4. Visitor Management.
5. Mustering.

6. LDAP / Active Directory integration for single-user logon authentication.
7. Access levels disable for immediate lockdown.
8. A completely customizable access level based on threat levels, multiple schedules, and user groups.
9. The ACS shall support encrypted reader to panel communications using the SIA OSDP protocol.

F. All equipment shall be installed as shown on the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications, or drawings, shall be submitted in writing to the Security Consultant for clarification in an RFI.

G. Equipment lists are provided to set equipment expectations and may not be complete. Coordinate with devices shown on drawings for system intent. Provide a complete and functional system as described within the construction documents.

H.

2.2 AUTHORIZED MANUFACTURER:

A. LENEL / S2 NetBox

2.3 GENERAL EQUIPMENT REQUIREMENTS:

A. Provide all necessary equipment to ensure a complete access control system is achieved. Provide the following equipment as a baseline for the access control system:

1. Access Control Head-End Equipment/Panels

Description	Manufacturers	Part Number
Access Control Software	LenelS2	NetBox Operating Software
Intelligent Control Panel	LenelS2	S2-NN-E2R-WM
Access Control Application Blade	LenelS2	S2-ACM
Supervised Input Application Blade	LenelS2	S2-INP
Relayed Output Application Blade	LenelS2	S2-OUTP
Electrified Door Hardware Power Supplies	LifeSafety Power & Altronix	
Rechargeable Sealed Back-up Batteries	Yuasa, PowerSonic, Elk	12V, 8Ah

2. End Devices

Standard Wall Credential Car Reader	HID Global-Signo 40	40NKS-02-000000
Mullion Style Credential Car Reader	HID Global-Signo 20	20NKS-02-000000
Recessed Door Position Contact	Nascom	N1178C Series
Surface Mount Position Contact	Nascom	NC1010T Series
Roof Hatch Position Contact	Nascom	N505AU Series
Rail Mounted Garage Door Position Contact	Nascom	N505AUTM Series
Momentary Door Release Button	Alarm Controls	TS-18 (under desk)
Emergency School Lockdown Switch	Honeywell	270R (under desk)
Request to Exit Motion	Bosch	DS160
Request to Exit Motion Trim Plate	Bosch	TS160(if applicable)
IP Two-Way Audio/Video Intercom Door Station	Axis Communications	I8116-E / 02409-001
Mico 64GB SDXC Memory Card	Axis Communications	5801-951
IP Two-Way Audio/Video Intercom Answering Base Station and Desk Stand		
	2N, Indoor View	02087-001 (BLK)
	2N, Desk Stand	02039-001 (BLK)

B. Equipment lists are provided to set equipment *expectations* and may not be complete. Coordinate with devices shown on drawings, system risers and equipment list for system intent. Provide a complete and functional system as described within the construction documents.

1. DIV.8 will provide and install the electrified door hardware (electric strikes, exit rim device/crash bars, maglocks, electric locksets).
2. DIV.28 will provide and install all integrated credential card reader / electrified lockset combinations.
3. DIV.28 will provide all of the power supplies for electrified door hardware

equipment. Coordinate & verify with DIV.8 for the exact power requirements.

4. Coordinate, discuss, and verify with the architect, owner, and electrical contractor the door hardware that is going to be provided & installed.
5. Provide 1 year of software updates for access control software.

2.4 POWER SUPPLIES:

A. The DC Voltage power supply shall provide dual output fused ports of either 12 or 24VDC and receive power inputs of either 120 or 230VAC. Units shall be expandable by adding additional modules for up to three power modules. Power modules shall provide power capabilities from 75 to 250W. The system shall provide configurations for; power distribution, control and signaling, fire alarm interface or fail safe/fail secure locking control and shall be a standard feature of the system.

B. Power supplies shall be located by the access control panel(s). Provide additional enclosures as needed.

C. Power supplies and access control panels should have a minimum of two 12V, 8Ah batteries per panel.

D. A network module shall be available as an optional device for remote functionality such as control, status reporting, information logging, remote battery testing, fault reporting / restore, and shall interface with multiple control and monitoring modules to extend the remote functionality to multiple individual outputs for direct control, extended information gathering and reporting.

E. The DIV.28 contractor shall provide power supplies for the electrified locks, access control panels, and any other access control device needing power.

F. Minimum standby capacity shall be 24 hours, battery calculations to verify system standby time are required.

G. Coordinate with the electrical contractor and owner and review what electrical circuits the active access control head end control panels and the electrified door hardware power supplies will need to be connected to (i.e., emergency backup power circuits, or standard dirty power circuits).

2.5 CREDENTIAL CARD READERS:

A. The contactless smart card reader shall comply with the following 13.56MHz-related standards: ISO 15693, ISO 14443A, ISO 14443B

B. The card reader shall be configurable to provide secure, bidirectional communication in compliance with v2 of the SIA Open Supervised Device Protocol (OSDP).

C. The contactless smart card reader shall utilize an EAL5+ certified secure element to protect keys and execute cryptographic functions. It shall support 3DES and AES algorithms.

D. The contactless smart card reader shall support secure sector read of iCLASS SeoS credentials and Mobile Identities powered by SeoS.

E. The contactless smart card reader must support Bluetooth Low Energy (BLE) and Near Field Communication (NFC) communication technologies.

F. Optionally the reader shall support 125kHz HID Prox credentials.

G. Mobile Identity operation must be configurable.

H. The contactless smart card reader shall provide enhanced user feedback options through the use of tri-colored LEDs configurable to support any three-color combinations (RGB - Red, Green, and Blue).

I. Reader behavior configuration options shall include Intelligent Power Management (IPM) mode to reduce power consumption by at least 59%.

J. The Contactless smart card reader shall be connected with pigtail cable

K. Tamper detection on card readers shall be programmed to send notification through access control system in the event of damaged or tampered with.

L. Credential card readers must have the capability to support mobile phone credentials if the owner chooses to upgrade to mobile credentials in the future.

M. Card readers are to be mounted on a 4 square j-box with a single gang mud ring. Mullion style card readers that are mounted onto mullions do not need back box; wiring should be routed though mullion/door frame.

PART 3 – EXECUTION

3.1 INSTALLATION OF ACCESS CONTROL SYSTEM:

A. General: Install access control system as indicated, in accordance with equipment manufacturers written instructions, and with recognized industry practices, to ensure that system equipment complies with requirements. Comply with requirements of NEC, and applicable portions of NECA's "Standards of Installation" practices.

B. Prior to starting any work, coordinate and verify the access control layout, wiring, equipment device locations, and mounting details with the owner, architect, and any other trades and suppliers that are applicable, and get written approval.

C. Coordination Meetings:

1. Meet at least twice with the door hardware systems installer. Hold first meeting before submittal of shop drawings to coordinate electronic door hardware components for each door, rough-in requirements, door schedules. Hold the second prior to the physical installation of components to verify raceway and cabling, equipment list, verify any and all changes have been accounted for, and verify site conditions for each area.
2. Review and coordinate access control system layout and wiring with owner.

D. Device Mounting: Mount access control devices a minimum of three feet from heat or air movement sources.

E. Network Devices: Provide network cable(s) to any networked devices for access control system and coordinate terminations.

F. Grounding: Provide grounding connections sufficiently tight to assure permanent and effective ground.

G. Testing: Upon completion of installation of system and after energized, demonstrate system compliance with intent.

H. Wiring & Terminations: All components of this system will need to be in accordance with the manufacturer’s specifications & recommendations. All final connections shall be made by a qualified & certified technician familiar with the manufacture’s equipment and adhering to the owner’s procedures.

I. On-Site Equipment: Contractor is required to provide their own equipment unless they have written permission from the owner to use any of the owner’s equipment (lifts, ladders, tools, etc.) onsite. It is the contractor’s responsibility to provide all equipment costs in their proposals.

J. Zoning: Each detector, door position switch, and sensing device shall be considered a location. Multiple doors at a common entry can be considered one location. The system shall be programmed to log and detect individual status of a monitored door based on a schedule. Doors with a door contact must have the ability to receive alerts for that specific opening if the door is opened during a certain time and/or left open for a specific time (60 seconds).

K. Labeling: The contractor shall develop and submit for approval a labeling system for the cable installation. Coordinate with the owner and negotiate an appropriate labeling scheme with the contractor. At a minimum, the labeling system shall clearly identify all components of the system: racks, cables, panels, and wall plates. The labeling system shall designate the cable’s origin and destination and a unique identifier for the cable within the system. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.

1. All labels shall meet UL 969 requirements for legibility, defacement, and adhesion requirements. Handwritten labels are not allowed. All labels shall maintain consistent typeface, size, and color.
2. Provide laminated plans (minimum size 11x17) of all Security Systems as-built plans (including riser diagrams) at each telecom room/panel location.

L. Occupancy Adjustments: When required within 1 year of date of substantial completion, provide on-site assistance in adjusting and reprogramming to suit actual occupied conditions. Provide 1 visit to the site for this purpose without additional cost.

M. Mounting Height: Credential card readers and intercoms should meet all ADA mounting requirements. Credential card readers shall be mounted 48” from the floor to the top of the card reader.

N. Roof Hatches: Verify each roof hatch location with the owner and install DPS's on each one. Each roof hatch DPS shall be tied into the ACS, and into the intrusion detection system that will provide a scheduled notification when opened.

O. Request to Exit Motions: REX should be mounted above the door frame onto a single gang horizontally mounted P-Ring.

2.2 WIRING:

A. Pathway Requirements:

1. 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.
2. All pathways shall be designed, constructed, grounded, and installed in accordance with all recommendations delineated within TIA 569-B and Standard TIA 942-B.
3. If applicable, provide plenum rated cable/connectors where required, cabling/connectors must be appropriate for the environment that it is installed in.
4. Provide moisture rated cable for all wet locations, including any conduit in or below slab on grade.

B. Conduits:

1. Achieve the best direct route parallel with building lines with no single bend greater than 90 degrees or an aggregate of bends in excess of 180 degrees between pull points or pull boxes.
2. Provide large radius elbows on all bends.
3. Conduit runs shall not have continuous sections longer than 100 feet without a pull box. Refer to rough-in schedule for conduit fill capacity.
4. Conduits should not be routed over or adjacent to heat sources such as boilers, hot water lines, or steam lines. Neither should they be routed near large motors, generators, photocopy equipment, or electrical power cabling and transformers.
5. After installation, conduits shall be clean, dry, unobstructed, capped for protection, labeled for identification, reamed, and fitted with bushings.
6. A 200lb pull cord (nylon, 1/8" minimum) shall be installed in any empty conduit.
7. All cabling shall be installed in a minimum of 3/4" conduit to accessible ceiling space unless otherwise noted. Provide conduit to accessible ceiling space and then utilize non-continuous open top cable supports every 5'.

C. Cabling System:

1. Follow T568B scheme for network copper category cabling terminations.
2. In a false ceiling environment, a minimum of 3 inches shall be maintained between cable supports and false ceiling. At no point shall cable(s) rest on lay-in ceiling grids or panels.
3. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
4. Cables shall not be attached to ceiling grid seismic support wires or lighting fixture seismic support wires. Where support for cable is required, the contractor shall install appropriate carriers to support the cabling. No exposed cabling is allowed.
5. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
6. Cable shall not be draped on, tied, or otherwise secured to electrical conduit, plumbing, ventilation ductwork or any other equipment. Cable shall be secured to building supports or hangers or to additional blocks or anchors specifically installed for this purpose.

D. Access Control Cable:

1. Provide the following cable from the ACS head-end panel(s) to the junction box located above each door that has access control door hardware equipment installed:
   a. Access Control Composite Cable: (OSDP) Access Control Composite Cable Windy City Wire #4461030-OSDP.
2. All access control outer cable jacketing shall be **Yellow**, CMP rated & UL Listed.
3. Provide the following cables from the junction box above each door that has access control & door hardware equipment to each device:
   a. (CR) Credential Card Readers: 22/1P OAS Lo-Cap, RS-485, 120 Ohms + 18-02 Twisted Non-Shielded, Jacketed (OSDP) Stranded, CMP, UL Listed.
   b. (REX) Request for Exit Motion: 4/C, 22 AWG Stranded, CMP, UL Listed.
   c. (ES, ECB, EL, MAG): Door Locking Hardware 4/C, 18 AWG Stranded, CMP, UL Listed.
   d. (DC) Door Position Contact: 2/C, 22 AWG Stranded, CMP, UL Listed.
4. Provide the following cable from the access control head-end panel(s) to these end devices:
   a. School Lockdown Switch: 4/C, 18 AWG Stranded, CMP, UL Listed.
   b. Momentary Door Release Button: 4/C, 18 AWG Stranded, CMP, UL Listed.
5. ADA Equipment Integration: The security contractor will be responsible to coordinate with the owner and the DIV.8 & 26 contractors to discuss how the ADA equipment will need to integrate and function with the access control system. Security contractor will be responsible for integrating the access control system to operate with the ADA equipment.
6. Program credential card reader and ADA operators per IBC requirements and to the owner's instructions.
7. All ADA devices shall be wired. No wireless equipment allowed.
8. Wiring by Divisions 26: The electrical connections/terminations for certain equipment provided under door hardware divisions has not been specifically indicated on the electrical drawings and must be provided by and field coordinated by the door hardware trade requiring such electrical connections. Electrical contractor shall review architectural drawing, door hardware specifications and coordinate with said contractors to confirm electrical needs.

2.3 SYSTEM CONFIGURATION, PROGRAMMING:

A. Contractor shall configure the system for full operation. Include owner in the process as much as feasible to understand their intended operation and insure full transfer of operations to them.

B. Contractor shall provide a fully commissioned system to ensure the entire system is operating as intended and in accordance with school district's policy and instructions. Label cables on both ends in all boxes, panels, and racks according to the school district's standards.

C. The contractor shall include in the base contract all costs required to program emergency procedures based upon the requirements and direction of the owner.

D. The contractor shall include necessary programming for fire-alarm panel tie-in and door release based upon the requirements and direction of the owner and/or AHJ.

E. Contractor shall input database of all required card holders and desired schedules for users and/or groups. It is the contractor's responsibility to coordinate with the owner on which card holders have access to which openings.

2.4 CYBER SECURITY:

A. Contractor shall change all default username and passwords for all network devices provided. A strong password should -
   1. Be at least 8 characters in length
   2. Contain both upper and lowercase alphabetic characters (e.g., A-Z, a-z)
   3. Have at least one numerical character (e.g., 0-9)
   4. Have at least one special character (e.g., ~!@#$%^&*()_-+=)

B. No written username or passwords shall be located in any area of installation.

C. Network devices to be set up on a separate network other than owner's LAN ensuring no internal or external users can access system without authorization.

D. Follow manufacturers hardening guide and use best industry practices to secure network and devices provided by contractor and associated with system.

E. No equipment in this specification shall contain Huawei / HiSilicon chips or any other equipment deemed a cyber security risk on owners' network.

F. All credential card readers and access control panels communication shall use the latest version of Open Supervised Device Protocol (OSDP).

3.7 OPERATING AND MAINTENANCE MANUALS:

A. Operating and maintenance manuals shall be submitted prior to testing of system. Provide two operational manuals, shall be delivered to the owner. Manuals shall include all model numbers, service, installation, and programming information. All information must be bookmarked with a table of contents.

B. Include all the following information:

1. Warranty
2. Network settings (IP & MAC Addresses)
3. Username and passwords
4. Riser diagrams from Shop drawings
5. Training videos
6. USB Flash drive with programing source code and software editing programs
7. Installers and manufacturer contact information

3.8 RECORD DRAWINGS:

A. The Owner shall provide electronic (DWG) format of the access control system drawings that as-built construction information can be added to. These documents will be modified by the security contractor to denote as-built information as defined above and returned to the Owner.

B. A complete set of CAD as-builts are expected to be maintained during project installation (progress-set) and submitted upon final completion. These as-builts shall show wire paths, final device location, color coding, specific interconnections between all equipment, and internal wiring of the equipment and any changes to the configuration of the original construction drawings. No handwritten as-built documentation is allowed. Provide a complete set of "as built" drawings in paper and electronic (DWG and PDF) to owner.

3.9 TRAINING:

A. Provide two sessions that consist of two hours each of training on the operation and the function of the access control system, at job site, at no cost to owner, and ensuring that the school district is proficient in the control and operation of the access control system.

B. The access control systems shall be complete and have been finalized by the school district, architect, and the consultant prior to doing any training.

C. Provide the school district with contact information so they can have it readily available.

D. Contractor shall provide a three-month follow-up that will consist of two hours of training on advanced features of the system at no cost to the school

END OF SECTION 28 2205

SECTION 28 2300

IP VIDEO SURVEILLANCE SYSTEM

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 the work of this section.

B. Division 26 & 27 basic materials and methods sections apply to work specified in this section.

C. Division 7 firestopping applies to the work of this section.

D. Refer to other Division 26 sections for requirements for raceway, trays, boxes, fittings, supporting devices, cabling, conduit, junction box color requirements, and any other sections, as applicable.

E. Refer to specification 27 1500 for category and/or optical fiber cable and connectivity specifications.

F. All unshielded twisted pair category cabling for security equipment used on this project shall match the horizontal cabling within the building.

1.2 ADMINISTRATIVE REQUIREMENTS:

A. BNA Project Contact(s):

1. Riley Richards
   Phone: 801-532-2196
   Email: RRichards@bnaconsulting.com

2. Dan Varney
   Phone: 801-532-2196
   Email: DVarney@BNAConsulting.com

1.3 DESCRIPTION OF WORK:

A. The extent of the video surveillance work is indicated by drawings and is hereby defined to include, but not be limited to raceway, cabling, outlets, coverplates, grounding, and miscellaneous items required for a complete raceway system. The security contractor will be responsible for installing the Verkada surveillance cameras to the owner's requirements and instructions. All of the active video surveillance equipment and the IP surveillance cameras will be provided by and programmed by the owner.

B. Refer to other Division 26 sections for requirements for raceways, trays, boxes, and fittings, and supporting devices, and other sections, as applicable.

C. The division 27 1500 contractor shall install and execute all of the requirements for the category network cabling, fiber optic cabling, and required connectivity.

D. The Division 27 1500 contractor is responsible for providing and installing all specified category network cabling and fiber optic cabling from each IP surveillance camera back to the assigned data rack and patch panel, ensuring proper termination, and testing.

E. The contractor shall provide all of the labor, materials, tools, and equipment required for a complete installation of work.

F. Contractor is responsible for coordinating & verifying with the owner, and other trades for equipment locations and heights, mounting requirements, supports, and plenum space requirements.

G. The work of this section includes electrical raceways (minimum 3/4”), boxes and fittings, as specified in applicable Division 26 & 27 Basic Materials and Methods sections, which are used to enclose the category network cable. Utilize cable tray where possible.

H. All of the active Verkada video surveillance equipment & devices will be owner furnished, and the surveillance cameras will be contractor installed.

1.4 BID SUBMITTAL:

A. Provide a detailed scope of work document for all services provided.

B. Provide a complete bill of materials that includes all components, accessories and hardware that is outlined in the contract documents for the assembly of a fully functional system.

C. Provide a breakout cost of material and labor as different line items. Bids must include line-item pricing for major parts and components of the system.

D. Submit manufacturer certifications for all systems provided. Certifications must be provided by the local office providing the installation.

E. All permitting costs shall be included in the base bid.

F. All equipment shall be installed as shown in the drawings and in strict accordance with the specifications. Any errors, conflicts, or omissions discovered in the specifications, or drawings, shall be submitted in writing to the security consultant for clarification in an RFI prior to bid.

1.5 COORDINATION:

A. Prior to starting any work coordinate & review with the owner each camera rough-in location and height requirements, orientations and views.

B. Meet with the electrical contractor prior to the pathway rough-in to coordinate system requirements in each area.

C. Notify the engineer of any modifications between contract documents and submittals. It is the contractor’s responsibility to ensure compliance with the documents.

1.6 SUBMITTALS:

A. Refer to specification 26 0502 for shop drawing submittal requirements.

PART 2 – PRODUCTS

2.1 General Requirements: Provide complete raceway and cabling system for the video surveillance system including but not limited to, raceway, cabling, boxes, outlets, cover plates, backboards, cabinets, grounding, and miscellaneous items as required.

A. Provide cable that is rated for the environment that it is getting installed in (i.e., plenum, underground conduit, direct burial, conduit in slab on grade, etc.) All cabling installed in wet locations shall be listed for use in wet locations.

B. The CAT6 category network cable outer jacketing color for the IP surveillance cameras is to be *GREEN*.

C. Provide each IP surveillance camera location with a manufacture suggested junction back box, cover, and ¾” conduit.

PART 3 – EXECUTION

3.1 INSTALLATION OF THE SECURITY RACEWAY SYSTEM:

A. All installation requirements shall adhere to the requirements for Division 27 1500.

B. Prior to starting any work, the contractor shall coordinate with the owner to verify all camera locations, heights, cable pathways, and cabling manufacture.

C. Install raceway system and the category network cabling as indicated, per the expectations of the owner, and to comply with NEC, recognized best industry practices, and to all of the installed manufactures specifications.

D. Provide products & materials that have been UL-Listed and labeled.

E. Provide a minimum of one specification-grade CAT6 network cable to each IP surveillance camera location. Route the CAT6 cabling through the accessible ceiling space using cable supports and cable trays, extending it to the designated telecommunications equipment racks and patch panels, with industry-standard service loops at each end.

F. At each IP surveillance camera location, terminate the CAT6 cable with a manufacturer-recommended RJ45 connector, and terminate the opposite end at the designated patch panel within the telecommunications equipment rack.

D. All cabling, terminations, connectors, hardware, and equipment shall meet both manufacturer specifications and industry standards.

E. Any CAT6 category cables that are over 295' summarize and document this information and provide it to the owner.

F. Provide pulling twine in all raceways and conduits. And for long pulls provide nylon pulling line.

G. All stubbed-out conduits end shall have plastic / nylon bushings.

G. Splicing is strictly prohibited on both the category network cabling and the fiber optic cabling.

3.2 GROUNDING: Refer to Division 27 1500.

3.3 WIRING: Refer to Division 27 1500.

3.4 LABELING: Refer to Division 27 1500.

3.5 TESTING: Refer to Division 27 1500.

3.6 WARRANTY: Provide warranty complying with Division 26 0500 & Division 27 1500.

3.7 ELECTRICAL IDENTIFICATION: Refer to Division 26 0553 for requirements.

END OF SECTION 28 2300

SECTION 28 3111

FIRE ALARM AND DETECTION SYSTEM

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 work of this section.

B. Division-26 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

A. Provide new addressable fire alarm devices as required to expand the existing fire alarm system as required.

1. The existing system is an EST iO Series Panel monitored by Summit Fire.
2. Provide new addressable fire alarm and detection system devices as required for this project.

B. New NAC/Booster Panels.

1. Provide and install NAC/booster panels as needed throughout the project as required within the new Telecom Room. Coordinate with the electrical contractor for the provision of all 120V 20A circuits required.

C. Provide all fire alarm devices.

D. Provide duct smoke detectors and fan relays at all fan units 2000 CFM and over. Shut down all supply and return fans upon a general alarm signal.

E. Provide CO detectors, Monitor Module and fan relays at all gas fired fan units. Shut down all supply and return fans upon a general alarm signal.

F. Provide a fire alarm duct detector within 5-feet of any fire/smoke damper as required to comply with IMC 607.5.4.1. The duct detector shall be listed for the air velocity, temperature and humidity at the point where it is to be installed. A duct detector will not be required at a fire/smoke damper located on a corridor wall where the corridor has smoke detection devices installed. For dampers installed within an un-ducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5-feet horizontally of the damper. Provide a fire alarm relay at each fire/smoke damper. Provide a test switch at each location where the damper is located above an inaccessible ceiling or is located more than 10 feet above the finished floor. Coordinate the location of test switches with owner/architect.

G. All initiating devices connected to the fire alarm control panel shall be analog addressable.

H. All wiring shall be in conduit (3/4" minimum). All conduit and connectors, shall be made of steel. All conduit runs shall form a complete loop from the fire alarm control panel.

I. Provide vandal resistant cages to protect horn/strobes, smoke and heat detectors as indicated on drawings and, in gyms whether shown or not. Securely fasten security cages as required. Provide backing and bracing as required to ensure that attachment extends beyond the ceiling materials. Cages shall have two pieces, one backplate and one cover to attach to backplate. Provide cages/guards on horn/strobes that are clear and do not limit their effect on the field performance with the listing requirements.

J. Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories. Provide components and systems, which are UL-listed and labeled for fire alarm. Provide fire alarm and detection systems and accessories, which are FM approved. Comply with State and local requirements as applicable. Provide wiring of horn/strobe units such that the horn section and the strobe section are controlled separately. Provide the ability to silence the horns and maintain the operation of the strobes.

K. The project shall be UL Certificated. Upon completion of the project, provide to the owner, a certificate from the UL Listed supplier with the project specific certificate. Certificate and number shall be documented and included as part of the closeout documentation.

L. Ensure that the fire alarm supplier has a minimum of (1) NICET Level IV, and (3) NICET Level III technicians on staff.

M. **Carefully review all Division 23 drawings for all fire/smoke and smoke dampers. Fire/smoke and smoke dampers are NOT shown on electrical plans. Electrical contractor is responsible for coordinating 120V power to all dampers and providing fire alarm connections to each one. See mechanical drawings for all locations.**

N. Provide a fire alarm duct detector within 5-feet of any fire/smoke damper as required to comply with IMC 607.5.4.1. The duct detector shall be listed for the air velocity, temperature and humidity at the point where it is to be installed. A duct detector will not be required at a fire/smoke damper located on a corridor wall where the corridor has smoke detection devices installed. For dampers installed within an un-ducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5-feet horizontally of the damper. Provide a fire alarm relay at each fire/smoke damper. Provide a test switch at each location where the damper is located above an inaccessible ceiling or is located more than 10 feet above the finished floor. Coordinate the location of test switches with owner/architect.

O. Comply with applicable provisions of current NFPA Standard 72 National Fire Alarm and Signaling Code (as applicable), local building codes, the most current adopted revision of the International Building Code (IBC), the International Fire Code (IFC), the International Mechanical Code (IMC), and meet requirements of local authorities having jurisdiction.

1.3 QUALITY ASSURANCE:

A. Installer:

1. Fire alarm installers shall have the highest manufacturer's certifications as follows:
   a. Edwards iO Series
2. Integrating firm shall have worked satisfactorily for a minimum of (5) years of completing systems equal to this scope, quality, type and complexity.
3. Key personnel assigned to the project shall each have minimum of (10) years of experience in completing systems equal to this scope, quality, type and complexity.
4. Contractor shall be a factory authorized distributor of all equipment specified for the geographical area of the project.
5. Contractor shall maintain complete installation and service facilities for the duration of the project contract.

6. Contractor shall have current manufacturer certificates for all fire alarms systems and equipment listed within this specification.
7. Contractor shall be in good standing with owner based on previous projects.
8. Contractors that do not meet the above requirements cannot bid on this project.

B. All work shall be done by expert technicians qualified in the field with knowledge of specified systems. Workmanship shall comply with industry best practices concerning grounding, shielding, cable dressing, cable termination and equipment mounting.

C. PRE-APPROVED INSTALLERS:

1. CURRENTLY MONITORING BUILDING: Summit Fire & Security (Salt Lake City)
2. StateFire Sales & Service
   a. Kyle A. Arigot - Regional Sales Manager; karigot@statefire.com
   b. Cell: 801-707-0796, Office: 801-288-2100
3. Wasatch Electric
   a. Brandon Carlile, (801) 487-4511, bcarlile@wasatchelectric.com
      2455 W 1500 South, STE A, Salt Lake City, UT 84104
4. Bids submitted by non-approved installers will not be accepted.
5. Bidders not pre-approved shall submit in writing the following for review at least (8) working days prior to bid:
   a. List of qualifications including:
      i. Industries certifications including manufacturers.
      ii. Approved resale manufacturers.
   b. Past and current projects within the last 5 years similar in scope and size.
   c. (3) Different referrals from the owners of (3) different projects within the last 5 years.

1.4 SUBMITTALS:

A. Refer to Section 26 0502 for electrical submittal requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. MANUFACTURER: Subject to compliance with requirements, provide fire alarm and detection systems of one of the following:

1. Edwards iO Series

B. The job foreman or lead technician shall be factory trained and certified on the system being installed. Individual shall have a minimum NICET II certification.

2.2 FIRE ALARM AND DETECTION SYSTEMS:

A. GENERAL: Provide an electrically operated, electrically supervised fire alarm system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials which comply with Division 26, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.

B. SYSTEM TYPE: Analog addressable, non-coded. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes all fire alarm signaling devices, sounding a non-coded alarm and providing device identification on an annunciator panel.

C. SYSTEM OPERATION: Provide system such that any manual station or automatic initiating device annunciates all alarm indicating units (bells, horns, buzzers, chimes, visual alarm lamps, etc.) continuously until the manual station or initiating device is restored to normal and the fire alarm control unit reset. Annunciate alarm signals by device at the control panel and all remote annunciators. Provide all conductors, raceway, equipment and labor to accomplish the following:

D. For fans which are not part of the smoke evacuation system, deactivate air supply and return fan units simultaneously by means of a supervised master fan shutdown relay with slave relays as required. Restart air units automatically after panel has been reset. Provide a bypass switch for master fan shut down relay for drill purposes, and indicate by a locked-in lamp that the circuit has been bypassed.

E. Selectively activate and/or deactivate fan units as required.

F. Release all magnetic door holders upon activation of an alarm from any device by use of a master relay in the control panel.

G. Provide supervised circuits for the following:

1. Close dampers upon activation of an alarm from any device through the HVAC interface relays at the Fire Command Center.

2. Recall elevators, upon activation of an alarm, to the floor of building egress unless the alarm is on the egress floor, in which case recall elevator to the level designated by the Fire Marshall. Cooperate with the elevator supplier to ensure complete operable system. Provide shunt trip breaker(s) as required.

H. Central Station Monitoring. Provide a UL listed fire control communicator in accordance with NFPA 71 with a minimum of two reporting zones to the central station. Provide a communicator with dual phone lines for central station reporting by using Contact I.D. format. Provide integral trouble annunciator. Provide with compatibility for automatic test reports every 24 hours. Provide system and components which comply with UL 2635 and UL 864.

I. Provide fire alarm control panel with capability of shutting down individual initiating devices for maintenance purposes without affecting the continued operation of other initiating devices.

J. Provide manual fire alarm stations in boiler rooms, and main administrative office. Provide external alarm horns sufficient to be heard in all parking areas.

K. Sprinkler Supervision. Provide a signal initiating and supervisory circuit to each PIV (post indicator) valve, and to each sprinkler riser and subdivision. Provide continuous alarm signal upon actuation of any water flow signal initiating device. Sound alarm until the condition has been corrected and the panel manually reset as required by UL864. Provide separate alarm zones for: (1) alarm zones from “waterflow alarms”, (2) alarm zones from “supervisory alarm” indicating sprinkler system trouble. Provide power to all alarm bells furnished under Division 23. Review final fire sprinkler drawings and coordinate for panel, flow and tamper switch locations.

L. Provide relays, monitor modules and connections as required at control panel of kitchen hood suppression system for initiation of alarm signal to fire alarm control panel. Connect hood suppression control panel to shunt trip breakers as required.

M. Provide all required wiring from gas shut off valve to the hood suppression control panel. Make all connections to insure a properly operating system. Verify with Mechanical Contractor.

2.3 FIRE ALARM CONTROL PANEL

A. Existing; expand as required.

2.4 MONITOR MODULE:

A. Remote identification module devices shall be attached to any single normally open initiating device (heat detector, waterflow switch, duct detectors, sprinkler, tamper switches, kitchen hood, pull station, etc.). The modules shall supply addressing and status information to the Fire Alarm Control Panel through the dual loop module.

2.5 CONTROL POINT MODULE:

A. The control point module shall be connected to the same loop as the initiating devices, and shall provide a relay output (Form "C" 2 Amp @ 24 VDC, resistive only).

B. This relay output shall be used to perform auxiliary functions.

C. When the AOM is activated, the red "ACTIVE" LED shall be on solid. Under normal conditions, the red "ON LINE" LED shall flash.

2.6 DOOR HOLDER:

A. Door Holders and Keyed Switch Supplied by door hardware installer and installed by division 26. Provide 24VDC power and control from fire alarm control panel. Include 120V power and 24VDC transformers as required.

2.7 MANUAL FIRE ALARM STATION:

A. Provide red enclosure, manual fire alarm stations with the following features:

1. Die-cast construction, for semi-flush mounting.

2. Addressable alarm type electrically compatible with system requirements.

3. Double Action

4. Break glass design requiring unit to be opened for resetting, and requiring resetting before closing. Provide one spare “glass” for each manual station. Key reset, keyed like fire control panel.

2.8 IONIZATION SMOKE DETECTORS:

A. All ionization smoke detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All ionization fire detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.9 DUCT FIRE DETECTORS:

A. Provide ionization type with UL 268A listings. Each detector shall be equipped with a remote light. Each detector shall have (2) form "c" alarm contacts rated at 10 amps (at 120VAC).

2.10 THERMAL DETECTORS:

A. Thermal detectors shall operate on the Rate-of-Rise principal. The detectors shall have a fixed temperature rating of 135 degrees Fahrenheit. Exception: in Boiler rooms, provide temperature rating of 200 degrees Fahrenheit.

1. The heat detector shall consist of a base and a head.

2. The base shall be capable of accepting either a smoke detector or a 135 (or 200) degree heat detector.
3. The head shall automatically restore to its normal standby condition when the temperature returns to its normal range.

2.11 AUDIOVISUAL ALARM HORNS:

A. Provide audio-visual alarm horns with selectable multi-candela strobes (15/30/75/110 cd) and selectable horn (90 or 95 dba). Provide outdoor devices listed for exterior use. Provide white devices inside and red devices outside, or as instructed by the architect.

B. All strobes shall be synchronized.

2.12 CEILING MOUNTED AUDIOVISUAL ALARM HORNS:

A. Provide audio-visual alarm horns with selectable multi-candela strobes (15/30/75/110 cd) and selectable horn (90 or 95 dba). Provide outdoor devices listed for exterior use. Provide white devices inside and red devices outside, or as instructed by the architect.

B. All strobes shall be synchronized.

2.13 CEILING MOUNTED VISUAL ALARM STROBES:

A. Provide visual alarm strobes with selectable multi-candela strobes (15/30/75/110 cd). Provide white devices.

B. All strobes shall be synchronized.

2.14 VISUAL ALARM STROBES:

A. Provide visual alarm strobes with selectable multi-candela strobes (15/30/75/110 cd). Provide white devices.

B. All strobes shall be synchronized.

2.15 CARBON MONOXIDE (CO) DETECTOR:

A. Provide a carbon monoxide detector. Provide detectors with the following features:

1. Compliance with UL2075.
2. Trouble relay.
3. Wiring supervision with SEMS Terminals.
4. A six year end-of-life timer.
5. Sounder base for sound audible alarm.

2.16 VISUAL ALARM STROBES (BLUE):

A. Provide a visual alarm strobe with blue light for CO notification.

2.17 AUXILIARY RELAY:

A. Remote auxiliary relay boards shall be rated at 10 AMPS @ 120 VAC. A red LED shall light to indicate relay activation. All relays shall transfer on general alarm and latch on until reset. All relays shall be supervised. The control output provided can be used in conjunction with fire alarm applications (i.e. fan controls, dampers, doors, and any other general alarm control).

2.18 HORN AMPLIFIER (As required for higher amp requirements).

2.19 WATER FLOW MODULE.

2.20 INITIATING MODULES:

A. Provide style "6" initiating modules capable of receiving and annunciating an alarm from any detector, even with a single fault condition on any initiating circuit.

B. Power all smoke detectors from the "Style 6" initiating loop wiring. For systems which power smoke detectors separately from the "Style 6" loop, provide monitoring for both the power source and the independent initiating wiring, so that complete trouble and alarm indication is achieved by loop. Provide capability to operate all smoke detectors, even with a single fault condition on the smoke detector power wiring. Provide one spare initiating circuit.

2.21 SIGNALING MODULES:

A. Provide signaling as required. Provide power adequate to sound all signaling devices concurrently. Provide supervised indicating circuits for polarized 24V D.C. alarm signaling devices. Provide 2 spare signaling circuits.

B. Each signal circuit shall have a separate disconnect switch for servicing the fire alarm system. Each and every indicating circuit shall have a distinct location description. Power supply shall be at fire alarm control panel. Remote power supplies and indicating circuits will not be acceptable.

2.22 SUPPLEMENTAL NOTIFICATION CIRCUITS:

A. Provide supplementary notification appliance circuit panel(s) as required. The ‘PANELS’ shall be capable of supplying up to four Class A, Style Z notification appliance circuits. The panel shall contain its own battery charger, regulated power supply, and shall be supervised for ground fault, overcurrent, open circuits and low battery conditions. Ground fault, battery and circuit trouble conditions shall transmit a trouble signal to the main fire alarm control panel.

2.23 SYSTEM CONFIGURATION PROGRAMMING:

A. To help the owner in programming, system changes, and servicing, the fire alarm system shall have the following functions:

1. The FACP shall be capable of an auto-configuration, which, via a password, all analog devices and panel modules are automatically programmed into the system. At this point the system will operate as a general alarm system without any other programming.

2. If any two devices are addressed the same, the LED's on both devices will light steady and the panel will read "extra address with the address number".

2.24 If any device is installed and not programmed into the system, the LED will light steady and the panel will read the same as above.

2.25 BATTERIES/POWER SUPPLIES:

A. Provide standby batteries capable of operating fire alarm system for minimum of 24 hours, then operating all indicating units for at least five minutes. Locate batteries in fire alarm control unit, or in similar type enclosure located as directed. Provide all interconnecting wiring. Place batteries which vent hydrogen gas in separate enclosure. Provide 30 percent spare capacity.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS:

A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "standard of installation".

B. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 26 Basic Materials and Methods section, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings", and in accordance with other sections, as applicable. Label all junction boxes "F.A." and paint box and cover red, per Section 16135.

C. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protective signaling circuit cable per NEC, Article 760.

D. If twisted or shielded wire is required or recommended by the manufacturer it must be used.

E. Review proper installation procedure for each type of device with equipment supplier before installation.

F. Provide Two (2) network IP addresses at the new fire alarm control unit for connection to the fire alarm system. Coordinate with the district IT department for network connections.

G. Coordinate the mechanical units that are protected by Carbon Monoxide Detectors and shut down the unit upon detection of CO. Verify exact requirements with the Fire Marshal.

H. Label the end of wires in all boxes including panel, power supplies, pull boxes, etc.

I. Label circuit breaker feeding fire alarm panel: "Fire alarm circuit". Use plastic laminate label, white letters on red background.

J. Where smoke or heat detectors are specified, install device a minimum of three feet from adjacent air supply diffusers to ensure proper operation of device.

K. Refer to NFPA for spacing and exact placement of fire alarm devices.

L. Provide one set of approved, stamped, fire alarm system drawings on site throughout construction, and make available for Fire Marshal reference.

M. Upon completion of the Fire Alarm System Installation, a test of the entire fire alarm and CO monitoring system is required prior to a scheduled inspection in the presence of a representative from the Utah State Fire Marshal's Office. Include a 24-hour secondary power test.

N. Provide one set of instructions on operation of the Fire Alarm System and one set of the As-Built Drawings in a cabinet, located at or near the Fire Alarm Control Unit (FACU), or Fire Alarm Control Panel (FACP) as approved by the Architect and Fire Marshal. Label the cabinet "SYSTEM RECORD DOCUMENTS".

3.2 GUARANTEE:

A. Furnish a three-year guarantee for all equipment, materials and installation, including all labor, transportation, and equipment.

B. Emergency Response. The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

3.3 PRE-TEST:

A. The contractor shall with a representative of the manufacturer conduct a test 3 days before the final test to verify operation of all devices. Any problems must be corrected before the final test.

3.4 FINAL TEST:

A. Before the installation shall be considered completed and acceptable, a test on the system shall be performed as follows:

1. The contractor's job foreman, a representative of the manufacturer, a representative of the owner, shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel. Fan shutdown and door holder circuits shall operate.

2. Conduct a full 24-hour test of battery operation. System shall be put on the batteries for a full 24 hours and all notification appliances shall be operational for a period of 5 minutes.

3. The supervisory circuitry of the initiating and indicating circuits shall also be verified.

4. Provide printout demonstrating successful performance of all devices.

3.5 LABELING:

A. All devices shall be labeled with their appropriate address. The labels shall be 18 point pressure sensitive labels.

B. All initiating devices shall be programmed to include the device address and a complete user text English location description, i.e. Device L4S76, Smoke Detector, 1st floor Rm.17.

C. Label the end of all wires in all boxes including panels, power supplies, pull boxes, etc.

3.6 O & M and RECORD DRAWINGS: Refer to Section 26 0502 for requirements.

3.7 TRAINING:

A. Provide minimum four (4) hours training on the operation and installation of fire alarm system, at job site, at no cost to owner.

B. Provide programming training and software to the Owner.

END OF SECTION 28 3111

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish all labor, materials, equipment, tools and services required to fully complete all Chain Link Fence and Gate work as is indicated on the drawings and/or specified herein including, but not limited to, the following described items.
B. Standard fence framework, fabric, and accessories.
   1. 72 Inches high
C. Wire fabric .
D. Manual gates with related hardware.
E. Accessories.
F. Do not include sales tax, refer to Section 00 0104 - Notice to Contractors.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 REFERENCE STANDARDS

A. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire; 2013.
B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
D. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).
E. ASTM A428/A428M - Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles; 2010 (Reapproved 2014).
F. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric; 2011 (Reapproved 2022).
G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
I. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2021b.
J. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2014a.
K. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2017a.
L. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2016.
M. ASTM F1665 - Standard Specification for Poly(Vinyl Chloride)(PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence; 2008 (Reapproved 2013).
N. CLFMI CLF-FIG0111 - Field Inspection Guide; 2014.
O. CLFMI CLF-PM0610 - Product Manual; 2017.
P. CLFMI CLF-SFR0111 - Security Fencing Recommendations; 2014.
Q. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.
D. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation, and anchor bolt templates.
E. Project Record Documents: Accurately record actual locations of property perimeter posts relative to property lines and easements.

1.05 QUALITY ASSURANCE

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

1.06 GUARANTEE

A. The Contractor shall guarantee this work for a period of One (1) year(s) from date of Substantial Completion. Guarantee shall be on form included in Section 01 7800.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Chain Link Fences and Gates:
    1. Western Fence Co.: www.westernfenceco.com.
    2. United Fence Co.: www.unitedfenceco.com.
    3. Mountain States Fence Co.: www.msfence.com.
    4. American Fence Co.: www.americanfence.com.
    5. Allied Fence Co.: www.alliedfence.com.
    6. Master-Halco, Inc.: www.masterhalco.com.
    7. Vinyl Industries; www.Vinyli.com
    8. Substitutions: See Section 01 6000 - Product Requirements.

2.02 COMPONENTS

A. Line Posts:
    1. 36 to 96 inch (914 to 2438 mm) high fence 2.38 inch diameter.
B. Corner and Terminal Posts
    1. 36 to 72 inch (914 to 1829 mm) high fence: 3.5 inch diameter.
C. Gate Posts
    1. Gate height up to and including 72 inches :
        a. Gate width up to 48 inches :: 3-1/2 inch diameter.
        b. Gate width over 48 inches 4-1/2 inch diameter
    2. Gate height from 72 to 144 inches (1829 to 3658 mm):
        a. Gate width from 72 to 144 inches: 4-1/2 inch diameter.
D. Top, Center and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.
E. Bottom Rail: 1.66 inch diameter, plain end, sleeve coupled.
F. Gate Frame:
    1. Man Gate 1.66 inch diameter for welded fabrication.
G. Conform to CLFMI CLF-PM0610.
H. Wire Fabric: 2 inch diamond mesh interwoven wire, 9 gauge, 0.1483 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

I. Wire Fabric:
   1. Wire Fabric: ASTM A 392 zinc coated GBW steel chain link fabric.

J. Brace and Tension (Stretcher Bar) Bands: 12 gage (2.67mm) pressed steel by 3/4 inch (19mm) formed to a minimum 300 degree profile curvature for post attachment. Secure bands using minimum 5/16 inch (7.94 mm) galvanized carriage bolt and nut.

K. Tension (Stretcher) Bars: One piece length equal to 2 inches (50 mm) less than full height of fabric with a minimum cross-section of 3/16 x 3/4 inch (4.76 x 19 mm). Provide tension (stretcher) bars where chain link fabric is secured to the terminal post.

L. Truss Rod Assembly: 5/16 inch (7.9 mm) diameter truss rod with pressed steel tightener

M. Tie Wire: 9 gage (3.76 mm) galvanized steel wire for attachment of fabric to line posts and rails. Tie wire per ASTM F 626.

2.03 MATERIALS

1. ASTM F 1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction.
   a. Minimum yield strength of 30 ksi (205 MPa) at Standard Fence and car enclosure
   b. Minimum yield strength of 83 ksi (572 MPa) at Outfield Fence and Backstop Fence locations.

B. ASTM A1011/A1011M, Designation SS; hot-rolled steel strip, cold formed to pipe configuration, longitudinally welded construction, minimum yield strength of 50 ksi; zinc coating complying with ASTM F1043 and ASTM F1083.

C. Line Posts: Type I round in accordance with FS RR-F-191/1D.

D. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.

E. Comply with CLFMI CLF-PM0610.

F. Comply with CLFMI CLF-PM0610.

G. Brace and Tension (Stretcher Bar) Bands: ASTM F626 galvanized pressed steel.

H. Tension (Stretcher) Bars: ASTM F626 galvanized steel.

I. Truss Rod: ASTM F626 galvanized steel.

J. Concrete - Ready-mixed, complying with ASTM C 94/C 94M; normal Portland cement; 3000 psi strength at 28 days, 3 inch slump; 3/4 inch nominal size aggregate.

2.04 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Double Swinging Gates: 180 degree hinges, 3 for gates up to 72" tall; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

B. Hinges: Finished to match fence components.
   1. Brackets: Round.
   2. Mounting: Center.
   3. Closing: Manual.

C. Latches: Finished to match fence components.
   1. Brackets: Round.
   2. Locking: Mechanical.

2.05 ACCESSORIES

A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

B. Fittings: Sleeves, bands, clips, rail ends, fasteners, fittings and angled connection fittings; galvanized steel per ASTM F 626.

2.06 FINISHES

A. Components at Standard Fence: Galvanized in accordance with ASTM A 123/A 123M, at 1.9 oz/sq ft.
B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.

PART 3 EXECUTION

3.01 CHAIN LINK FRAMEWORK INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567 and manufacturer's instructions.
B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.
C. Space line posts uniformly maximum 96 inches (2438 mm) on center.
D. Concrete Set Posts: Excavate holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than outside dimension of post, and depths approximately 6 inches (152 mm) deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 42 inches (914 mm) below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post and slope to direct water away from posts.
E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.
F. Bracing: Install horizontal brace and truss assembly at mid-height or above for fences 72 inches (1829 mm) and over at each fabric connection to the terminal post. The diagonal truss rod is installed at the point where the brace rail is attached to the terminal post and diagonally down to the bottom of the adjacent line post. Place the truss rod in tension by adjusting the turnbuckle.
G. Top Rail: Install in lengths of 21 feet (6400 mm). Connect ends with sleeves forming a rigid connection, allow for expansion and contraction.
H. Center Rails: Install mid rails between line posts and attach to post using rail end or line rail clamps. A center rail is required for fabric height 120 inches (3048 mm) and over.
I. Bottom Rails: Install bottom rails between posts and attach to post using rail end or line rail clamps.

3.02 CHAIN LINK FABRIC INSTALLATION

A. Install fabric on security side, pull fabric taut; thread the tension bar through fabric and attach to terminal posts with tension bands spaced maximum of 15 inches (381 mm) on center and attach so that fabric remains in tension after pulling force is released. Install fabric so that it is 2 inches (50 mm) +/- 1 inch (25 mm) above finish grade.
B. Secure fabric using wire ties to line posts at 15 inches (381 mm) on center and to rails and braces 24 inches (610 mm) on center, and to the tension wire using hog rings 24 inches (610 mm) on center. Tie wire shall be secured to the fabric by wrapping it two 360 degree turns around the chain link wire pickets. Cut off any excess wire and bend back so as not to protrude so as to avoid injury if a pedestrian may come in contact with the fence.

3.03 CHAIN LINK GATE INSTALLATION

A. Gate Framework: Fabricate chain link gates in accordance with ASTM F 900. Gate frame to be of welded construction. Weld areas to be protected with zinc-rich paint per ASTM A 780. The gate frame members are to be spaced no greater than 96 inches (2434 mm) apart horizontally or vertically.

B. Gate Fabric: Fabric to be stretched tightly and secured to vertical outer frame members using tension bar and tension bands spaced 12 inches (304.8 mm) on center and tied to the horizontal and interior members 12 inches (304.8 mm) on center using 9 gage galvanized steel ties.
C. Swing gates: Installation of swing gates and gate posts shall be per ASTM F 567. Direction of swing shall be as shown on drawings. Gates shall be hung plumb in the closed position with minimal space from grade to bottom of gate leaf. Double gate drop bar receiver shall be set in a minimum concrete footing 6 inch (152 mm) diameter by 24 inches (610 mm) deep. Gate leaf holdbacks shall be installed on all double gates and all gate leafs greater than 60 inches (1524 mm) in width.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.
B. Maximum Offset From True Position: 1 inch.
C. Do not infringe on adjacent property lines.

3.05 FIELD QUALITY CONTROL

A. See Section 01 4300 - Quality Assurance, for additional requirements.
B. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

END OF SECTION 32 3113

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SECTION 03 10 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Anchor bolts.
2. Expansion, contraction and construction joints.
3. Waterstops.
4. Bearing and filler pads.
5. Joint sealers.
6. Floor Sealer.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcing steel and required supports for cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs-on-grade, and other concrete components associated with building.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

1.04 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with other Sections of Work in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

1.05 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's information (catalog data) for the following:

1. Anchor Bolts and Sealant
2. Joint sealer.
3. Floor Sealer

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.06 QUALITY ASSURANCE

A. Qualifications of Workmen:

1. Use workmen thoroughly trained and experienced in placing and finishing the types of materials specified.

B. Comply with federal, state and local codes and regulations.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered, stored, and handled so as to prevent damage by water or inclusion of foreign materials. Packaged materials shall be delivered and stored in original package, marked with brand and maker's name, until ready for use. Packages of materials showing evidence of water or other damage shall be rejected. Bulk cement shall be identified by shipping and delivery statements.

PART 2 - PRODUCTS

2.01 CONCRETE ACCESSORIES

A. Plastic Waterstops:

1. Shall be of an approved type, supplied by an approved manufacturer and shall be plastic made of virgin polyvinyl chloride compound, shall be ribbed, uniform in dimensions, dense, homogeneous and free from porosity. The material shall meet the following minimum requirements:

Tensile strength	2000psi
Ultimate elongation	350%
Shore hardness	70 - 80
Specific gravity	1.3
Stiffness in flexure	1300 psi
Cold brittleness	35 F
Water absorption in 48 hours	0.320%
Tear resistance	290 #/inch
Water head	150 feet

2. Permissible tolerances:

Width (6" and less) -- plus or minus 1/8"
Width (over 6") -- plus or minus 1/4"
Thickness -- plus 1/16", minus 1/32"

B. Rubber Waterstops: In lieu of plastic, rubber waterstops will be considered provided the proposed section will develop the same ultimate force as the plastic waterstop section specified, and provided splices can be made which will be fully watertight and will be able to develop a strength of 75 percent of the pulling strength of the waterstop.

C. Neoprene Bearing Pads:

1. Shall be of the dimensions and hardness shown on the Drawings and shall conform to ASTM D2000, including the following:

Durometer	ASTM Designation	Design	Test Temperature ‘C	Design	Maximum Swell Volume	Minimum Tensile Strength MPa	Psi	Ultimte Elongation (%)
40	MBC 414	B	100	C	120	14	2031	400
30	MBC 310	B	1010	C	120	10	1450	400

2. The Contractor shall provide reports of tests made in accordance with the applicable ASTM standards by an independent testing laboratory approved by the Engineer for the following properties:escription:

a. Test Temperature
b. Maximum Swell Volume
c. Minimum Tensile Strength.
d. Ultimate Elongation

3. Additional tests may be performed at the expense of the Owner by a testing laboratory of Owner's choice to further demonstrate the conformance of the bearing pads with this specification.

D. Neoprene Filler Pads:

1. Shall be closed cell type, soft grade, conforming to SCE-41 of ASTM D 1056-67 and 68 and RE-4IEI of ASTM DI056-73.
2. Shall be at least 1/4" wider than theoretically required to facilitate placing and to reduce development of voids between filler pads, bearing pads and waterstops.
3. Quality Standard: Rubatex R411N

E. Joint Sealant:

1. Shall be polyurethane based, multi-component elastomeric sealant complying with Federal Specification TT -00227E Class A Type II and with ASTM C-920.
2. Quality Standard: Sikaflex-2c, Permapol RC-270.
3. Slump: Joint sealer shall not sage when installed in 1/2" wide, 1" deep and at least 6" long groove in concrete and maintained in a vertical position at a temperature of 180 F for 24 hours.
4. Extensibility: Joint sealer shall not pull away from sides or rupture within itself when installed between two concrete blocks and a temperature of 50 F extended 50 times at the rate of 0.1" to 0.15" per hour.
5. Plasticity: Joint sealers shall be of a soft enough consistency that the material may be placed in the grooves with the aid of putty knives without having to heat the material when installed under 70 F ambient temperature conditions.

F. Backer Rod:

1. Shall be installed prior to applying sealant following Sealant manufacturer's recommendations. Backer Rod must be polyethylene or other closed cell material.

G. Floor Sealant

1. Shall be XYPEX or an approved equal.

2.02 ANCHOR BOLTS

A. Anchor bolts shall conform to ASTM A-276 for Type 302 Stainless Steel

PART 3 - EXECUTION

3.01 ANCHOR BOLTS

A. Locate in accordance with the Drawings.

3.02 EXPANSION, CONTRACTION AND CONSTRUCTION JOINTS

A. Locate joints in accordance with the Drawings or these Specifications, or as otherwise approved by the Engineer. The method and materials used shall be subject to the approval of the Engineer.

B. Remove all obstructions including concrete and nails from surfaces of floor, footing and roof joints before installing waterstops, bearing pads, filler pads and joint sealers.

C. Make all joints perpendicular and straight. In no case shall fixed metal, embedded in or otherwise bonded to the concrete, be continuous through an expansion joint.

D. Expansion joints shall be formed as shown on the Drawings or as required by local jurisdiction having authority.

1. Walks, curb, gutter and drive apron: Expansion joints shall be constructed at intervals multiple of the contraction joint interval nearest to 50'. No dowel bars shall be required at the joints.

E. Immediately after the forms are removed, the expansion joints shall be inspected carefully. Any concrete or mortar that has sealed across the joint shall be cut neatly and removed.

F. Construction joints shall be located as shown or noted on the Drawings or as required by these Specifications, and shall be as detailed or otherwise approved by the Engineer

G. No horizontal construction joints in reservoir walls will be permitted. Vertical construction joints in reservoir walls shall be no farther apart than 60 feet.

H. Before depositing new concrete on or against concrete, which has hardened, or when horizontal cold joints are encountered, the forms shall be retightened. The surface of the hardened concrete shall be roughened in a manner that will not leave loosened particles of aggregate or damaged concrete at the surface. It shall be thoroughly cleaned of foreign matter and latency and covered with a 2" mortar bed immediately before the new concrete is placed.

3.03 WATERSTOPS

A. Shall be correctly positioned in the forms so that the center of the waterstop is centered on the joint.

B. Where preformed expansion joint material is used in conjunction with the waterstop, allowance shall be made for equal waterstop embedment on each side in the concrete.

C. Waterstop shall be held in place in the forms by use of a split form or other approved method that will positively hold the waterstop in the correct position and to the correct alignment.

D. Horizontal waterstops shall be bent up during placing of concrete until the concrete has been brought to the level of the waters top; additional concrete shall then be placed over the waterstop, after which the concrete shall be thoroughly vibrated.

E. All horizontal and vertical waterstops, which are not accessible during pouring, shall be tied off in two directions every 12 inches in such a manner that bending over one way or another is prevented. A hog-ring or nail may be driven through both ends of the waterstop to facilitate placing and tying of waterstops to reinforcing steel forms or form ties.

F. All waterstops shall be properly spliced and joints shall be checked for strength and pinholes after splicing. Splices shall be strong enough to develop a pulling force of 75 % of the strength of the waterstop, and shall be watertight.

G. The ends of the radial waterstop in wall footings shall be joined to the circumferential waterstop in the wall to wall-footing joint and to the circumferential waterstops in the floor to wall-footing joints.

3.04 BEARING AND FILLER PADS

A. Shall be glued to the concrete with an approved rubber cement material to prevent uplift of the pads during concrete pouring.
In addition, for poured in place walls, all pads shall be held down with approved plastic chairs or shim plates placed under the reinforcing steel.

B. Nailing down pads will not be permitted.

C. Voids and cavities between bearing and filler pads, waterstop and seismic cable sleeves, irrespective of whether these voids are large or small, shall be filled with a soft mastic of a consistency that will not adversely affect the quality of plastic and neoprene materials.

D. Workmanship shall be such that no cement grout or concrete seepage will occur through the bearing and filler pad area resulting in a restraint of radial wall movements.

E. A continuous neoprene pad and one or more sponge filler pads shall be provided between the top of the wall and the underside of the roof. Any void areas shall be caulked and sealed to prevent any mortar from the roof pour to come in contact with the wall top.

3.05 JOINT SEALANTS

A. Joint sealed areas shall be sandblasted and blown clean of dust and sand with compressed air before the material may be applied.

B. Joints shall be primed and sealant shall be applied in accordance with the manufacturer's recommendations.

3.06 FLOOR SEALANTS

A. Surface Preparation - Concrete surfaces to be treated must be clean and free of laitance, dirt, films, paint, coatings or other foreign matter. The surfaces must also have an open capillary system so as to provide tooth and suction for the treatment. If surfaces are too smooth, the concrete should be acid etched, lightly sandblasted or waterblasted. Structural defects such as cracks, faulty construction joints and honeycombing should be routed out to sound concrete and repaired. Horizontal surfaces should have a rough wood float or broom finish.

B. Floors shall be primed and sealant shall be applied in accordance with the manufacturer's recommendations.

END OF SECTION 03 10 00

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Form materials, waterstops, and accessories required to form cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs on grade, and other concrete components associated with building.
3. Section 033500 - Concrete Finishing: Reinforcement for concrete floor toppings.
4. Section 033713 - Shotcrete: Reinforcement for shotcrete.
5. Section 033800 - Post-Tensioned Concrete: On-Site post-tensioning of cast-in-place concrete, structural building framing members, and slabs.
6. Section 034100 - Precast Structural Concrete: Reinforcement for precast structural concrete.
7. Section 034500 - Precast Architectural Concrete: Reinforcement for precast concrete panels.
8. Section 034713 - Tilt-Up Concrete: Reinforcement for tilt-up precast concrete.
9. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding concrete reinforcement.
10. Section 316223 - Composite Piles: Cast-in-place concrete-filled steel pipe piles.
11. Section 316300 - Bored Piles: Cast-in-place concrete footings.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.

2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:
1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

C. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10PLACE - Placing Reinforcing Bars.

1.04 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.05 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify that products meet or exceed specified ASTM A-615, grade 60 requirements.

C. Submit certified copies of mill test report of reinforcement materials analysis.

1.06 QUALITY ASSURANCE

A. Perform Work according to CRSI 10-MSP

B. Maintain copy of standard affecting Work of this Section on Site.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. During shipment, steel shall be adequately packaged against intrusion of chemical contaminants (from the atmosphere or otherwise) for the protection of the steel against physical damage and corrosion during shipping and storage.

C. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage. Steel that has sustained physical damage through rust or otherwise will be rejected.

D. Store materials according to manufacturer instructions.

E. During construction, steel shall be stored off the ground on planks, supported by 4" x 4" timber, which shall be covered with polyethylene or sizalkraft paper to prevent any moisture from coming up from the bottom.

F. Protection:

1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.
3. Steel and accessories shall be covered with waterproof tarpaulins to protect them from rain, moisture and dust.

1.08 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A-615.
2. Yield Strength: 60 ksi (grade 60).
3. Billet Bars: shall be deformed and round, unless otherwise shown.
4. Finish: shall be galvanized where shown on the Drawings.
5. All reinforcement shall be uncoated, free from rust, scale, form oil, etc.

B. Plain Bar Mats:

1. Material: Steel bars.
2. Comply with ASTM A704.
3. Fabrication: ASTM A615.
4. Yield Strength: 60 ksi (60 grade)
5. Finish: Galvanized or Epoxy coated.

C. Deformed Wire:

1. Comply with ASTM A1064
2. Finish: Uncoated or Epoxy coated.

2.02 FABRICATION

A. Fabricate concrete reinforcement according to ACI 318.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks, and seismic hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Fabricate column reinforcement with offset bends at reinforcement splices.

E. Form ties and stirrups from following: according to detail drawing

F. Splicing:

1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.
2. Obtain approval of splice locations from Engineer.

2.03 SHOP FINISHING

A. Galvanized Finish for Steel Bars:

1. Comply with ASTM A767,
2. Hot-dip galvanized after fabrication.

B. Epoxy-Coated Finish for Steel Bars: Comply with ASTM A775

C. Epoxy-Coated Finish for Steel Wire: Comply with ASTM A884.

2.04 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 18 gage, annealed type.
2. All wire tie ends shall point away from forms

B. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
2. Furnish load-bearing pad on bottom to prevent vapor retarder puncture.
3. Spacing clips: Shall be stainless steel unless otherwise specified.
4. Chairs, spacers, saddles, etc., which are set in contact with forms, are to be galvanized or provided with plastic tips or coating to prevent rust spots on finish concrete surface
5. The pattern of the units and their spacing shall be such as to maintain prescribed distances between the reinforcement and the surfaces of the forms and between adjacent reinforcing steel members. Chairs which support top bars for slabs on grade shall be provided with metal plates

6. Spacing clips: Shall be stainless steel.
7. Shims: Shall be Preco SH 203
8. Concrete blocks: Shall have a minimum compressive strength of 5000 psi. Wire for securing concrete spacer blocks in place shall be Type 304 stainless steel. Concrete blocks may be used in the locations specified in this section or as shown.

C. Reinforcing Splicing Devices:

1. Splicing shall be accomplished by placing the bars in contact with each other and wiring them together.
2. Tack welding of reinforcing bars in place shall not be allowed

2.05 SOURCE QUALITY CONTROL

A. Provide shop inspection and testing of completed assembly.

B. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

C. Comply with federal, state, and/or local codes and regulations.

D. All work shall be performed by experienced and qualified workmen. Qualifications of prestressing specialty contractor shall be examined and approved prior to award of Contract.

E. Information shall be supplied with the Bid as required by Owner.

F. Certificate of Compliance:

1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
2. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All reinforcement shall be free from loose mill scale, loose or thick rust, dirt, paint, oil, or grease, and shall present a clean surface.

B. Place, support, and secure reinforcement against displacement.

C. Do not deviate from required position beyond specified tolerance.

D. Tack welding of reinforcing bars in place shall not be allowed.

E. Do not displace or damage vapor retarder.

F. Placing bars on layers of fresh concrete as the work progresses and adjusting bars during the placing of concrete will not be permitted.

G. Accommodate placement of formed openings.

H. Spacing:

1. Space reinforcement bars with minimum clear spacing equal to one bar diameter but not less than 1 inch.
2. If bars are indicated in multiple layers, place upper bars directly above lower bars.
3. Structural Slabs: Reinforcement shall be supported at 30" O.C. on metal chairs or slab bolsters designed to support steel at the height from the form shown on the Drawings

I. Provide following minimum concrete cover over reinforcement:

1. Slabs: 2 inches.
2. Beams, Girders, and Trusses: 2 inches.
3. Joists: 2 inches.
4. Columns: 2 inches.
5. Cast against and permanently exposed to earth: 3 inches
6. Exposed to earth or weather: 1.5 inches.
7. Not exposed to weather or in contact with ground: ¾”

J. Splice reinforcing where indicated on Drawings according to manufacturer's instructions.

1. Splices of bars shall be made only where shown on the plans or as approved by the Engineer
2. Where bars are spliced, they shall be lapped at least 36 bar diameters, or 24" minimum, unless otherwise shown on the plans.

K. Hooks:

1. All continuous reinforcement shall terminate with a 90 degree hook or corner bar unless noted otherwise on the Drawings.

L. Concrete blocks may be used for support of reinforcing steel in the following locations:

1. Floor slabs on grade: Concrete blocks size 4" x 4" x 2-2/3" may be used for the support of reinforcing 2-3/8" above grade.
2. Columns: Concrete chair blocks with cast-in wire ties may be used in lieu of spacing clips to hold column vertical reinforcing steel in proper alignment. Three sets of 4 concrete chair blocks shall be provided at 8', 16' and 24' above the top of the footing.

M. Bending reinforcement:

1. Bends and hooks in bars shall be made in the manner prescribed in the "Manual of Standard Practice" of the Concrete Reinforcing Steel Institute, and in accordance with the Drawings or as specifically directed by the Engineer.
2. Bars shall not be bent or straightened in a manner which will injure the material.

3. Bars with kinks or unspecified bends shall not be used.
4. No re-bent steel shall be used.
5. All bending shall be done cold

3.02 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Install reinforcement within following tolerances for flexural members, walls, and compression members:

1. Reinforcement Depth Greater Than 8 Inches:

   a. Depth Tolerance: Plus or Minus 3/8 inch .
   b. Concrete Cover Tolerance:Minus 3/8 inch.

2. Reinforcement Depth Less Than or Equal to 8 Inches:

   a. Depth Tolerance: Plus or Minus 1/2 inch.
   b. Concrete Cover Tolerance:Minus 1/2 inch.

C. Foundation Walls: Install reinforcement within tolerances according to ACI 530/530.1.

3.03 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Perform field inspection and testing according to ACI 318 code.

C. Reinforcement Inspection:

1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.
2. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.

3.04 ATTACHMENTS

A. Reinforcement for Superstructure Framing Members: Deformed bars, unfinished.

B. Reinforcement for Foundation Wall Framing Members and Slabs on Grade: Deformed bars and wire fabric, galvanized finish.

C. Reinforcement for Parking Structure Framing Members: Deformed bars, epoxy-coated finish.

END OF SECTION 03 20 00

SECTION 03 30 00

SITE CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes Civil Site Cast-in-Place Concrete for Following Items:
   1. Slabs on grade.
   2. Control, expansion, and contraction joint devices.
   3. Thrust blocks.
   4. Manholes.

B. Related Requirements:

   1. Section 031000 - Concrete Forming and Accessories
   2. Section 032000 - Concrete Reinforcing: Requirements for reinforcing steel and supports.
   3. Section 033500 - Concrete Finishing: Finishing of concrete floor surfaces.
   4. Section 033900 - Concrete Curing: Curing of concrete floor surfaces.
   5. Section 079000 - Joint Protection: Requirements for sealants and primers.
   6. Section 079500 - Expansion Control: Requirements for expansion and control joint cover assemblies.
   7. Section 312323 - Fill: Sand layer over vapor retarder.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

   1. Should the 28-day strength of concrete be less than the minimum strength specified, the Contractor shall allow a credit to the Owner which shall be computed as follows:

      Credit = «CSS-CSA)/CSS)*(1.4)*LSA

      Example: CSS = 28-day compressive strength specified = 5000 psi

      CSA = Average 28-day compressive strength achieved to the date of any Application for Payment for the class of concrete = 4700 psi.

LSA = Lump sum amount requested for the class of concrete and other ancillary items already installed directly impacted by the structural integrity of the concrete (asphalt, framing, masonry, trusses, ladders, etc.) in any Application for Payment = $40,000

Credit = «5000-4700)/5000)*(1.4)*($40,000) = $3,360

2. Concrete with a compressive strength less than 90% of that specified shall be evaluated by the Engineer for acceptability as a part of the structure. The engineer shall make the final decision regarding acceptability.

1.03 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 305R - Guide to Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 308.1 - Specification for Curing Concrete.
5. ACI 318 - Building Code Requirements for Structural Concrete.

B. ASTM International:

1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3. ASTM C33 - Standard Specification for Concrete Aggregates.
4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.

19. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
20. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
31. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
33. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.04 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

1.05 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.

C. A mix design and information based on trial batch test results shall be submitted to Owner at least two weeks prior to commencement of the work.

D. Mill Certificates shall be furnished by the cement manufacturer certifying compliance with the requirements of ASTM C-150. One certificate shall be provided for each 100 sacks used.

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

F. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Results from a reputable independent testing laboratory showing concrete aggregates comply with applicable sections of ASTM C-33. Contractor shall pay for necessary tests as directed by Engineer. A minimum of one test shall be made on the aggregate used for the first 5 cubic yards of concrete and for each 100 cubic yards thereafter. Should the Engineer deem that additional testing of aggregate is necessary, he may select samples from any of the aggregate to be used and have these samples tested by a recognized laboratory of his choice. Material questioned by the Engineer, shall not be used in the work until the test reports are available. Should the material fail to meet the specified requirements, the aggregate will be rejected and the expense of testing shall be borne by the Contractor. Should the tests show the aggregate to be satisfactory, the cost of additional testing will be borne by the Owner.

1.06 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

1.07 QUALITY ASSURANCE

A. Perform Work according to ACI 301, 318.

B. Comply with ACI 305R when pouring concrete during hot weather.

C. Comply with ACI 306.1 when pouring concrete during cold weather.

D. Comply with federal, state and local codes and regulations.

E. Comply with American Society for Testing and Materials (ASTM):

1. C-150 or C595, "Portland Cement”.
2. C-33, "Concrete Aggregates".
3. C-94, "Ready-Mixed Concrete".
4. C-618 "Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.”

F. Acquire cement and aggregate from one source for Work.

G. Maintain copies of each standard affecting Work of this Section on Site.

H. Qualifications of Workmen:

1. Use workmen thoroughly trained and experienced in placing and finishing the types of concrete specified.

1.08 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum seven days.

1.09 DELIVERY, STORAGE AND HANDLING

A. Ready-mixed concrete: Concrete shall be mixed only in such quantities as are required for immediate use. The maximum allowable time between charging of the material in the mixing drum and final placing shall be ninety minutes for air temperatures below 80° F and sixty minutes for temperatures above 80° F. Concrete not placed within these time limits, or if an initial set has developed, shall not be used.

B. Tempering concrete by adding water or by other means will not be permitted.

C. Materials shall be delivered, stored, and handled so as to prevent damage by water or inclusion of foreign materials. Packaged materials shall be delivered and stored in original package, marked with brand and maker's name, until ready for use. Packages of materials showing evidence of water or other damage shall be rejected. Bulk cement shall be identified by shipping and delivery statements.

D. Cement shall not be stored longer than 4 months before usage.

1.10 WARRANTY

A. Work done under this section shall have a 3 year guaranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete:

1. Cement:

a. Comply with ASTM C150 or ASTM C595

b. Cement type should be based on suphalte exposure provided by Geotechnical report. If no geotechnical report provide use Type II or IL Portland Cement

2. Coarse Aggregates:
   a. Coarse aggregate shall consist of gravel, crushed gravel, crushed stone, air¬ cooled blast furnace slag, or crushed by hydraulic-cement concrete, or a combination thereof, conforming to the requirements of ASTM C-33.
   b. Shall not be used in the work until approval by the Engineer of the tests performed by the independent testing laboratory.
   c. The amount of deleterious substances included in the aggregate shall not exceed the amount specified in ASTM C33.
   d. Coarse aggregate size shall be graded within the following limits:

Coarse Aggregate Size (Nominal)	Percent Passing (by weight)					
	1-1/2"	1"	3/4"	1/2"	3/8"	No.4
1"	100	95-100	--	25 -60	--	0-10
3/4"		100	90-100		20-55	0-10

3. Fine Aggregate:

   a. Fine aggregate shall consist of natural sand, manufactured sand, or a combination thereof, conforming to the requirements of ASTM C-33.
   b. Shall not be used in the work until approval by the Engineer of the tests performed by the independent testing laboratory.
   c. The amount of deleterious substances included in the aggregate shall not exceed the amount specified in ASTM C33.
   d. Fine aggregate shall be uniformly graded from coarse to fine within the following gradation:

Sieve Size	Percent Passing by weight
3/8"	100
No.4	95 - 100
No. 16	45 - 80
No. 50	10 - 30
No. 100	2 - 10

4. Water:

   a. Comply with ACI 318.
   b. Water used in washing aggregate and mixing concrete shall be of a potable quality clean and free from oil, acid, salt, injurious amounts of alkali, organic matter or there deleterious substances,

B. Admixtures:

1. Air Entrainment: Comply with ASTM C260 and be added at the mixer. Quality standard: Sika AER.
2. Chemical:
   a. Type A - Water Reducing: Shall decrease drying shrinkage, increase compressor strengths at all ages up to and including 2 years, and shall increase flexural strengths, modules of elasticity, abrasion resistance and shall not contain chlorides. Comply with ASTM C494

3. Pozzolan: Comply with ASTM C618, Class F, latest revision and also meet or exceed the following specifications:

   Loss on Ignition (Maximum) = 1.0%

   CaO (%) -5 = 1.5 (maximum)
   Fe203

   Prior to acceptance of any class F pozzolan, the contractor shall submit to the engineer a quality history of the pozzolan representing a minimum of 20 of the most current ASTM C 618 analysis. The analysis shall include those items pertinent to this specification. Acceptance shall be at the discretion of the engineer. Continuing quality analysis shall be submitted throughout the life of the project from the approved source. Under no circumstances shall the pozzolan source be changed without the approval or direction of the engineer.

   Each truckload of pozzolan material shall be tested by the pozzolan supplier for loss on Ignition and for fineness. The pozzolan supplier shall certify that all shipments meet the conditions of this specification.

4. Concrete curing compound:

   a. Liquid membrane curing compound shall conform to all applicable sections of ASTM C-309.
   b. Quality Standard: Vulkem 2100 by Mameco Int., Inc.

5. Plasticizing:

   a. Comply with ASTM C494.
   b. Type II, plasticizing and retarding.

6. Joint Sealant: see Section 32500 – Concrete Accessories

2.02 CONCRETE MIX

A. Concrete shall consist of a mixture of Portland Cement, Pozzolan, water, fine and coarse aggregates, a water reducing agent, and an air entraining agent.

B. The proportions of the concrete materials shall produce a mixture that will work readily into corners and angles of forms and around reinforcing steel.

The mixture shall have a water content which does not exceed the maximum specified amount, and which shall have the required compressive strength.

C. The methods of measuring concrete materials shall permit proportions to be accurately controlled and easily checked. Measurement of materials for ready-mixed concrete shall conform to ASTM C-94. Engineer shall have free access to the mixing plant at all times.

D. Testing of trial mixes:

1. Before a mix for a class of concrete is approved, the Contractor shall have 4 test cylinders prepared in accordance with the trial mix proportions, and tested by an independent testing laboratory for compressive strength at 1, 3, 7 and 28 days.
2. The cost of compressive tests of concrete cylinders prepared from trial mixes shall be borne by the Contractor.
3. Re-testing: Should the compressive tests indicate that concrete in accordance with the trial mix has less than the specified compressive strength, the trial mix shall be adjusted and re-tested until conformance with the specifications is demonstrated to the Engineer.
4. Water to Cement Ratio and Cement Content for trial mixes and for the Work shall not exceed that indicated for each class of concrete, regardless of the compressive strength achieved.
5. The exact proportions of all materials entering into the concrete shall be as established by trial mix design and shall be changed only as directed by the Engineer when necessary to obtain specified strength or required density, uniformity, and workability.

E. Concrete mix shall be as follows (unless otherwise shown or specified). The proportions given below are intended to give the required strength and shall be carefully followed as to minimum quantity of cement per cubic yard of concrete and as to water/cement ratios. More cement per cubic yard of concrete will be required if tests indicate necessity for such increased quantity to achieve the design strength:

Max Course Aggregate Size	Minimum 7 -Day Compressive Strength (PSI)	Minimum 28-Day Compressive Strength (PSI)	Air En-trainment (% By Vol.)	Fiber Mesh (#/cy)	Maximum Water/ Cement Ratio (#/#)
1 1/2"	3000	4000	6±1	2.0	.45

F. Notes:
1. Pozzolan may replace cement up to 25%.
2. Super plasticizer (ASTM C-494 Type II).
3. Fibrillated Micro-reinforcement polypropelene fibers, placement per ASTM C-1116, Type III, Section 4.1.3

G. Admixtures:

1. Water Reducers/Super Plasticizers: Shall be used in accordance with manufacturer's instructions.
2. The contractor shall be responsible for obtaining and paying for the mix design.
3. Flyash Pozzolan as specified under paragraph 2.01. E. Admixtures, may be used with concrete mixtures subject to the following:

    a. The amount of fly ash in the mix shall be limited to 25 % by weight of the total cementitious material (sum of the weight of cement and the weight of fly ash).
    b. The cement shall be replaced with fly ash on the basis of 1 part cement to 1.25 parts fly ash.
    c. The concrete mixtures containing fly ash shall be trial batched as specified and must meet the requirements of this specification prior to approval by engineer for use on this project.
4. Cold Weather:

    a. Use accelerating admixtures in cold weather.
    b. Use of admixtures will not relax cold-weather placement requirements.

5. Hot Weather: Use set-retarding admixtures.
6. Do not use calcium chloride or admixtures containing calcium chloride.
7. Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing or deicing chemicals.

H. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94 C685.

I. Site-Mixed Concrete: Mix concrete according to ACI 318.

2.03 GROUT AND MORTAR

A. Mortar Bed: Shall consist of one part cement to one part sand mixed with water.

B. Damp-pack for honeycombed areas: One part Portland Cement to 2 parts sand and fine gravel; epoxy and sand mix; or any combination of materials and mixes as the situation dictates in the opinion of the Engineer.

C. Grout for Rubbed Finish: One part Ideal Hydro-Plastic Waterproof Cement and 2 Parts #30 pure silica sand.

D. Mortar for Patched Finish: One part of cement to 1.5 parts of plaster sand. Water shall be added to the cement-sand mix so that mortar can be driven into the voids by hammer and compacted properly.

2.04 EQUIPMENT

A. Mixing equipment shall be subject to approval. Mixers may be of the stationary plant, paver, or truck mixer type.

B. Each mixer shall be equipped with a device for accurately measuring and indicating the quantity of water entering the concrete, and the operating mechanism shall be such that leakage will not occur when the valves are closed.

C. Adequate equipment and facilities shall be provided for accurate measurement and control of all materials, and for readily changing the proportions of the material. The batch plant shall be capable of controlling the delivery of all material to within 1 % by weight of the individual material. If bulk cement is used, it shall be weighed on a separate visible scale which will accurately register the scale load at any stage of the weighing operation from zero to full capacity.

D. Neither speed nor volume capacity of the mixers shall exceed manufacturer's recommendations. Excessive over-mixing, requiring additions of water to preserve the required consistency, will not be permitted.

E. Vibrators: Only high frequency internal vibrators, with operating speeds of preferable 21,000 vpm, but not less than 14,000 vpm, shall be used unless otherwise approved in writing by the Engineer.

2.05 ACCESSORIES

A. Joint Sealers: See Section 03250 - CONCRETE ACCESSORIES

B. Bearing and Filler Pads: See Section 03250 - CONCRETE ACCESSORIES.

C. Waterstops: See Section 03250 - CONCRETE ACCESSORIES.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify requirements for concrete cover over reinforcement.

C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

D. Inspect sub grade surface and verify grade and adequacy of compaction.

E. Correct grade and compaction deficiencies.

F. Notify the Engineer in writing of readiness to place concrete in any portion of the work, this notification shall be given as far in advance of the placing of concrete as the Engineer deems necessary for him to make final inspection of the preparations at the location of the proposed concrete placing. All forms, steel, screeds, anchors, ties, and inserts shall be in place before the Contractor's notification of readiness is given to the Engineer.

G. No concrete shall be placed until forms, reinforcement, etc. has been inspected by the Engineer.

3.02 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Previously Placed Concrete:

1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
2. Remove laitance, coatings, and unsound materials.

C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

D. Remove debris and ice from formwork, reinforcement, and concrete substrates.

E. Remove water from areas receiving concrete before concrete is placed.

F. Thoroughly dampen the surfaces which will come into contact with the concrete (except in freezing weather), forms may be oiled instead; remove all standing water. Reinforcement shall be thoroughly cleaned of all ice and other coatings.

G. Thoroughly clean all transporting and handling equipment.

H. Obtain the Engineer's approval of location of all construction joints and control joints in the Work prior to start of concrete placement.

I. Erect and maintain suitable barriers to protect the finished surface. Any section damaged from traffic or other causes occurring prior to its official acceptance shall be repaired or replaced by the Contractor at his own expense in a manner satisfactory to the Owner.

J. The concrete surface must not be damaged or pitted by rain.

K. Concrete shall not be placed until all reinforcement is securely and properly fastened in its correct position, and until the form ties at construction joints have been retightened, all sleeves, hangers, pipe, bolts and any other items required to be embedded in the concrete have been placed and anchored and the forms cleaned and coated as specified.

L. Mortar Bed:
1. Horizontal surfaces: At wall and column base joints and where the congestion of steel near forms makes placing concrete difficult, mortar shall be deposited in the forms to a depth of two inches before concrete pour is started.
2. Existing concrete: Where fresh concrete is to be placed on or against existing concrete, or when horizontal cold joints are encountered during pouring, the surface of the concrete already in place shall be roughened, cleaned, and then covered with a 2-inch mortar bed immediately before the new concrete is placed.

3.03 INSTALLATION

A. Placing Concrete:

1. Place concrete according to ACI 318.
2. Notify testing laboratory and Engineer minimum 24 hours prior to commencement of operations.
3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints, and are not disturbed during concrete placement.
4. Install vapor retarder under interior slabs on grade according to ASTM E1643.
5. Except by specific written authorization, concreting operations shall not be continued when a descending air temperature, in the shade and away from artificial heat, falls below 40 F, operations shall not be resumed until ascending air temperature, in the shade and away from artificial heat, reaches 35 F. Follow guidelines of COLD WEATHER CONCRETING.
6. Convey concrete from mixer to place of final deposit by methods that will prevent separation and loss of materials.

    a. The free fall of concrete from the end of the spout or chute, or from a transporting vehicle, shall not exceed 6 feet, except when beginning a wall pour, in which case the free fall shall not exceed 2 feet
    b. When the distance through which concrete must be dropped vertically exceeds the maximums specified above, a tremie or flexible metal spout shall be used. Flexible metal spouts having sufficient strength to hold the weight of the concrete shall be composed of conical sections not more than 3 feet long, with the diameter of the outlet and taper of the various sections such that the concrete will fill the outlet and be retarded in its flow.
    c. Chutes, troughs, or pipes used as aids in placing concrete shall be arranged and used so that the ingredients of the concrete will not be separated. Chutes and troughs shall be of metal or metal-lined. When steep slopes are necessary, the chutes shall be equipped with baffle boards or a reversed section at the outlet. Open troughs and chutes shall extend, if necessary, down inside the forms or through holes left in the forms; or the ends of such chutes shall terminate in vertical downspouts.
    d. Pumping: The equipment shall be so arranged that no vibrations result which might damage freshly placed concrete. Where concrete is conveyed and placed by mechanically applied pressure, the equipment shall be suitable in kind and adequate in capacity for the work. The operation of the pump shall be such that a continuous stream of concrete without air pockets is produced. When pumping is completed, the concrete remaining in the pipe line, if it is to be used, shall be ejected in such a manner that there will be no contamination of the concrete or separation of the ingredients. Before and after this operation, the entire equipment shall be thoroughly cleaned. Water shall not be added to the concrete in the pump hopper.

7. Place concrete as dry as possible consistent with good workmanship, never exceeding the maximum specified slump.
8. Place concrete at such a rate that concrete is at all times plastic and flows readily between bare bars. No segregation of coarse aggregate shall occur when placing or dropping between bars.

9. When placing is once started, carry it on as a continuous operation until placement of the section is complete.
10. Do not pour a greater area at one time than can be properly finished without checking; this is particularly important during hot or dry weather.
11. Do not use retempered concrete that has been contaminated by foreign materials.
12. Sequence of placing: Any floor, wall and roof sections showing continuous reinforcing through the joints, which are not considered expansion and contraction joints, shall be poured in a sequence indicated on the Drawings or as instructed by the Engineer.
13. Struts, stays, and braces serving temporarily to hold the forms in correct shape and alignment, pending the placing of concrete at their locations, shall be removed when the concrete placing has reached the elevation and strength rendering their service unnecessary. These temporary members shall be entirely removed from the forms.
14. Build into concrete any nosings, inserts, anchors, structural members, ties and hangers required to secure abutting or adjacent materials. Waterstops shall be prevented from bending over or being moved out of position.
15. Unless necessary materials and equipment are readily available to adequately protect the concrete in place, placing operations may be postponed by the Engineer when, in the opinion of the Engineer, impending conditions may result in rainfall or low temperatures which will impair the quality of the finished work. The Contractor shall pay for all delay related costs resulting from such postponements including costs for removing and replacing damaged concrete. In case rainfall should occur after placing operations are started, provide ample covering to protect the work.
16. Whenever it is necessary to continue the mixing, placing, and finishing of concrete after daylight hours, the site of the work shall be adequately lighted so that all operations are plainly visible. Every effort shall be made to enable finishing to be done in daylight.
17. Clean up all spilled concrete and washings thoroughly. Concrete trucks shall not be washed-out on job site. Wash trucks at off-site location in accordance with all applicable laws and ordinances.
18. Joint Devices: See Section 32500 CONCRETE ACCESSORIES
19. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
20. Place concrete continuously between predetermined expansion, control, and construction joints.
21. Do not interrupt successive placement and do not permit cold joints to occur.
22. Place floor slabs in indicated checkerboard or saw-cut pattern.
23. Saw-Cut Joints:

    a. Saw-cut joints within 12 hours after placing.
    b. Use 3/16 inch thick blade.
    c. Cut into 1/4 depth of slab thickness.

24. Screeding:

    a. Screed floors and slabs on grade level.
    b. Surface Flatness: maximum 1/4 inch in 10 feet.

B. Vibration:

1. During placement, thoroughly compact the concrete by mechanical vibration. Do not over vibrate. Vibrating equipment shall be subject to approval by the Engineer.
2. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through the forms. Vibrators shall be applied at uniformly spaced points not farther apart than the visible effectiveness of the machine.
3. The vibrator shall at all times be inserted through the newly placed layer into the next lower course, to insure a proper integration of one course to another, and shall then be pulled up slowly, the speed of which is dependent upon mix design and type of vibrator.
4. Due to the high density and strength requirements, only experienced and approved vibrator operators may be used for any concrete placed in prestressed concrete reservoir construction. The vibrator operator shall vibrate the concrete systematically from one point to another without skipping any areas or without having to move backwards and forwards in anyone single pass.
5. Particular care to vibrating concrete shall be given at horizontal and vertical construction joints to eliminate any possibility of honeycomb around waterstops and in corners. Every effort shall be made to avoid any contact of vibrator to reinforcing steel and vertical prestressing tendons
6. The intensity and duration of vibration shall be sufficient to accomplish thorough and uniform compaction. Vibrators shall not be used to flow or transport concrete inside of forms. Where necessary, vibration shall be supplemented by forking or spading by hand adjacent to the forms on exposed faces in order to secure smooth, dense, even surfaces. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures.
7. The number of vibrators employed shall be ample to consolidate the incoming concrete to the proper degree within five minutes after it is deposited. The number of vibrators will be predicated on the nature of the job and the ability to sufficiently consolidate the concrete within the specified time. However, if in the opinion of the Engineer, proper consolidation can be obtained with a lesser number of vibrators than stated above, then he will so inform the Contractor.

C. Hot Weather Concreting:

1. Hot weather is defined as any combination of high air temperature, low relative humidity, and wind velocity tending to impair the quality of fresh or hardened concrete or otherwise resulting in abnormal properties. Hot weather concreting shall follow the guidelines of ACI 305R, latest edition.
2. Undesirable hot weather effects on concrete in the plastic state may include:

    a. Increased water demand.
    b. Increased rate of slump loss and corresponding tendency to add water at job site.
    c. Increased rate of setting resulting in greater difficulty with handling, finishing, and curing, and increasing the possibility of cold joints.
    d. Increased tendency for plastic cracking.
    e. Increased difficulty in controlling entrained air content.
3. Undesirable hot weather effects on concrete in the hardened state may include:

    a. Decreased strength resulting from higher water demand and increased temperature level.

b. Increased tendency for drying shrinkage and differential thermal cracking.
c. Decreased durability.
d. Decreased uniformity of surface appearance.

4. Placing and curing:

a. Concrete shall be handled and transported with a minimum of segregation and slump loss. Concrete temperature at time of placement shall be such that the rate of evaporation for the weather conditions shall not cause cracking.
b. The aggregate shall be cooled by frequent spraying in such a manner as to utilize the cooling effect of evaporation. The placement schedule shall be arranged, as approved, in such a manner as to provide time for the temperature of the previously placed course to begin to reduce. The mixing water shall be the coolest available at the site insofar as is practicable.
c. Concrete shall be placed where it is to remain.
d. Concrete shall be placed in layers shallow enough to assure vibration well into the layer below.
e. Surfaces exposed to the drying wind shall be covered up immediately after finishing with polyethylene sheets and be water cured continuously as soon as the concrete has set up.
f. Joints be made on sound, clean concrete.
g. Finishing operations and their timing be shall be guided only by the readiness of the concrete for them, and nothing else.
h. Curing shall be conducted in such a manner that at no time during the prescribed period will the concrete lack ample moisture and rec control. Facilities must be ready to protect promptly all exposed surfaces from drying. All work determined by Engineer to be damaged from hot weather shall be removed and replaced at no cost to Owner.
i. All materials and workmanship required to meet the hot weather requirements shall be supplied at the Contractor's own expense

D. Cold Weather Concreting

1. Cold weather is generally defined as a period when for more than 3 successive days the mean daily temperature drops below 40 F. When temperatures above 50 F occur during more than half of any 24-hour period, the weather should no longer be regarded as "cold". The times and temperatures given for various conditions and situations are not exact values and should not be used as such. Weather conditions are variable and common sense must be used to protect the concrete. Cold weather concreting shall follow the guidelines of ACI 306R, latest edition.
2. All materials and workmanship required to meet the cold weather requirements shall be supplied at the Contractor's own expense.
   a. Preparation:
      1) When specific written authorization is given to permit concreting operations at temperatures below those specified in 3.03 PLACING CONCRETE, arrangements for covering, insulating, housing, or heating materials and/or newly-placed concrete should be made in advance of placement and should be adequate to achieve the temperature and moisture conditions recommended herein in all parts of the concrete. All equipment and materials necessary should be at the work site before the first frosts are likely to occur, not after concrete

has been placed and its temperature begins to approach the freezing point.

b. Placement and protection:
   1) During placement of concrete, tarpaulins, or other readily movable coverings supported on horses or framework should follow closely the placing of the concrete so that only a few feet of concrete are exposed to outside air at any time.
   2) The housing, covering, or other protection used in curing shall remain intact at least 24 hours after artificial heating is discontinued.
   3) All concrete placed in forms shall have a temperature between 55°F and 90°F after placement. Adequate means shall be provided for maintaining the surrounding air at 60 F for at least seventy-two hours after placing and at no less than 40 F for an additional four days. All methods and equipment for heating shall be subject to approval. Insulating blankets shall be used when required to maintain a satisfactory temperature during the curing period.
   4) No dependence shall be placed on salt or other chemicals for the prevention of freezing.
   5) If heating or other protective measures need to be taken to prevent concrete from freezing, the concrete may require special curing methods to prevent rapid drying, as described in ACI 306R-78.

E. Concrete Finishing:

1. Remove forms and form tie metal, fill form tie holes, and remove any remaining joint marks, bellies, projections and loose materials. Wet all concrete before applying grout or mortar mix.
2. Honeycombed areas:

   a. Defective surfaces, such as honeycomb, shall be cut out entirely until homogeneous concrete is met, even if it means going through the entire wall, floor or roof slab.
   b. Such areas shall be coated with an approved epoxy bonding material, which shall be applied in accordance with the manufacturer's instructions, before damp packing the area with a mixture consisting of 1 part of Portland Cement to 2 parts of sand and fine gravel, epoxy and sand mix, or any combination of materials and mixes as the situation dictates in the opinion of the Engineer. The water content of the damp-pack material shall be such that a ball of the mix may be squeezed in the hand without bringing free water to the surface.
   c. Damp-pack material shall be tamped into place and finished to match concrete surfaces. Particular care should be taken that no sagging of the material will occur.
   d. The bond between any two layers of damp-pack shall be improved through the use of an approved epoxy bonding agent.
   e. Surfaces which have been damp-packed shall be kept continuously wet during and for a period of not less than seven days after completing the damp-pack operation.
   f. Under no circumstances shall the Contractor apply a plaster coat over the honeycomb areas to conceal the existence of the honey-comb in the

concrete. Neither shall Embeco or calcium chloride be used for filling honeycomb areas, or be mixed with damp-pack material.

3. Surface preparation: Immediately after the removal of forms, all fins and irregular projections shall be removed from surfaces, whether or not they are to be covered with high tensile wire and shotcrete covercoats.
4. Finish Types:
   a. Patched: Remove all fins and irregular projections. Clean form-tie holes thoroughly, coat with suitable epoxy and fill with mortar of dry consistency (see PART 2 - PRODUCTS).
   b. Rubbed: Use proper grout mix (see PART 2 - PRODUCTS) and point up voids with cement mortar. Thereafter, rub the entire surface with said grout mix and a carborundum stone to produce a relatively smooth, plane surface without defects and imperfections. Surface shall be properly cured. Use of plaster shall not be permitted. Upon completion of the rubbing, the surface shall be washed thoroughly with clean water.
   c. Float: This type of finish shall be an integral finish by float after screeding, to compact the surface evenly. Any excess surface water shall be removed before floating and no mortar shall be used for leveling.
   d. Soft Broom: Prior to the curing operation, the surface shall be broomed. Initial brooming operation shall permit Owner to review texture and recommendation modifications, if any.
   e. Steel Trowel: After striking off the wearing course to the established grade, it shall be compacted by rolling or tamping, and then floated with a wood or magnesium float or power floating machine. The surface shall be tested with a straightedge to detect high and low spots, which shall be eliminated. Floating shall be followed by steel troweling after the concrete has hardened sufficiently to prevent excess fine material from working to the surface. The finish shall be brought to a smooth surface, free from defects and blemishes. No dry cement or mixture of dry cement and sand shall be sprinkled directly on the surface of the wearing course to absorb moisture or to stiffen the mix. After the concrete has further hardened, additional troweling may be required. This shall be done as may be directed by the Engineer. Trowling shall produce a dense, smooth, impervious surface, free from defects and blemishes.
   f. Sandblasting: Sandblasting shall be done using a sharp silica sand. Exterior surfaces of concrete walls shall be sandblasted with #16 silica sand, preferably by the dry sandblasting process before wire wrapping may be started. The concrete surface shall be heavily pitted, leaving no traces of laitance, form-oil and original surface smoothness and surface color. The minimum sand consumption per 100 square feet of surface shall be 150 pounds of silica sand. Sandblasting shall not be started before the completion date of the drying period or before all tieholes have been dry-packed.
   g. Formed: Immediately after the removal of forms, all fins and irregular projections shall be removed from surfaces, whether or not they are to be covered with high tensile wire and shotcrete covercoats.
5. Finish concrete floor surfaces according to ACI 318.
6. In areas with floor drains, maintain floor elevation at walls and pitch surfaces uniformly to drains at 1/4 inch per foot nominal as indicated on Drawings.

F. Curing and Protection:

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Water for curing shall be as specified in PART 2 - PRODUCTS
3. Protect concrete footings from freezing for minimum of five days.
4. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.

5. Floor and Roof Slabs and Footings: May be covered with membrane curing compound and with plastic material equal to Visqueen in lieu of the water curing specified. Plastic material shall be secured in place by sand bags or other weights to insure the retention of moisture in the concrete during the full 7-day period of curing.
6. Walls and Columns: Shall be cured by the membrane curing compound method in lieu of the water curing specified. Curing compound used on inside surfaces of Reservoir walls shall be suitable for use with potable water. Curing compound on exterior walls shall be completely removed during sandblasting of walls.
7. Membrane curing compound method:

    a. Surface of newly placed or exposed concrete shall be kept moist or wet until the curing compound is applied. The curing compound shall be applied immediately after all patching or surface finishing has been completed.
    b. The curing compound shall be delivered to the work in ready-mixed form. At the time of use, the compound shall be in a thoroughly mixed condition with the pigment uniformly dispersed throughout the vehicle. The compound shall not be diluted or altered in any manner.
    c. Curing compound that has become chilled to such an extent that it is too viscous for satisfactory application shall be warmed to a temperature not exceeding 100° F, unless otherwise specified by manufacturer's recommendations.
    d. The curing compound shall be applied to the exposed surface at a uniform rate of 1 gallon per 150 square feet of area, unless otherwise required by manufacturer's recommendations.
    e. In the event that the application of curing compound is delayed, the application of water as provided in this section shall be started immediately and shall be continued until application of the compound is resumed or started.

3.04 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Testing: will be provided by a testing laboratory employed by the Owner.

C. All testing will be paid for by Owner, except for retesting of material which fails to meet these specifications. Such retesting shall be paid for by Contractor at no expense to Owner.

D. The Contractor, at his expense, shall furnish the concrete required for testing.

E. Provide unrestricted access to Work and cooperate with appointed testing firm.

F. Submit proposed mix design to Engineer and testing firm for review prior to commencement of Work.

G. Concrete sampled from a concrete pump shall be sampled from the hose after all of the priming grout has been wasted. The end of the hose shall be placed in a horizontal position before the concrete is discharged into the sampling pan. The concrete shall not be allowed to fall into the sampling pan.

H. The maximum allowable time between charging of the material in the mixing drum and final placing shall be ninety minutes for air temperatures below 80 F and sixty minutes for temperatures above 80 F. Concrete not placed within these time limits, or if an initial set has developed shall not be used. Tempering concrete by adding water or by other means will not be permitted.

I. Concrete Inspections:

1. Continuous Placement Inspection: Inspect for proper installation procedures.
2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.

J. Strength Test Samples:

1. Sampling Procedures: Comply with ASTM C172.
2. Cylinder Molding and Curing Procedures:

    a. Comply with ASTM C31.
    b. Cylinder Specimens: Standard cured.

3. Make one additional cylinder during cold weather concreting and field cure.

K. Field Testing:

1. Slump Test Method: Comply with ASTM C143.

    a. If a slump test does not meet the specification, a second slump test shall be made immediately on the same load. The concrete shall be accepted if the second slump test meets the specification or rejected and removed from the project if the second slump test does not meet the specification.

2. Air Content Test Method: Comply with ASTM C173 & C231.

    a. If an air test does not meet the specification, a second air test shall be made immediately upon the same load. The concrete shall be accepted if the second air test meets the specification or rejected and removed from the project if the second air test does not meet the specification.

3. Temperature Test Method: Comply with ASTM C1064.

4. Compressive Strength Concrete:

   a. Measure slump and temperature for each sample.
   b. Measure air content in air-entrained concrete for each sample.

5. Strength, slump and air tests may be taken in accordance with the placement rate per day as shown below:

Rate/day (C.Y.)	Air	Slump	Strength
0-8	1	1	Optional
8-50	1	1	1
For each 50 C.Y. or fraction thereof	1	1	1

   Additional tests may be made at the discretion of the Owner

L. Cylinder Compressive Strength Testing:

1. Test Method & Acceptance: Comply with ASTM C39.
2. At least one test (3 specimens) shall be made for each class of concrete poured during one day
3. Three specimens shall be made by the Engineer for each test, and these shall be broken at 7, 14 and 28 days.
4. Concrete with a compressive strength less than 90% of that specified shall be evaluated by the Engineer for acceptability as a part of the structure. The engineer shall make the final decision regarding acceptability.
5. Test cylinders shall be provided by the Contractor at his expense.
6. Dispose of remaining cylinders if testing is not required.

M. Defective Concrete:

1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Architect/Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

3.05 PROTECTION

A. Comply with applicable parts of Section 03300 for protection of concrete. Also comply with HOT WEATHER CONCRETING and COLD WEATHER CONCRETING requirements specified herein.

B. Provide barricades and enclosures to prevent damage to newly placed concrete.

C. Replace concrete curb, walls and exterior flatwork damaged by construction activities as directed, at no cost to Owner.

D. Every reasonable precaution shall be taken to protect finished surfaces from abrasions or other damage. Concrete surfaces or edges likely to be injured during the construction period shall be protected by leaving the forms in place or by erecting satisfactory covers. No fire shall be permitted in direct contact with concrete at any time. Concrete shall be adequately protected from injurious drying action by sun and wind, and from pitting by rain.

E. Calculation of bearing pressure: Contractor shall submit to the Engineer calculations, showing bearing pressure from supports for crane and other equipment when lifting maximum loads, at least 14 days before equipment is to be moved on to Reservoir floor.

F. Support of poured concrete during construction shall be the sole responsibility of the Contractor. He shall provide adequate support to resist lateral wind and seismic and all other forces. Any damage resulting to the reservoir because of inadequate support during construction shall be repaired by the Contractor and at his expense.

3.06 ATTACHMENTS

A. Schedule - Concrete Types and Finishes:

1. Foundation Walls: 3,000 psi (21 MPa), 28-day concrete; form finish with honeycomb-filled surface.
2. Underside of Supported Floors and Structure Exposed to View: 4,000 psi (28 MPa), 28-day concrete; sack-rubbed finish.
3. Exposed Portico Structure: 4,000 psi (28 MPa), 28-day concrete; air entrained; smooth stone rubbed finish.

B. Schedule - Joint Fillers:

1. Basement Floor Slab Perimeter Joint Filler: Type A; set 1/8 inch (3 mm) below floor slab elevation.
2. Exterior Retaining Wall at Loading Dock Joint Filler: Type F; recessed 3/8 inch (9.5 mm); provide sealant cover.

END OF SECTION 03 30 00

SECTION 31 22 13

ROUGH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating topsoil.
2. Excavating subsoil.
3. Cutting, rough grading, filling, compacting, site for site structures, and building pads.

B. Related Sections:

1. Section 024116 - Structure Demolition.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
4. Section 311000 - Site Clearing: Excavating topsoil.
5. Section 312316 - Excavation: Building excavation.
6. Section 312316.13 - Trenching: Trenching and backfilling for utilities.
7. Section 312316.26 - Rock Removal.
8. Section 312323 - Fill: General building area backfilling.
9. Section 329119 - Landscape Grading: Finish grading with topsoil to contours.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

A. See Section 012000 - Measurement and Payment Procedures: Contract Sum/Price modification procedures.

1.3 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

3. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported materials suppliers.

C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.6 QUALITY ASSURANCE

A. Perform Work in accordance with ASTM C136.

B. Perform Work in accordance with State and Municipality standards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Per Geotechnical report unless otherwise indicated.

B. See Section 312323 - Fill for backfill material options and specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.2 PREPARATION

A. Call Local Utility Line Information service at 811 not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum.

C. Notify utility company to remove and relocate utilities.

D. Protect utilities indicated to remain from damage.

E. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.3 TOPSOIL EXCAVATION

A. Excavate topsoil from areas indicated on drawings, without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Remove excess topsoil not intended for reuse, from site.

3.4 SUBSOIL EXCAVATION

A. Excavate subsoil from areas indicated in drawings.

B. Do not excavate wet subsoil.

C. When excavating through roots, perform Work by hand and cut roots with sharp axe.

D. Remove excess subsoil not intended for reuse, from site.

E. Stockpile excavated material in area designated on site.

F. Benching Slopes: Horizontally bench existing slopes greater as indicated in drawings to key placed fill material to slope to provide firm bearing.

G. Stability: Replace damaged or displaced subsoil as specified for fill.

3.5 FILLING

A. Fill areas to contours and elevations with unfrozen materials.

B. Maintain optimum moisture content of fill materials to attain required compaction density.

C. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.

D. Make grade changes gradual. Blend slope into level areas.

E. Repair or replace items indicated to remain damaged by excavation or filling.

F. Install Work in accordance with State and Municipality standards.

3.6 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Subgrade: Plus or minus 5/100 foot from required elevation.

3.7 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with ASTM D1557.

C. In place compaction testing: See Section 312323 - Fill

END OF SECTION 31 22 13

SECTION 31 23 16

EXCAVATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Soil densification.
2. Excavating for building foundations.
3. Excavating for paving, roads, and parking areas.
4. Excavating for slabs on grade.
5. Excavating for Site structures.
6. Excavating for landscaping.

B. Related Requirements:
1. Section 312213 - Rough Grading: Topsoil and subsoil removal from Site surface.
2. Section 312316.13 - Trenching: Excavating as required for building foundations and utilities within building perimeter.
3. Section 312323 - Fill: Backfilling at building perimeter and Site structures, and fill under slabs on grade, pavement, and landscaped areas.
4. Section 331416 - Site Water Utility Distribution Piping: Pipe materials, fittings, valves, meters, and backflow preventers.
5. Section 335216 - Gas Hydrocarbon Piping: Pipe materials, fittings, and valves normally encountered with Site-piped natural gas or propane gas distribution systems.
6. Geotechnical report: NOT AVAILABLE

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCE STANDARDS

A. Local utility standards when working within 24 inches of utility lines.

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Utility Service Locator:

1. Call local utility service-line information at 811 not less than three working days before performing Work.
2. Request that underground utilities be located and marked within and immediately surrounding construction areas.
3. Identify required lines, levels, contours, and data.

C. Existing Utilities:

1. Notify utility company to remove and relocate utilities.
2. Protect from damage utilities indicated to remain.

D. Protect plant life, lawns, rock outcroppings, and other features designated to remain as portion of final landscaping.

E. Protect benchmarks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

F. Do not close or obstruct roadways, sidewalks, or hydrants without permits.

G. Erect and maintain temporary barriers and security devices, including warning signs, warning lights, and similar measures, for protection of public, Owner and existing improvements indicated to remain.

3.02 EXCAVATION

A. Excavate subsoil to accommodate building foundations, slabs on grade, paving, and Site structures.

B. Excavations shall be so braced and supported as needed to prevent the ground, adjacent to the excavation, from sliding or settling.

C. Compact disturbed load-bearing soil in direct contact with foundations to original bearing capacity, as specified in Section 312323 - Fill and Section 312316.13 - Trenching.

D. Slope banks with machine to angle of repose or less until shored.

E. Do not interfere with 45-degree bearing splay of foundations.

F. Grade top perimeter of excavation to prevent surface water from draining into excavation.

G. Trim excavation and remove loose matter.

H. Removal of Deleterious Materials:

1. Remove lumped subsoil, boulders, and rock up to 1/3 cu. yd., measured by volume.
2. Remove larger material as specified in Section 312323 - Fill.
3. Remove excess and unsuitable material from Site.

I. Notify Engineer of unexpected subsurface conditions.

J. Correct over-excavated areas with structural fill as specified in Section 312323 - Fill and as directed by Engineer.

K. Remove excess and unused excavated material from Site.

L. Repair or replace items indicated to remain that have been damaged by excavation.

3.03 BACKFILL

A. See Section 312323 - Fill

3.04 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Inspecting: Request visual inspection of bearing surfaces by Engineer before installing subsequent Work.

C. Compaction Testing: See Section 312323 – Fill

3.05 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Prevent displacement or loose soil from falling into excavation, and maintain soil stability.

C. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

D. Protect structures, utilities, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that may be created by earth operations.

END OF SECTION 31 23 16

SECTION 31 23 16.13

TRENCHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

B. Related Sections:

1. Section 033000 - Cast-In-Place Concrete: Concrete materials.
2. Section 310513 - Soils for Earthwork: Soils for fill.
3. Section 310516 - Aggregates for Earthwork: Aggregates for fill.
4. Section 312213 - Rough Grading: Topsoil and subsoil removal from site surface.
5. Section 312316 - Excavation: General building excavation.
6. Section 312316.26 - Rock Removal: Removal of rock during excavating.
7. Section 312323 - Fill: General backfilling.
8. Section 329119 - Landscape Grading: Filling of topsoil over backfilled trenches to finish grade elevation.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. See Section 012000 - Measurement and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCES

A. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.

3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.04 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.05 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Materials Source: Submit name of imported fill materials suppliers.

C. Manufacturer's Certificate: Certify bedding and fill materials meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with State and local Municipality standard.

1.07 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.

B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Pipe Backfill:

1. Pipe Zone Backfill shall consist of the bedding material schedule shown in the Table below (A) below. All backfill material shall be free of frozen material, organic material, and debris. All pipe zone material except where noted on the plan, may be screened native material.

SIEVE SIZE	PERCENT PASSING FOR:			
	FOUNDATION MATERIAL*	BEDDING MATERIAL	PIPE ZONE MATERIAL	FINAL BACKFILL MATERIAL
2 inch	100	---	---	Native material which contains no sod, vegetation, rocks larger than 8" in diameter, asphalt or concrete chunks, etc.
3/4 inch	0 – 50	---	100	
No. 4	0 – 10	100	40 - 70	
No. 50	0 – 5	---	20 - 50	
No. 200	0 – 3	0 - 15	5 - 30	

B. Trench backfill above the pipe zone except where noted on the plans, may be native material. No backfill material in the remainder of the trench shall have rocks larger than 8-inches in diameter. All backfill material shall be free of frozen material, organic material and debris.

C. Within State Roadways, backfill placed above 12" over the top of the pipe shall be controlled low strength material (CLSM)/(flowable fill) as required by UDOT.

D. In improved areas such as under local roads, driveways, or drive approaches, pipe zone material and bedding material shall be imported. If construction is occurring October through April the top 18” of the trench shall be flowable fill. Applicable surface improvements shall occur.

PART 3 - EXECUTION

3.01 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.

1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.02 PREPARATION

A. Call Local Utility Line Information service not less than three working days before performing Work.

1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.

D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities indicated to remain.

F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

G. Each trench shall be excavated so that the pipe can be laid to the alignment and grade as required. All excavations shall be sheeted, braced, and shored as required to protect the workers and existing utilities and improvements from sliding, sloughing or settling of the trench walls while the work is in progress. All such sheeting, bracing and shoring shall comply with the requirements of the Utah State Industrial Commission. All damage resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the CONTRACTOR, and the CONTRACTOR shall affect all necessary repairs or reconstruction resulting from such damage. All trenches shall be drained so the pipe laying may take place in dewatered conditions.

H. The trench bottom shall be given a final trim using a string line, laser, or another method approved by the Engineer for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Bell holes shall be provided at each joint to permit the jointing to be made properly. The trench grade shall permit the pipe spigot to be accurately centered in the preceding laid pipe joint, without lifting the pipe above the grade, and without exceeding the permissible joint deflection.

3.03 TRENCHING

A. Excavation:

1. Excavation shall be performed to the lines and grades indicated. Excavated material not required or not satisfactory for backfill shall be removed from the site.
2. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29 CFR1926). The CONTRACTOR is responsible for assessing safety needs to meet such requirements, arranging for proper equipment and/or construction methods, and

maintaining such equipment, methods and construction practices so as to fully comply with all such safety requirements.

3. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
4. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
5. The CONTRACTOR is responsible for assessing safety needs related to confined space entry, as defined by OSHA. The CONTRACTOR shall meet all such requirements, arranging for proper equipment and/or construction methods, and maintaining such equipment, methods and construction practices so as to fully comply with all confined space safety requirements.
6. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.

B. Do not advance open trench more than 200 feet ahead of installed and backfilled pipe.

C. Trench Width:

1. The bottom of the trench shall have a minimum width equal to two (2) times the outside diameter of the pipe.
2. The width of the trench shall be ample to permit the pipe to be laid and jointed properly, and the backfill to be placed as specified. Trenches shall be of such extra width, when required, as will permit the convenient placing of timber supports, sheeting, and bracing, and the handling of special units as necessary. See standard drawing sheet number C-300 for trench detail.

D. Do not interfere with 45 degree bearing splay of foundations.

E. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Engineer until suitable material is encountered.

F. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Fill Type and compact to density equal to or greater than requirements for subsequent backfill material.

G. Trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

H. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.

I. Remove excess subsoil not intended for reuse, from site.

J. Removal of Water:

1. CONTRACTOR shall provide and maintain at all times ample means and devices with which to remove promptly and to properly dispose of all water entering the trench excavation.
2. CONTRACTOR shall obtain all necessary permits required for discharge of water.
3. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a menace to public health and convenience. No water

shall be drained into work built or under construction without prior consent of the Engineer.

4. Dewatering shall be accomplished by well points, sumps, or any other acceptable method which will ensure a dewatered trench. Any dewatering method shall be subject to the approval of the Engineer.

3.04 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.

3.05 BACKFILLING

A. Pipeline trenches shall be backfilled to a level 12-inches above the top of the pipe with screened native material fill material as specified in paragraph 2.01. Such material shall be compacted to 90% minimum Modified Proctor density (ASTM D-1557) in six inch maximum lifts. See standard detail sheet C-300 for trench detail.

B. After the pipe has been installed and approved and the initial portion of backfill has been placed as specified above, backfilling of the remainder of the trench may proceed. All backfill above the protected pipe shall be carefully placed and compacted. All backfill material shall be free of frozen material, organic material, and debris. Backfill placed above 12-inches over the pipe in improved areas, and additional areas as designated on the drawings, shall be compacted to 90% minimum Modified Proctor density (ASTM D-1557).

C. Maintain optimum moisture content of fill materials to attain required compaction density.

D. Backfill trenches to contours and elevations with unfrozen fill materials.

E. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

F. Place fill material in continuous layers and compact in accordance with schedule at end of this section.

G. Do not leave more than 40 feet of trench open at end of working day.

H. Protect open trench to prevent danger to the public.

3.06 FINISH GRADING, CLEANUP

A. CONTRACTOR shall grade the trench line to a smooth grade to effect a neat and workmanlike appearance of the trench line.

B. All tools, equipment and temporary structures shall be removed. All excess dirt and rubbish shall be removed from the site by CONTRACTOR.

C. CONTRACTOR shall restore the site to at least as good as original condition, including but not limited to final trench grade, native vegetation and restoration of affected public and private facilities whether in the public right of way or on private property. Any exception to this requirement must be in writing from the Engineer for the job specific conditions. See standard drawing sheet C-300 for trench detail.

3.07 TOLERANCES

A. Section 014000 - Quality Requirements: Tolerances.

B. Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch from required elevations.

C. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.08 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

B. Perform laboratory material tests in accordance with AASHTO T180.

C. Perform in place compaction tests in accordance with the following:

1. Compaction Quality Control Testing shall be scheduled a minimum of 24 hours (or as otherwise specified) notice must be given to with the Owner/Engineer.
2. It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork. It shall be the responsibility of the CONTRACTOR to control his operations by performing any additional tests necessary to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.

    a. Testing of Backfill Materials
        1) Characteristics of backfill materials shall be determined in accordance with the requirements of paragraph 2.01
        2) The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding 200 linear feet of trench backfill.
        3) Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
        4) After satisfactory conclusion of the initial compaction demonstration and at any time during construction, earthwork which does not comply with the specified degree of compaction shall not exceed the previously specified quantities.

5) Periodic compliance tests may be made by the Engineer to verify that compaction is meeting the requirements previously specified at no cost to the CONTRACTOR. The Engineer may require retesting of backfill that has settled from water penetration in the trench. CONTRACTOR shall remove the overburden above the level at which the Engineer wishes to test and shall backfill and re-compact the excavation after the test is complete at no additional cost.
6) If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the Engineer. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the CONTRACTOR. The CONTRACTOR's confirmation tests shall be performed in a manner acceptable to the Engineer. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.

3.09 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution and Closeout Requirements: Protecting finished work.

B. Reshape and re-compact fills subjected to vehicular traffic during construction.

3.10 SCHEDULE

A. Storm and Sanitary Piping:

1. Cover pipe and bedding with Final Backfill Material unless pipe is located under roadway or parking lot. If pipe is located under roadway or parking lot backfill trench with Foundation Material per Fill Material Table in section 2.1
2. Compact uniformly at 6-inch-thick lifts to minimum **95** percent of maximum density for pipes under roadways or parking lots.

END OF SECTION 31 23 16.13

SECTION 31 23 23

FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Backfilling building perimeter to subgrade elevations.
2. Backfilling site structures to subgrade elevations.
3. Fill under slabs on grade.
4. Fill under paving.
5. Fill for over-excavation.

B. Related Requirements:

1. Section 033000 - Cast-in-Place Concrete: Concrete materials.
2. Section 312213 - Rough Grading: Site filling.
3. Section 312316 - Excavation: Backfilling of building foundations and utilities within building perimeter.
4. Section 312316.13 - Trenching: Backfilling of utility trenches.
5. Section 331416 - Site Water Utility Distribution Piping: Pipe materials, fittings, valves, meters, and backflow preventers.
6. Section 333453 - Distribution Chambers: Materials and installation requirements for distribution chambers used to divert septic tank effluent to drainage fields.
7. Section 334113 - Foundation Drainage: Filter aggregate.
8. Section 334119 - Underslab Drainage: Filter aggregate.
9. Section 334200 - Stormwater Conveyance: Drainage facilities to collect and provide for flow of stormwater.
10. Section 335213 - Liquid Hydrocarbon Piping: Factory-insulated piping for use with oil distribution systems in belowground applications.
11. Section 335216 - Gas Hydrocarbon Piping: Pipe materials, fittings, and valves normally encountered with Site-piped natural gas or propane gas distribution systems.
12. Section 336100 - Hydronic Energy Distribution: Factory-insulated piping for use with hydronic distribution systems in underground applications.
13. Section 336300 - Steam Energy Distribution: Factory-insulated piping for use with steam distribution systems in underground applications.
14. Geotechnical report: NOT AVAILABLE

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCE STANDARDS

A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

B. ASTM International:

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D6031/D6031M - Standard Test Method for Logging In Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and Vertical Access Tubes.
6. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for geotextile fabric, indicating fabric and construction.

C. Materials Source: Submit name of imported materials suppliers.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.05 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.01 MATERIALS

A. Unless Geo-technical report specifies otherwise, fill materials shall be according to the table below:

B. Foundation Materials:

1. All foundation materials shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Engineer may be objectional or deleterious.
2. Undisturbed soil foundation material:

    a. Shall be natural trench bottom soil unless unable to adequately support pipe or structures.
    b. Shall not be lumpy or frozen

3. Gravel:

    a. Shall be hard, durable, broken stone or slag.
    b. Shall be graded within the following limits:

Sieve	%Passing
1 inch	100
3/4 inch	85-100
1/2 inch	20-40
No. 4	10-20

C. APWA 1” Base Course:

1. Shall be readily compactable and shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Engineer may be objectional or deleterious.
2. Shall be graded within the following limits:

Sieve	% Passing
3/4 inch	100
1/2 inch	85 -100
3/8 inch	70
No. 4	45
No. 8	30
No. 16	20
No. 100	10
No. 200	7

D. Backfill Materials

1. Granular backfill:

    a. Shall be readily compactable and shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Engineer may be objectional or deleterious.
    b. Graded within the following limits:

Sieve	% Passing
3 inch	100
No. 10	50 max.
No. 40	30 max.
No. 200	15 max.

c. May be select material from excavation if it will meet all requirements of granular backfill, including compaction requirements as specified for type of surface improvement above trench.

2. Excavated Soil Backfill Material:

a. Shall be free from alkali, salt, and petroleum products, roots, sod, limbs, and other vegetative matter, slag, cinders, ashes and rubbish, or other material that in the opinion of the Engineer may be objectional or deleterious.
b. Shall be select material from excavation, with no particle larger than 4 inches in diameter.
c. Use on site materials only if specified compaction requirements can be met.

E. Structural Fill:

1. Structural Fill

a. Naturally or artificially graded mixture of natural or crushed gravel, and natural or crushed sand; ASTM D 2940; well graded.
b. Graded within the following limits:

Sieve	% Passing
2 inch	100
1 1/2 inch	90
3/4 inch	85 -90
1/2 inch	70 - 80
No. 4	50 - 55
No. 10	30 - 40
No. 40	20 - 25
No. 200	17 max.

F. Subgrade Stabilizing Material

1. Use "Granular Backfill" as defined in Section above.

G. Drainage Fill:

1. Drainage Fill: Washed, narrowly graded mixture of crushed or uncrushed gravel; ASTM D 448; with 100 percent passing a 11/2 inch (38mm) sieve and 0 to 5 percent passing a No. 8 (2.36mm) sieve.

H. Stabilizing Fabric:

1. See APWA Utah Chapter Standard Specifications – Section 02075 – Part 1; Part 2.2; Part 3.1.

I. Flowable Fill Concrete:

1. Description: Lean.

2.02 ACCESSORIES

NOT USED

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that subdrainage, dampproofing, and waterproofing installations have been inspected.

C. Verify that underground float able structures such as tanks are anchored to their own foundations to avoid flotation after backfilling.

D. Verify structural integrity of unsupported walls to support loads imposed by fill.

3.02 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Compact subgrade to specified density requirements for subsequent backfill materials.

C. Soft Subgrade:

1. Cut out soft areas of subgrade not capable of compaction in place.
2. Backfill with structural fill and compact to density equal to or greater than specified requirements for subsequent fill material.

D. Scarify subgrade surface to depth of 6 inches.

3.03 BACKFILLING

A. Backfill areas to contours and elevations.

B. Systematically backfill to allow maximum time for natural settlement.

C. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces, and do not backfill with frozen materials.

D. Each lift shall be evenly spread and moistened or dried by disk harrowing or other means so that the required density will be produced.

E. Geotextile: Install separation fabric on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends where required by Engineer. See APWA Utah Chapter Standard Specifications, Section 02075, Part 2.2, part 3.1, and Part 3.7 for Specifications.

F. Maximum Compacted Depths:

1. Place material in continuous layers to following depths:

   a. Subsoil Fill: 8 inches.
   b. Structural Fill: 8 inches
   c. Granular Fill: 8 inches.

2. Mechanical compaction: Shall be accomplished by the use of sheeps foot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers of a size and type necessary to achieve the required degree of compaction.

G. Use placement method that does not disturb or damage foundation perimeter drainage, or utilities in trench

H. Maintain optimum moisture content of fill materials to attain required compaction density.

I. Structures:

1. Backfill against supported foundation walls.
2. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

J. Make gradual grade changes and blend slope into level areas.

K. Remove surplus backfill materials from Site.

L. Leave fill material stockpile areas free of excess fill materials.

3.04 TOLERANCES

A. Section 014000 - Quality Requirements: Requirements for tolerances.

B. Top Surface of Backfilling within Building Areas: Plus or minus 0.5 inch from required elevations.

C. Top Surface of Backfilling under Paved Areas: Plus or minus 0.5 inch from required elevations.

D. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.05 FIELD QUALITY CONTROL

A. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

B. Inspecting: Request visual inspection of bearing surfaces by Engineer before installing subsequent Work.

C. Compaction Testing:

1. Laboratory Material Testing: Comply with ASTM D1557
2. In-Place Compaction Testing:

    a. Under pavements, or other surface improvements, the average density shall be 96% of laboratory maximum density with no individual test lower than 92% of the laboratory maximum density, as determined by AASHTO Designation T 1 80 (ASTM D 1 557).

    b. In shoulders and other unimproved areas, the average density shall be 90% of laboratory maximum density with no individual test lower than 86% of the laboratory maximum density, as determined by AASHTO Designation T 1 80 (ASTM D 1 557).

    c. The CONTRACTOR shall demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:

        1) One (1) test per 1.5 feet of backfill thickness placed per structure

3. If compaction fails to meet the specified requirements, the CONTRACTOR shall remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by the CONTRACTOR. The CONTRACTOR's confirmation tests shall be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial work shall be double that amount specified for initial confirmation tests.
4. Proof-roll compacted fill surfaces under slabs on grade, pavers, and paving.

3.06 PROTECTION

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Reshape and recompact fills subjected to vehicular traffic during construction.

END OF SECTION 31 23 23

SECTION 32 12 16

ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Proof roll base course to reveal soft and yielding spots.
2. Place and compact asphaltic concrete paving.
3. Pavement Markings.
3. Protection of newly placed pavement.

B. Related Requirements:

1. Section 312213 - Rough Grading: Topsoil and subsoil removal from Site surface.
2. Section 312316 - Excavation: Building excavation.
3. Section 312323 - Fill: Backfilling at building perimeter and Site structures, and fill under slabs on grade, pavement, and landscaped areas.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 REFERENCES STANDARDS

A. The applicable provisions of the latest editions of the References listed below shall govern the Work covered under this Section, unless there is a conflict between said References and the requirements of this Section. In the case of such a conflict, the requirements of this Section shall apply.

B. American Society for Testing Materials (ASTM).

1. D1557, “Test for Moisture - Density Relationship of Soils using 10 lb (4.5 kg) Rammer in 18-inch (457 mm) Drop”.
2. D1559, “Resistance to Plastic Flow of Bituminous Mixtures using Marshall Apparatus”.
3. D2170, “Kinematic Viscosity of Asphalts (Bitumens)”.

C. American Association of Safety and Highway Transportation Officials (AASHTO)

1. Materials and compaction tests.

D. State of Utah Standard Specifications for Road and Bridge Construction, latest edition including Supplement #2.

1. Section 704.03 Asphaltic Cement.

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Submittals shall include, but not necessarily be limited to the following:

1. An asphaltic concrete paving mix design prepared by certified laboratory and materials certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements and shall be submitted for review and approval at least two weeks prior to commencement of the work.
2. Written certification of compliance for pavement marking paint.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.05 QUALITY ASSURANCE

A. Do not place asphaltic concrete paving when the air temperature in the shade and/or the roadbed temperature is below 50° F, or during rain, when the base course surface is wet, or during other adverse weather conditions.

B. Do not place tack coat when air temperature in the shade and the roadbed temperature are below 50° F, or during rain, fog, or other adverse weather conditions.

C. All work shall be performed by experienced and qualified workmen with equipment standard in the industry.

D. Approval by Engineer of sources of supply of materials shall be obtained prior to delivery of materials.

E. Comply with federal, state and/or local codes and regulations.

1.06 DELIVERY, STORAGE AND HANDLING

A. Contractor shall be responsible for proper storage of all equipment and materials to be provided as part of this specification in accordance with the manufacturer’s recommendations and shall be responsible for security and proper handling of such equipment and materials at the project site.

B. Any materials lost, stolen, or damaged prior to Owner's final acceptance are to be replaced or repaired to the Owner's satisfaction by the Contractor at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Materials suppliers shall provide, upon request, verification of a consistent record of meeting or exceeding materials or performance standards as specified herein.

2.02 ASPHALT PAVING CONCRETE

A. Asphaltic cement:

1. PG 58-28, conforming to requirements of ASTM D 3381 (AASHTO M 226, Table 2), and Section 704.03 State of Utah Standard Specifications for Road and Bridge Construction.
2. Shall not foam when heated to 350° F.

B. Mineral aggregate:

1. Shall consist of crushed stone, crushed gravel, or crushed slag, or a combination thereof; free of clay, silt, organic matter or other deleterious materials.
2. Gradation shall be in accordance with the following:

Sieve Size	Percent Passing By Weight
1/2"	100
#4	55-85
#16	24-38
#50	9-21
#200	4-8

3. Coarse aggregate, retained on the No. 4 sieve shall consist of clean, hard, rough, durable and sound fragments, with not less than 50 percent of particles by weight with at least one mechanically fractured face or clean angular face.

4. Fine aggregate passing the No. 4 sieve may be either a natural or manufactured product. The aggregate shall be clean, hard grained and moderately sharp, and shall contain not more than 2 percent by weight of vegetable matter or other deleterious substances.

5. That portion of the fine aggregate passing the No. 40 sieve shall be nonplastic when tested in accordance with ASTM D 424.

6. The weight of minus 200 mesh material retained in the aggregate, as determined by the difference in percent passing a No. 200 sieve by washing and dry sieving without washing, shall not exceed 6 percent of the total sample weight. That

portion of fine aggregate passing the No. 200 sieve shall be determined by washing with water in accordance with ASTM C 117.

7. The aggregate shall be of uniform density and quality and shall have a rodded weight of not less than 100 pounds per cubic foot when tested in accordance with ASTM C 29.

8. The aggregate shall have a percentage of wear not exceeding forty when tested in accordance with ASTM C 131 and C 535.

9. The aggregate shall have a weighted loss not exceeding 12 percent by weight when subject to five cycles of sodium sulfate and tested in accordance with ASTM C 88, D 1073, and D 692.

2.03 ASPHALTIC CONCRETE PAVING MIXTURE

A. Combine mineral constituents and asphalt cement in proportions per mix design at a central plant to produce an asphaltic concrete pavement mix.

B. Mix design shall be based on the Marshall Method. The combined mineral aggregate plus any approved additives when mixed with the asphaltic cement in accordance with ASTM D 1559 shall conform to the following requirements:

1. Marshall Stability: 1200 pounds minimum
2. Flow (0.01 inch): 10 18
3. Voids Content: 1.5% to 3%
4. Asphaltic Cement Content: 5.2% to 6% by weight
5. 15% Max RAP by Content

C. The asphaltic cement shall be heated at the mixing plant to a temperature at which it can be applied uniformly to the aggregate.

D. Coarse and fine aggregate shall be stored separately at the mixing plant in a manner that will prevent intermingling.

E. When it is necessary to blend aggregates from one or more sources to produce the combined gradation, each source or size of aggregate shall be stockpiled individually. Aggregate from the individual stockpiles shall be fed through separate bins to the cold elevator feeders. They shall not be blended in the stockpile.

F. Cold aggregates shall be fed carefully to the plant so that surpluses and shortages will not occur and cause breaks in the continuous operation.

G. The aggregate shall be dried and heated to provide a paving mixture temperature in conformance with placing conditions, but not to exceed 163°C (325°F).

H. The heated and dried aggregates shall not contain enough moisture to cause the mixture to slump, the asphalt to foam, or the aggregate to segregate during hauling and placing.

I. The shortest mixing time consistent with satisfactory coating of the aggregate shall be used. The mineral aggregate shall be considered satisfactorily coated with asphaltic cement when all of the particles passing the No. 4 sieve and 96 percent of the particles retained on the No. 4 sieve are coated with asphaltic cement. The required mixing time, as determined above, shall be in accordance with ASTM D 2489.

J. If a dryer drum mixing process is used, the mineral aggregate shall be considered satisfactorily coated with asphaltic cement when all of the particles passing the No. 4 sieve and 98 percent of the particles retained on the No. 4 sieve are coated with asphaltic cement. The moisture content of the asphaltic cement sampled behind the laydown machine prior to compaction shall not exceed 1 percent by weight.

2.04 TACK COAT

A. Cut back asphalt RC or MC 70 or 250.

2.05 MARKING PAINT

A. Alkyd resin, white in color, factory mixed, quick drying, and non-bleeding, complying with Section 713.07 of the Utah State Department of Transportation Standard Specification for Road and Bridge Construction. Contractor to apply two (2) coats of marking paint for all striping.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate layout and installation of paving materials with other construction elements to ensure adequate headroom, working clearance, and access.

B. Examine surfaces to receive asphaltic concrete paving for compliance with installation tolerances and other conditions affecting performance of the pavement system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 METHODS OR PROCEDURES

A. Preparation

1. Proof roll base course surface. Replace wet, spongy, soft, uncompactable or other unsuitable material with new base course material at no additional cost. Finish and compact repaired area as specified in Section 321123 Aggregate Base Course.
2. Ensure base course surface is to required elevation. Remove loose material from base course surface.
3. Do not place prime coat or asphaltic concrete paving until base course installation has been approved by the Construction Manager.

B. Transporting the Asphaltic Concrete Pavement

1. Transport time from the mixing plant to the job site shall not exceed 1 hour.
2. The hauling truck shall have no direct frame contact with the paver or bear down on the paver during dumping operations.

3.03 INSTALLATION

A. Tack Coat

1. Prior to placing pavement, a tack coat shall be applied to the vertical edges of concrete and "cold" pavement (over 1/2 hour old) which will be in contact with new pavement. Tack coat shall extend 12 inches onto adjacent base course material. The tack coat shall be carefully applied at a rate of 0.15 gal/SY. Tack coat shall also be applied uniformly at the same rate to the horizontal top surface of each lift of bituminous pavement prior to placing the next lift of bituminous pavement to promote a bond between the two courses of pavement. None of the material shall penetrate into the pavement and for this reason the application should be limited.
2. Prior to applying the material, the surface to be treated shall be swept or flushed free of dust or other foreign material.
3. Protect all surfaces not required to receive tack coat from any inadvertent application.
4. The temperature range of the tack coat at the time of application shall be such that the viscosity will be between 50 and 100 centistokes as determined in accordance with ASTM Designation D-2170.
5. Under no circumstances shall traffic be permitted to travel over the tacked surface. If detours cannot be provided, restrict operation to a width that will permit at least one-way traffic over the remaining portion of the roadbed. If one-way traffic is provided, the traffic shall be controlled in accordance with governing authority.
6. After application of tack coat, sufficient time shall be given to allow for complete separation of asphalt and water before paving operations begin. The tack coat shall be applied on only as many surfaces as will be paved against in the same day.
7. Under no circumstance shall traffic be permitted to travel over tacked surface. If detours cannot be provided, restrict operation to a width that will permit at least one-way traffic over the remaining portion of the roadbed. If one-way traffic is provided, the traffic shall be controlled in accordance with governing authority.

B. Placement of Asphaltic Concrete Pavement

1. Place asphalt pavement to provide a compacted depth as indicated on the plans. Placing the pavement shall be a continuous operation. The machine shall spread mixture and shall strike a finish that is smooth, true to cross section, uniform in density and texture, and free from hollows and other irregularities. If any irregularities occur, they shall be corrected before final compaction of the mixture. The paving machine shall be self-propelled, equipped with hoppers, distributing screws, adjustable screeds and equalizing devices, capable of spreading hot asphaltic concrete paving mixtures without tearing, shoving or gouging, and of

producing a finished surface of specified quality. Place inaccessible and small areas by hand.

2. Ensure asphalt pavement temperature is between 150 and 300 centistokes as determined with ASTM D 2170 when mixing with a pugmill, or between 220°F and 260°F when using the dryer drum mixing process, immediately after placing and prior to initial rolling.
3. Ensure joints made during paving operations are straight, clean, vertical and free of broken or loose material. Carefully make joints to insure a continuous bond between old and new pavement, or between successive day's work. A continuous bond between adjoining work is required.
4. If more than 1/2-hour elapses between adjacent paving passes, the "cold joint" shall have tack coat applied to the "cold" pavement prior to placing the adjacent pass.

C. Compaction

1. Roll and compact to specified density before temperature of the mixture drops below 180°F.
2. Compact asphalt paving course to required density, with a steel¬ wheeled tandem roller, steel three wheeled roller, vibratory roller, or a pneumatic tired roller, weighing not less than five tons. Start compaction as soon as pavement will bear equipment without checking or undue displacement. Speed of roller shall be slow enough to avoid displacement of hot mixture, and any displacements occurring as a result of changing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and of fresh mixture where required. Ensure each pass of roller overlaps previous passes by at least 1/2 of the roller width to ensure smooth surface free of roller marks. Keep roller wheels sufficiently moist so as not to pick up material. Rolling shall continue until roller marks are eliminated and no further compression is possible. The finished compacted pavement shall have a density of 96% minimum, no test less than 92% of the density determined in accordance with ASTM D-2041.
3. Leave pavement with a uniform, dense surface.
4. Perform hand tamping in areas not accessible to rolling equipment. Thorough compaction must be achieved, and joints between curbs, headers, manholes and similar structures must be effectively sealed.
5. Do not allow vehicular traffic on newly paved areas until surface has cooled to atmospheric temperature.

D. Pavement Marking

1. Unless otherwise directed by Construction Manager, the painting of parking stripes shall be commenced not earlier than 15 days after completion of the asphaltic concrete paving.
2. Prior to painting, broom or sweep the surface to remove dirt, loose stones or other foreign material. Solvent material that will damage pavement shall not be used as cleaning agents.

3.04 PROTECTION

A. Provide barricades and restrict access as appropriate to prevent damage to Work in place.

B. Contractor shall be responsible for protection of Work in place against displacement, damage, or loss until Owner's acceptance. Any work and subsequently damaged, lost or displaced shall be repaired or replaced to the Owner's satisfaction at no additional cost to Owner.

C. After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.05 FIELD QUALITY CONTROL

A. Testing and observation of asphalt pavement mix and asphalt pavement installation will be performed by testing laboratory in accordance with Section 01400 - QUALITY CONTROL. Testing and observation will be performed so as to minimize disruption to Work.

B. Testing laboratory shall verify weight or proportions, character of materials used and temperatures used in the preparation of asphaltic concrete mix.

C. Testing laboratory will perform one laboratory test on proposed asphalt pavement mix to determine conformity with requirements.

D. The testing laboratory will perform at least one series of compaction test for asphalt pavement, following pavement curing. Location of samples to be selected by the Engineer.

E. Ensure surface of completed asphalt pavement is true to lines, profiles and elevations indicated, and is free from depressions exceeding 1/8 inch when measured with a 10 ft. straightedge. The thickness of compacted pavement shall be within 1/4 inch of the design thickness, with the average thickness not less than the design thickness.

F. If tests indicate that asphalt paving does not meet specified requirements, remove defective work, replace and retest at Contractor's expense.

G. Areas not capable of being corrected by rerolling shall be removed and be rectangular in shape and completely enclosing the area to be corrected, with sides parallel or perpendicular with pavement edges. Skim patching is not permitted.

3.06 CLEANING

A. Thoroughly clean, rake, wash, flush or sweep as required to clean adjacent improvements of materials covered as part of this Work prior to submitting for Owner's acceptance.

B. Contractor shall provide all labor, equipment, materials and other items as required to perform clean up as required by the Owner, adjacent property owners and other jurisdictions.

C. Finish grading of areas affected by this Work shall be required as part of clean up.

D. The roadway including shoulders, slopes, ditches, and borrow pits shall be smoothly trimmed, and shaped by machinery, or other satisfactory methods, to the lines, grades and cross-sections, as established, and shall be so maintained until accepted. Any surplus material not suitable for spreading along the road to widen the existing shoulder or raise the grade shall be disposed of as specified above.

END OF SECTION 32 12 16

SECTION 32 91 13

SOIL PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Preparation of subsoil.
2. Soil testing.
3. Placing topsoil.

B. Related Sections:

1. Section 312213 - Rough Grading: Rough grading of site.
2. Section 312316.13 - Trenching: Rough grading over cut.
3. Section 329223 - Sodding.

1.02 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.03 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with Municipality.

1.05 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate with installation of underground sprinkler system piping and watering heads.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots;

2.02 ACCESSORIES

2.03 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Testing, inspection and analysis requirements.

B. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.

C. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.02 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.03 PLACING TOPSOIL

A. Spread topsoil to minimum depth of 4 inches over area to be seeded. Rake until smooth.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install edging at periphery of seeded areas in straight lines to consistent depth.

END OF SECTION 32 91 13

SECTION 33 05 61

CONCRETE MANHOLES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Modular precast concrete manholes and structures with tongue-and-groove joints and masonry transition to cover frame, covers, anchorage, and accessories.
2. Masonry manhole and structure sections with masonry transition to cover frame, covers, anchorage, and accessories.
3. Cast-in-place concrete manholes and structures with masonry transition to cover frame, covers, anchorage, and accessories.
4. Doghouse manhole connections to existing sanitary storm sewer lines.
5. Bedding and cover materials.
6. Pile support systems.
7. Vertical adjustment of existing manholes and structures.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Erection and bracing of forms.
2. Section 032000 - Concrete Reinforcing: Reinforcing steel as required by this Section.
3. Section 033000 - Cast-in-Place Concrete: Concrete type for manhole and structure foundation slab construction.
4. Section 040513 - Masonry Mortaring: Mortar.
5. Section 040516 - Masonry Grouting: Grout.
6. Section 042000 - Unit Masonry: Clay brick units for use in manhole and structure construction.
7. Section 061300 - Heavy Timber Construction: Timber cradle construction.
8. Section 310513 - Soils for Earthwork: Soils for backfill in trenches.
9. Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.
10. Section 310519.13 - Geotextiles for Earthwork: Filter fabric for subsurface drainage.
11. Section 312316 - Excavation: Excavating for manholes, structures, and foundation slabs.
12. Section 312323 - Fill: Backfilling after manhole and structure installation.
13. Section 316219 - Timber Piles: Pile support systems.
14. Section 330130.61 - Packer Injection Grouting: Grout sealing as required by this Section.
15. Section 330130.86 - Manhole Rim Adjustment: Resetting existing castings and grates.

16. Section 330573 - Polyethylene Manholes: Requirements for manholes constructed of PE.
17. Section 330576 - Fiberglass Manholes: Requirements for manholes constructed of fiberglass.
18. Section 333100 - Sanitary Sewerage Piping: Piping connections to manholes.
19. Section 333111 - Public Sanitary Sewerage Gravity Piping: Piping connections to manholes.
20. Section 334200 - Stormwater Conveyance: Piping connections to manholes and structures.
21. Section 337119 - Electrical Underground Ducts, Ductbanks, and Manholes: Ducts and manholes affected by this Section.

1.02 DEFINITIONS

A. Bedding: Specialized material placed under manhole prior to installation and subsequent backfill operations.

1.03 UNIT PRICE - MEASUREMENT AND PAYMENT

A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.04 REFERENCE STANDARDS

A. American Association of State Highway Transportation Officials:

1. AASHTO M91 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
2. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
3. AASHTO M306 - Standard Specification for Drainage, Sewer, Utility, and Related Castings.

B. American Concrete Institute:

1. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.

C. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C55 - Standard Specification for Concrete Building Brick.
5. ASTM C361 - Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.

6. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections.
7. ASTM C497 - Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile.
8. ASTM C877 - Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections.
9. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures.
10. ASTM C923 - Standard Specification for Resilient Connectors between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
11. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.
12. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
13. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

1.05 COORDINATION

A. Section 013000 - Administrative Requirements: Requirements for coordination.

B. Coordinate Work of this Section with connection to utility service and trenching.

1.06 PREINSTALLATION MEETINGS

A. Section 013000 - Administrative Requirements: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.07 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for manhole covers, component construction, features, configuration, and dimensions.

C. Shop Drawings:

1. Indicate structure locations and elevations.
2. Indicate sizes and elevations of piping.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

H. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.08 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

B. Project Record Documents: Record actual locations of manholes and connections, and record invert elevations.

1.09 QUALITY ASSURANCE

A. Perform Work according to local municipality standards.

1.10 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Handling: Comply with precast concrete manufacturer instructions and ASTM C913 for unloading and moving precast manholes and drainage structures.

D. Storage:

1. Store materials according to manufacturer instructions.
2. Store precast concrete manholes and drainage structures to prevent damage to Owner's property or other public or private property.
3. Repair property damaged from materials storage.

E. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.12 AMBIENT CONDITIONS

A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.

B. Cold Weather Requirements: Comply with ACI 530/530.1.

1.13 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.14 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Requirements for warranties.

B. Furnish five -year manufacturer's warranty for concrete manholes.

PART 2 - PRODUCTS

2.01 CONCRETE AND MASONRY MANHOLES

A. Furnish materials according to manufactures standards

B. Manhole Sections:

1. Materials:

a. Reinforced Precast Concrete: Comply with ASTM C478.
b. Gaskets: Comply with ASTM C923.

2. Joints:

a. Comply with ASTM C913.
b. Maximum Leakage: 0.025 gal. per hour per foot of joint at 3 feet of head.

C. Shaft and Eccentric Cone Top Sections:

1. Pipe Sections: Reinforced precast concrete.
2. Joints:

a. Lipped male/female.
b. Dry.

3. Sleeved to receive pipe sections.

D. Shape: Cylindrical

E. Clear Inside Dimensions:
   1. As indicated on Drawings.

F. Design Depth:
   1. As indicated on Drawings.

G. Clear Cover Opening:
   1. As indicated on Drawings.

H. Pipe Entry: Furnish openings as indicated on Drawings.

I. Structure Joint Gaskets:

   1. Comply with ASTM C361.
   2. Material: Rubber.

2.02 FRAMES AND COVERS

A. Furnish materials according to manufactures standards

B. Description:

   1. Material:

      a. Cast iron.
      b. Comply with AASHTO M306.

   2. Lid:

      a. Bearing Surface: Machined flat.
      b. Configuration: Removable.
      c. Security: None.

   3. Cover Design: Closed.
   4. Live-Load Rating: 2.29 psf.
   5. Cover: Molded with identifying name and logo.
   6. Grate: Bicycle Safe.
   7. Nominal Lid or Grate Size: 30-inch diameter.

2.03 RISER RINGS

A. Furnish materials according to manufactures standard

B. Riser Rings:

   1. Thickness of 4 to 6 Inches:

      a. Precast concrete.

b. Comply with ASTM C478.

2. Thickness Less Than 4 Inches:

a. Cast iron.
b. Comply with AASHTO M306.

3. Rubber Seal Wraps:

a. Wraps and Band Widths: Comply with ASTM C877, Type III.
b. Cone/Riser Ring Joint: Minimum 3-inch overlap.
c. Frame/Riser Ring Joint: 2-inch overlap.
d. Additional Bands: Overlap upper band by 2 inches.

2.04 MATERIALS

A. Cover and Bedding:

1. Bedding: Granular Backfill, as specified in Section 312323 – Fill.
2. Cover: Granular Backfill, as specified in Section 312323 – Fill.

2.05 ACCESSORIES

A. Steps:

1. Rungs: Formed Polypropylene.
2. Diameter: 3/4 inch.
3. Width:

a. 12 inches.

4. Spacing:

a. 16 inches o.c. vertically, set into structure wall.

B. Foundation Slab:

1. Cast-in-place concrete as specified in Section 033000 - Cast-in-Place Concrete or Precast concrete as specified in Section 034100 – Precast Structural Concrete.
2. Top Surface: Level.

C. Joint Sealant: Comply with ASTM C990.

D. Fasteners: Galvanized steel; ASTM F1554.

E. Geotextile Filter Fabric:

1. Description:

a. Non-biodegradable.

b. Woven.

2. Comply with AASHTO M288.

F. Concrete: As specified in Section 033000 - Cast-in-Place Concrete.

G. Grout: As specified in Section 033000 - Cast-in-Place Concrete.

H. Soil Backfill from Above Pipe to Finish Grade:

1. Soil Type S1 or S2, as specified in Section 310513 - Soils for Earthwork.
2. Subsoil: No frozen earth, or foreign matter, or rocks more than 6 inches in diameter.

2.06 FINISHES

A. Furnish materials according to manufactures standards

1. Description: As specified in Section 099000 - Painting and Coating.

B. Steel Galvanizing:

1. Hot-dip galvanize after fabrication.
2. Comply with ASTM A123/A123M.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are properly sized and located.

C. Verify that built-in items are in proper location and are ready for roughing into Work.

D. Verify that excavation base is ready to receive Work and excavations and that dimensions and elevations are as indicated on Drawings.

3.02 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.

B. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers as indicated on Drawings to indicate its intended use.

C. Coordinate placement of inlet and outlet pipe or duct sleeves as required by other Sections.

D. Do not install manholes and structures where Site conditions induce loads exceeding structural capacity of manholes or structures.

E. Inspect precast concrete manholes and structures immediately prior to placement in excavation to verify that they are internally clean and free from damage; remove and replace damaged units.

3.03 INSTALLATION

A. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface structures or utilities in immediate or adjacent areas.

B. Correct over-excavation with coarse aggregate.

C. Remove large stones or other hard matter impeding consistent backfilling or compaction.

D. Protect manhole from damage or displacement while backfilling operation is in progress.

E. Excavating:

1. As specified in Section 312316 - Excavation and in indicated locations and depths.
2. Provide clearance around sidewalls of manhole or structure for construction operations, granular backfill, and placement of geotextile filter fabric.
3. If ground water is encountered, prevent accumulation of water in excavations; place manhole or structure in dry trench.
4. Where possibility exists of watertight manhole or structure becoming buoyant in flooded excavation, anchor manhole or structure to avoid flotation as approved by Architect/Engineer.

F. Base and Alignment:

1. Place foundation slab and trowel top surface level.
2. Grout base of shaft sections to achieve slope to exit piping, trowel smooth, and contour to form continuous drainage channel, as indicated on Drawings.
3. Place manhole sections plumb and level, trim to correct elevations, and anchor to foundation slab.

G. Attachments:

1. As Work progresses, build fabricated metal items.
2. Cut and fit for pipe.
3. Set cover frames and covers level to correct elevations without tipping.

H. Backfilling: As specified in Section 312323 - Fill.

I. Precast Concrete Manholes:

1. Lift precast components at lifting points designated by manufacturer.
2. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure that interior of pipeline and structure remains clean.
3. Assembly:

    a. Assemble multi-section manholes and structures by lowering each section into excavation.
    b. Install rubber gasket joints between precast sections according to manufacturer recommendations.
    c. Lower, set level, and firmly position base section before placing additional sections.

4. Remove foreign materials from joint surfaces and verify that sealing materials are placed properly.
5. Maintain alignment between sections by using guide devices affixed to lower section.
6. Joint sealing materials may be installed on Site or at manufacturer's plant.
7. Verify that installed manholes and structures meet required alignment and grade.
8. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe; fill annular spaces with mortar.
9. Cut pipe flush with interior of structure.
10. Shape inverts through manhole and structures as indicated on Drawings.

J. Sanitary Manhole Drop Connections: As indicated on Drawings.

3.04 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

END OF SECTION 33 05 61