Purchasing Division

Invitation for Bid

IFB-4278-16-DH
Construction and Site Work for the Las Colonias Park Amphitheater

Responses Due:

September 13, 2016 prior to 3:30pm

Accepting Electronic Responses Only

Responses Only Submitted Through the Rocky Mountain E-Purchasing System (RMEPS)

https://www.rockymountainbidsystem.com/default.asp

(Purchasing Representative does not have access or control of the vendor side of RMEPS. If website or other problems arise during response submission, vendor MUST contact RMEPS to resolve issue prior to the response deadline. 800-835-4603)

Purchasing Representative:
Duane Hoff Jr., Senior Buyer
duaneh@gjcity.org
970-244-1545

This document has been developed specifically to solicit competitive responses for this solicitation, and may not be the same as previous City of Grand Junction solicitations. All vendors are urged to thoroughly review this solicitation prior to responding. Submittal by **FAX, EMAIL or HARD COPY IS NOT ACCEPTABLE** for this solicitation.

Invitation for Bids

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1. Instructions to Bidders

1.1. **Purpose:** The City of Grand Junction is soliciting competitive bids from qualified and interested companies for all labor, equipment, and materials required to provide construction services for slough excavation, concrete demo, and nesting for the Las Colonias Project. All dimensions and scope of work should be verified by Contractors prior to submission of bids.

1.2. **Recommended Pre-Bid Briefing:** Due to the complexity of the project, prospective bidders are ***highly encouraged*** to attend a pre-bid briefing on **August 30, 2016 at 9:00 a.m. at Grand Junction City Hall, 250 N. 5th Street in the Auditorium. Bidders are then invited to attend a walk through on the site at 925 Struthers Avenue immediately following the pre-bid briefing.** The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

1.3. **The Owner:** The Owner is the City of Grand Junction and/or Mesa County, Colorado and is referred to throughout this Solicitation. The term Owner means the Owner or his authorized representative.

1.4. **Prequalification Requirement: CITY ONLY** Contractors submitting bids over $50,000 must be pre-qualified in accordance with the City's *"Rules and Procedures for Pre-qualification of Contractors*". All bids received by the specified time will be opened, but the City will reject bids over $50,000 from contractors who have not been prequalified. Application forms for prequalification are available at the Administration Office of the Department of Public Works and Planning, City Hall, 250 North Fifth Street, Room 245. Call 970-256-4126 or 970-244-1555 for additional information. Due to the time required to process applications, *all applications must be submitted no later than two weeks prior to the Response Due Date*. Application link: http://www.gjcity.org/PreQualification.aspx

1.5. **Submission:** ***Each proposal shall be submitted in electronic format only, and only through the Rocky Mountain E-Purchasing website (https://www.rockymountainbidsystem.com/default.asp).*** *This site offers both "free" and "paying" registration options that allow for full access of the Owner's documents and for electronic submission of proposals. (Note: "free" registration may take up to 24 hours to process. Please Plan accordingly.)* Please view our "**Electronic Vendor Registration Guide"** at http://www.gjcity.org/BidOpenings.aspx for details. (Purchasing Representative does not have access or control of the vendor side of RMEPS. If website or other problems arise during response submission, vendor **MUST** contact RMEPS to resolve issue prior to the response deadline. **800-835-4603**)

1.6. **Printed Form for Price Bid:** All Price Bids must be made upon the Contractor's Bid Form attached, and should give the amounts both in words and in figures, and must be signed and acknowledged by the bidder.

1.7. **Exclusions:** No oral, telephonic, emailed, or facsimile bid will be considered

1.8. Contract Documents: The complete IFB and bidder's response compose the Contract Documents. Copies of these documents can be obtained from the City Purchasing website, http://www.gjcity.org/BidOpenings.aspx.

1.9. Examination of Specifications: Bidders shall thoroughly examine and be familiar with the project Statement of Work. The failure or omission of any Offeror to receive or examine any form, addendum, or other document shall in no way relieve any Offeror from any obligation with respect to his bid. The submission of a bid shall be taken as evidence of compliance with this section.

1.10. Questions Regarding Statement of Work: Any information relative to interpretation of Scope of Work or specifications shall be requested of the Purchasing Representative, in writing, in ample time prior to the response time.

1.11. Addenda & Interpretations: If it becomes necessary to revise any part of this solicitation, a written addendum will be posted electronically on the City's website at http://www.gjcity.org/BidOpenings.aspx. The Owner is not bound by any oral representations, clarifications, or changes made in the written specifications by Owner, unless such clarification or change is provided in written addendum form from the City Purchasing Representative.

1.12. Taxes: The Owner is exempt from State retail and Federal tax. The bid price must be net, exclusive of taxes.

1.13. Offers Binding 60 Days: Unless otherwise specified, all formal offers submitted shall be binding for sixty (60) calendar days following opening date, unless the Bidder, upon request of the Purchasing Representative, agrees to an extension.

1.14. Collusion Clause: Each bidder by submitting a bid certifies that it is not party to any collusive action or any action that may be in violation of the Sherman Antitrust Act. Any and all bids shall be rejected if there is evidence or reason for believing that collusion exists among bidders. The Owner may, or may not, accept future bids for the same services or commodities from participants in such collusion.

1.15. Public Disclosure Record: If the bidder has knowledge of their employee(s) or sub-contractors having an immediate family relationship with a City/County employee or elected official, the bidder must provide the Purchasing Representative with the name(s) of these individuals. These individuals are required to file an acceptable "Public Disclosure Record", a statement of financial interest, before conducting business with the City/County.

2. General Contract Conditions for Construction Projects

2.1. The Contract: This Invitation for Bid, submitted documents, and any negotiations, when properly accepted by the City/County, shall constitute a contract equally binding between the City/County and Contractor. The contract represents the entire and

integrated agreement between the parties hereto and supersedes all prior negotiations, representations, or agreements, either written or oral. The contract may be amended or modified with Change Orders, Field Orders, or Addendums.

2.2. The Work: The term Work includes all labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in such construction.

2.3. Execution, Correlation, Intent, and Interpretations: The Contract Documents shall be signed in not less than triplicate by the Owner (City/County) and Contractor. City/County will provide the contract. By executing the contract, the Contractor represents that he/she has visited the site, familiarized himself with the local conditions under which the Work is to be performed, and correlated his observations with the requirements of the Contract Documents. The Contract Documents are complementary, and what is required by any one, shall be as binding as if required by all. The intention of the documents is to include all labor, materials, equipment and other items necessary for the proper execution and completion of the scope of work as defined in the technical specifications and drawings contained herein. All drawings, specifications and copies furnished by the City/County are, and shall remain, City/County property. They are not to be used on any other project, and with the exception of one contract set for each party to the contract, are to be returned to the owner on request at the completion of the work.

2.4. The Owner: The Owner is the City of Grand Junction and/or Mesa County, Colorado and is referred to throughout the Contract Documents. The term Owner means the Owner or his authorized representative. The Owner shall, at all times, have access to the work wherever it is in preparation and progress. The Contractor shall provide facilities for such access. The Owner will make periodic visits to the site to familiarize himself generally with the progress and quality of work and to determine, in general, if the work is proceeding in accordance with the contract documents. Based on such observations and the Contractor's Application for Payment, the Owner will determine the amounts owing to the Contractor and will issue Certificates for Payment in such amounts, as provided in the contract. The Owner will have authority to reject work which does not conform to the Contract documents. Whenever, in his reasonable opinion, he considers it necessary or advisable to insure the proper implementation of the intent of the Contract Documents, he will have authority to require the Contractor to stop the work or any portion, or to require special inspection or testing of the work, whether or not such work can be then be fabricated, installed, or completed. The Owner will not be responsible for the acts or omissions of the Contractor, and sub-Contractor, or any of their agents or employees, or any other persons performing any of the work.

2.5. Contractor: The Contractor is the person or organization identified as such in the Agreement and is referred to throughout the Contract Documents. The term Contractor means the Contractor or his authorized representative. The Contractor shall carefully study and compare the General Contract Conditions of the Contract, Specification and Drawings, Scope of Work, Addenda and Modifications and shall at once report to the Owner any error, inconsistency or omission he may discover.

Contractor shall not be liable to the Owner for any damage resulting from such errors, inconsistencies or omissions. The Contractor shall not commence work without clarifying Drawings, Specifications, or Interpretations.

2.6. Sub-Contractors: A sub-contractor is a person or organization who has a direct contract with the Contractor to perform any of the work at the site. The term sub-contractor is referred to throughout the contract documents and means a sub-contractor or his authorized representative.

2.7. Award of Sub-Contractors & Other Contracts for Portions of the Work: As soon as practicable after bids are received and prior to the award of the contract, the successful Contractor shall furnish to the Owner, in writing for acceptance, a list of the names of the sub-contractors or other persons or organizations proposed for such portions of the work as may be designated in the proposal requirements, or, if none is so designated, the names of the sub-contractors proposed for the principal portions of the work. Prior to the award of the contract, the Owner shall notify the successful Contractor in writing if, after due investigation, has reasonable objection to any person or organization on such list. If, prior to the award of the contract, the Owner has a reasonable and substantial objection to any person or organization on such list, and refuses in writing to accept such person or organization, the successful Contractor may, prior to the award, withdraw their proposal without forfeiture of proposal security. If the successful Contractor submits an acceptable substitute with an increase in the proposed price to cover the difference in cost occasioned by the substitution, the Owner may, at their discretion, accept the increased proposal or may disqualify the Contractor. If, after the award, the Owner refuses to accept any person or organization on such list, the Contractor shall submit an acceptable substitute and the contract sum shall be increased or decreased by the difference in cost occasioned by such substitution and an appropriate Change Order shall be issued. However, no increase in the contract sum shall be allowed for any such substitution unless the Contractor has acted promptly and responsively in submitting a name with respect thereto prior to the award.

2.8. Supervision and Construction Procedures: The Contractor shall supervise and direct the work, using his best skill and attention. He shall be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the work under the contract.

2.9. Warranty: The Contractor warrants to the Owner that all materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance with the Contract Documents. All work not so conforming to these standards may be considered defective. If required by Owner, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. If within ten (10) days after written notice to the Contractor requesting such repairs or replacement, the Contractor should neglect to make or undertake with due diligence to the same, the City may make such repairs or replacements. All indirect and direct costs of such correction or removal or replacement shall be at the Contractor's expense. The

Contractor will also bear the expenses of making good all work of others destroyed or damaged by the correction, removal or replacement of his defective work.

2.10. Permits, Fees, & Notices: The Contractor shall secure and pay for all permits, governmental fees and licenses necessary for the proper execution and completion of the work. The Contractor shall give all notices and comply with all laws, ordinances, rules, regulations and orders of any public authority bearing on the performance of the work. If the Contractor observes that any of the Contract Documents are at variance in any respect, he shall promptly notify the Owner in writing, and any necessary changes shall be adjusted by approximate modification. If the Contractor performs any work knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Owner, he shall assume full responsibility and shall bear all costs attributable.

2.11. Responsibility for Those Performing the Work: The Contractor shall be responsible to the Owner for the acts and omissions of all his employees and all sub-contractors, their agents and employees, and all other persons performing any of the work under a contract with the Contractor.

2.12. Use of the Site: The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents, and shall not unreasonably encumber the site with any materials or equipment.

2.13. Cleanup: The Contractor at all times shall keep the premises free from accumulation of waste materials or rubbish caused by his operations. At the completion of work he shall remove all his waste materials and rubbish from and about the project, as well as all his tools, construction equipment, machinery and surplus materials.

2.14. Insurance Requirements: The selected Bidder agrees to procure and maintain, at its own cost, policy(s) of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by the Bidder pursuant to this Section. Such insurance shall be in addition to any other insurance requirements imposed by this Contract or by law. The Bidder shall not be relieved of any liability, claims, demands, or other obligations assumed pursuant to this Section by reason of its failure to procure or maintain insurance in sufficient amounts, durations, or types.
Bidder shall procure and maintain and, if applicable, shall cause any Subcontractor of the Bidder to procure and maintain insurance coverage listed below. Such coverage shall be procured and maintained with forms and insurers acceptable to the Owner. All coverage shall be continuously maintained to cover all liability, claims, demands, and other obligations assumed by the Bidder pursuant to this Section. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Minimum coverage limits shall be as indicated below unless specified otherwise in the Special Conditions:

(a) Worker Compensation: Contractor shall comply with all State of Colorado Regulations concerning Workers' Compensation insurance coverage.

(b) General Liability insurance with minimum combined single limits of:

One Million Dollars ($1,000,000) each occurrence and
One Million Dollars ($1,000,000) per job aggregate.

The policy shall be applicable to all premises and operations. The policy shall include coverage for bodily injury, broad form property damage (including completed operations), personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall include coverage for explosion, collapse, and underground hazards. The policy shall contain a severability of interests provision.

(c) Comprehensive Automobile Liability insurance with minimum combined single limits for bodily injury and property damage of not less than:

One Million Dollars ($1,000,000) each occurrence and
One Million Dollars ($1,000,000) aggregate

This policy shall provide coverage to protect the contractor against liability incurred as a result of the professional services performed as a result of responding to this Solicitation.

With respect to each of Bidder's owned, hired, or non-owned vehicles assigned to be used in performance of the Work. The policy shall contain a severability of interests provision. The policies required by paragraphs (b), and (c) above shall be endorsed to include the City and/or County, and the City's and/or County's officers and employees as additional insureds. Every policy required above shall be primary insurance, and any insurance carried by the Owner, its officers, or its employees, or carried by or provided through any insurance pool of the Owner, shall be excess and not contributory insurance to that provided by Bidder. No additional insured endorsement to any required policy shall contain any exclusion for bodily injury or property damage arising from completed operations. The Bidder shall be solely responsible for any deductible losses under any policy required above.

2.15. Indemnification: The Contractor shall defend, indemnify and save harmless the Owner, and all its officers, employees, insurers, and self-insurance pool, from and against all liability, suits, actions, or other claims of any character, name and description brought for or on account of any injuries or damages received or sustained by any person, persons, or property on account of any negligent act or fault of the Contractor, or of any Contractor's agent, employee, sub-contractor or supplier in the execution of, or performance under, any contract which may result from proposal award. Contractor shall pay any judgment with cost which may be obtained against the Owner growing out of such injury or damages.

2.16. Miscellaneous Conditions: Material Availability: Contractors must accept responsibility for verification of material availability, production schedules, and other pertinent data prior to submission of bid. It is the responsibility of the bidder to notify

the Owner immediately if materials specified are discontinued, replaced, or not available for an extended period of time. OSHA Standards: All bidders agree and warrant that services performed in response to this invitation shall conform to the standards declared by the US Department of Labor under the Occupational Safety and Health Act of 1970 (OSHA). In the event the services do not conform to OSHA standards, the Owner may require the services to be redone at no additional expense to the Owner.

2.17. Time: The Contract Time is the period of time allotted in the Contract Documents for completion of the work. The date of commencement of the work is the date established in a Notice to Proceed. If there is no Notice to Proceed, it shall be the date of the Contract or such other date as may be established therein, or as established as entered on the Bid Form. The Date of Substantial Completion of the work or designated portions thereof is the date certified by the Owner when construction is sufficiently complete, in accordance with the Contract Documents.

2.18. Progress & Completion: The Contractor shall begin work on the date of commencement as defined in the Contract, and shall carry the work forward expeditiously with adequate forces and shall complete it within the contract time.

2.19. Payment & Completion: The Contract Sum is stated in the Contract and is the total amount payable by the Owner to the Contractor for the performance of the work under the Contract Documents. Upon receipt of written notice that the work is ready for final inspection and acceptance and upon receipt of application for payment, the Owner's Project Manager will promptly make such inspection and, when he finds the work acceptable under the Contract Documents and the Contract fully performed, the Owner shall make payment in the manner provided in the Contract Documents.

2.20. Quantities of Work and Unit Price: Materials or quantities stated as unit price items in the Bid are supplied only to give an indication of the general scope of the Work. The City does not expressly or by implication agree that the actual amount of Work or material will correspond therewith, and reserves the right after award to increase or decrease the quantity of any unit item of the Work without a change in the unit price. The City also reserves the right to make changes in the Work including the right to delete any bid item in its entirety or add additional bid items.

2.21. Bid Bond: Each Bid shall as a guaranty of good faith on the part of the Bidder be accompanied by a Bid Guaranty consisting of: a certified or cashier's check drawn on an approved national bank or trust company in the state of Colorado, and made payable without condition to the City; or a **Bid Bond** written by an approved corporate surety in favor of the City. The amount of the Bid Guaranty shall not be less than 5% of the total Bid amount. Once a Bid is accepted and a Contact is awarded, the apparent successful bidder has ten calendar days to enter into a contractor in the form prescribed and to furnish the bonds with a legally responsible and approved surety. Failure to do so will result I forfeiture of the Bid Guaranty to the City as Liquidated Damages.

2.22. Performance & Payment Bonds: Contractor shall furnish a Performance and a Payment Bond, each in an amount at least equal to that specified for the contract amount as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. These bonds shall remain in effect for the duration of the Warranty Period (as specified in the Special Conditions). Contractor shall also furnish other bonds that may be required by the Special Conditions. All bonds shall be in the forms prescribed by the Contract Documents and be executed by such sureties as (1) are licensed to conduct business in the State of Colorado and (2) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff, Bureau of Accounts, U.S. Treasury Department. All bonds singed by an agent must be accompanied by a certified copy of the Authority Act. If the surety on any bond furnished by the Contractor is declared bankrupt, or becomes insolvent, or its rights to do business in Colorado are terminated, or it ceases to meet the requirements of clauses (1) and (2) of this section, Contractor shall within five (5) days thereafter substitute another bond and surety, both of which shall be acceptable to the City.

2.23. Retention: The Owner will deduct money from the partial payments in amounts considered necessary to protect the interest of the Owner and will retain this money until after completion of the entire contract. The amount to be retained from partial payments will be five (5) percent of the value of the completed work, and not greater than five (5) percent of the amount of the Contract. When the retainage has reached five (5) percent of the amount of the Contract no further retainage will be made and this amount will be retained until such time as final payment is made.

2.24. Liquidated Damages for Failure to Enter Into Contract: CITY ONLY Should the Successful Bidder fail or refuse to enter into the Contract within ten Calendar Days from the issuance of the Notice of Award, the City shall be entitled to collect the amount of such Bidder's Bid Guaranty as Liquidated Damages, not as a penalty but in consideration of the mutual release by the City and the Successful Bidder of all claims arising from the City's issuance of the Notice of Award and the Successful Bidder's failure to enter into the Contract and the costs to award the Contract to any other Bidder, to readvertise, or otherwise dispose of the Work as the City may determine best serves its interest.

2.25. Liquidated Damages for Failure to Meet Project Completion Schedule: CITY ONLY If the Contractor does not achieve Final Completion by the required date, whether by neglect, refusal or any other reason, the parties agree and stipulate that the Contractor shall pay liquidated damages to the City for each such day that final completion is late. As provided elsewhere, this provision does not apply for delays caused by the City. The date for Final Completion may be extended in writing by the Owner.

The Contractor agrees that as a part of the consideration for the City's awarding of this Contract liquidated damages in the daily amount of **$350.00** is reasonable and necessary to pay for the actual damages resulting from such delay. The parties agree that the real costs and injury to the City for such delay include hard to quantify items

such as: additional engineering, inspection and oversight by the City and its agents; additional contract administration; inability to apply the efforts of those employees to the other work of the City; perceived inefficiency of the City; citizens having to deal with the construction and the Work, rather than having the benefit of a completed Work, on time; inconvenience to the public; loss of reputation and community standing for the City during times when such things are very important and very difficult to maintain.

The Contractor must complete the Work and achieve final completion included under the Bid Schedule in the number of consecutive calendar days after the City gives is written Notice to Proceed. When the Contractor considers the entire Work ready for its intended use, Contractor shall certify in writing that the Work is substantially complete. In addition to the Work being substantially complete, Final Completion date is the date by which the Contractor shall have fully completed all clean-up, and all items that were identified by the City in the inspection for final completion. Unless otherwise stated in the Special Conditions, for purposes of this liquidated damages clause, the Work shall not be finished and the Contract time shall continue to accrue until the City gives its written Final Acceptance.

If the Contractor shall fail to pay said liquidated damages promptly upon demand thereof after having failed to achieve Final Completion on time, the City shall first look to any retainage or other funds from which to pay said liquidated damages; if retainage or other liquid funds are not available to pay said liquidated damages amounts, the Surety on the Contractor's Performance Bond and Payment Bond shall pay such liquidated damages. In addition, the City may withhold all, or any part of, such liquidated damages from any payment otherwise due the Contractor.
Liquidated damages as provided do not include any sums to reimburse the City for extra costs which the City may become obligated to pay on other contracts which were delayed or extended because of the Contractor's failure to complete the Work within the Contract Time. Should the City incur additional costs because of delays or extensions to other contracts resulting from the Contractor's failure of timely performance, the Contractor agrees to pay these costs that the City incurs because of the Contractor's delay, and these payments are separate from and in addition to any liquidated damages.

The Contractor agrees that the City may use its own forces or hire other parties to obtain Substantial or Final Completion of the work if the time of completion has elapsed and the Contractor is not diligently pursuing completion. In addition to the Liquidated Damages provided for, the Contractor agrees to reimburse the City for all expenses thus incurred.

2.26. Contingency/Force Account: Contingency/Force Account work will be authorized by the Owner's Project Manager and is defined as minor expenses to cover miscellaneous or unforeseen expenses related to the project. The expenses are not included in the Drawings, Specifications, or Scope of Work and are necessary to accomplish the scope of this contract. Contingency/Force Account Authorization will be directed by the Owner through an approved form. Contingency/Force Account funds are the property of the Owner and any Contingency/Force Account funds, not

required for project completion, shall remain the property of the Owner. Contractor is not entitled to any Contingency/Force Account funds, that are not authorized by Owner or Owner's Project Manager.

2.27. Protection of Persons & Property: The Contractor shall comply with all applicable laws, ordinances, rules, regulations and orders of any public authority having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss. Contractor shall erect and maintain, as required by existing safeguards for safety and protection, and all reasonable precautions, including posting danger signs or other warnings against hazards promulgating safety regulations and notifying owners and users of adjacent utilities. When or where any direct or indirect damage or injury is done to public or private property by or on account of any act, omission, neglect, or misconduct by the Contractor in the execution of the work, or in consequence of the non-execution thereof by the Contractor, he shall restore, at his own expense, such property to a condition similar or equal to that existing before such damage or injury was done, by repairing, rebuilding, or otherwise restoring as may be directed, or it shall make good such damage or injury in an acceptable manner.

2.28. Changes in the Work: The Owner, without invalidating the contract, may order changes in the work within the general scope of the contract consisting of additions, deletions or other revisions, the contract sum and the contract time being adjusted accordingly. All such changes in the work shall be authorized by Change Order and shall be executed under the applicable conditions of the contract documents. A Change Order is a written order to the Contractor signed by the Owner issued after the execution of the contract, authorizing a change in the work or an adjustment in the contract sum or the contract time. The contract sum and the contract time may be changed only by Change Order.

2.29. Claims for Additional Cost or Time: If the Contractor wishes to make a claim for an increase in the contract sum or an extension in the contract time, he shall give the Owner written notice thereof within a reasonable time after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the work, except in an emergency endangering life or property in which case the Contractor shall precede in accordance with the regulations on safety. No such claim shall be valid unless so made. Any change in the contract sum or contract time resulting from such claim shall be authorized by Change Order.

2.30. Minor Changes in the Work: The Owner shall have authority to order minor changes in the work not involving an adjustment in the contract sum or an extension of the contract time and not inconsistent with the intent of the contract documents.

2.31. Field Orders: The Owner may issue written Field Orders which interpret the Contract Documents in accordance with the specifications, or which order minor changes in the work in accordance with the agreement, without change in the contract sum or time. The Contractor shall carry out such Field Orders promptly.

2.32. Uncovering & Correction of Work: The Contractor shall promptly correct all work rejected by the Owner as defective or as failing to conform to the contract documents whether observed before or after substantial completion and whether or not fabricated installed or competed. The Contractor shall bear all costs of correcting such rejected work, including the cost of the Owner's additional services thereby made necessary. If within one (1) year after the date of completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the contract documents, any of the work found to be defective or not in accordance with the contract documents, the Contractor shall correct it promptly after receipt of a written 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 discover of condition. All such defective or non-conforming work under the above paragraphs shall be removed from the site where necessary and the work shall be corrected to comply with the contract documents without cost to the Owner. The Contractor shall bear the cost of making good all work of separate Contractors destroyed or damaged by such removal or correction. If the Owner prefers to accept defective or non-conforming work, he may do so instead of requiring its removal and correction, in which case a Change Order will be issued to reflect an appropriate reduction in the payment or contract sum, or, if the amount is determined after final payment, it shall be paid by the Contractor.

2.30. Amendment: No oral statement of any person shall modify or otherwise change, or affect the terms, conditions or specifications stated in the resulting contract. All amendments to the contract shall be made in writing by the Owner.

2.31. Assignment: The Contractor shall not sell, assign, transfer or convey any contract resulting from this IFB, in whole or in part, without the prior written approval from the Owner.

2.32. Compliance with Laws: Bids must comply with all Federal, State, County and local laws governing or covering this type of service and the fulfillment of all ADA (Americans with Disabilities Act) requirements.

2.33. Confidentiality: All information disclosed by the Owner to the Contractor for the purpose of the work to be done or information that comes to the attention of the Contractor during the course of performing such work is to be kept strictly confidential.

2.34. Conflict of Interest: No public official and/or City/County employee shall have interest in any contract resulting from this IFB.

2.35. Contract Termination: This contract shall remain in effect until any of the following occurs: (1) contract expires; (2) completion of services; (3) acceptance of services or, (4) for convenience terminated by either party with a written *Notice of Cancellation* stating therein the reasons for such cancellation and the effective date of cancellation.

2.36. Employment Discrimination: During the performance of any services per agreement with the Owner, the Contractor, by submitting a Bid, agrees to the following conditions:

2.36.1. The Contractor shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, age, handicap, or national origin except when such condition is a legitimate occupational qualification reasonably necessary for the normal operations of the Contractor. The Contractor agrees to post in conspicuous places, visible to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

2.36.2. The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, shall state that such Contractor is an Equal Opportunity Employer.

2.36.3. Notices, advertisements, and solicitations placed in accordance with federal law, rule, or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

2.37. Immigration Reform and Control Act of 1986 and Immigration Compliance: The Offeror certifies that it does not and will not during the performance of the contract employ illegal alien workers or otherwise violate the provisions of the Federal Immigration Reform and Control Act of 1986 and/or the immigration compliance requirements of State of Colorado C.R.S. § 8-17.5-101, *et.seq.* (House Bill 06-1343).

2.38. Ethics: The Contractor shall not accept or offer gifts or anything of value nor enter into any business arrangement with any employee, official, or agent of the Owner.

2.39. Failure to Deliver: In the event of failure of the Contractor to deliver services in accordance with the contract terms and conditions, the Owner, after due oral or written notice, may procure the services from other sources and hold the Contractor responsible for any costs resulting in additional purchase and administrative services. This remedy shall be in addition to any other remedies that the Owner may have.

2.40. Failure to Enforce: Failure by the Owner at any time to enforce the provisions of the contract shall not be construed as a waiver of any such provisions. Such failure to enforce shall not affect the validity of the contract or any part thereof or the right of the Owner to enforce any provision at any time in accordance with its terms.

2.41. Force Majeure: The Contractor shall not be held responsible for failure to perform the duties and responsibilities imposed by the contract due to legal strikes, fires, riots, rebellions, and acts of God beyond the control of the Contractor, unless otherwise specified in the contract.

2.42. Independent Contractor: The Contractor shall be legally considered an Independent Contractor and neither the Contractor nor its employees shall, under any circumstances, be considered servants or agents of the Owner. The Owner shall be at no time legally responsible for any negligence or other wrongdoing by the Contractor, its servants, or agents. The Owner shall not withhold from the contract payments to the Contractor any federal or state unemployment taxes, federal or state

income taxes, Social Security Tax or any other amounts for benefits to the Contractor. Further, the Owner shall not provide to the Contractor any insurance coverage or other benefits, including Workers' Compensation, normally provided by the Owner for its employees.

2.43. Nonconforming Terms and Conditions: A bid that includes terms and conditions that do not conform to the terms and conditions of this Invitation for Bid is subject to rejection as non-responsive. The Owner reserves the right to permit the Contractor to withdraw nonconforming terms and conditions from its bid prior to a determination by the Owner of non-responsiveness based on the submission of nonconforming terms and conditions.

2.44. Ownership: All plans, prints, designs, concepts, etc., shall become the property of the Owner.

2.45. Oral Statements: No oral statement of any person shall modify or otherwise affect the terms, conditions, or specifications stated in this document and/or resulting agreement. All modifications to this request and any agreement must be made in writing by the Owner.

2.46. Patents/Copyrights: The Contractor agrees to protect the Owner from any claims involving infringements of patents and/or copyrights. In no event shall the Owner be liable to the Contractor for any/all suits arising on the grounds of patent(s)/copyright(s) infringement. Patent/copyright infringement shall null and void any agreement resulting from response to this IFB.

2.47. Remedies: The Contractor and Owner agree that both parties have all rights, duties, and remedies available as stated in the Uniform Commercial Code.

2.48. Venue: Any agreement as a result of responding to this IFB shall be deemed to have been made in, and shall be construed and interpreted in accordance with, the laws of the City of Grand Junction, Mesa County, Colorado.

2.49. Expenses: Expenses incurred in preparation, submission and presentation of this IFB are the responsibility of the company and cannot be charged to the Owner.

2.50. Sovereign Immunity: The Owner specifically reserves its right to sovereign immunity pursuant to Colorado State Law as a defense to any action arising in conjunction to this agreement.

2.51. Non-Appropriation of Funds: The contractual obligation of the Owner under this contract is contingent upon the availability of appropriated funds from this fiscal year budget as approved by the City Council or Board of County Commissioners from this fiscal year only. State of Colorado Statutes prohibit obligation of public funds beyond the fiscal year for which the budget was approved. Anticipated expenditures/obligations beyond the end of the current Owner's fiscal year budget shall be subject to budget approval. Any contract will be subject to and must contain a governmental non-appropriation of funds clause.

2.52. Cooperative Purchasing: Purchases as a result of this solicitation are primarily for the City/County. Other governmental entities may be extended the opportunity to utilize the resultant contract award with the agreement of the successful provider and the participating agencies. All participating entities will be required to abide by the specifications, terms, conditions and pricings established in this Bid. The quantities furnished in this bid document are for only the City/County. It does not include quantities for any other jurisdiction. The City or County will be responsible only for the award for its jurisdiction. Other participating entities will place their own awards on their respective Purchase Orders through their purchasing office or use their purchasing card for purchase/payment as authorized or agreed upon between the provider and the individual entity. The City/County accepts no liability for payment of orders placed by other participating jurisdictions that choose to piggy-back on our solicitation. Orders placed by participating jurisdictions under the terms of this solicitation will indicate their specific delivery and invoicing instructions.

2.53. Keep Jobs in Colorado Act: Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a). If Contractor claims it is entitled to a waiver pursuant to C.R.S. §8-17-101(1), Contractor shall state that there is insufficient Colorado labor to perform the work such that compliance with Article 17 would create an undue burden that would substantially prevent a project from proceeding to completion, and shall include evidence demonstrating the insufficiency and undue burden in its response.

Unless expressly granted a waiver by the Owner pursuant to C.R.S. §8-17-101(1), Contractor shall be responsible for ensuring compliance with Article 17 of Title 8, Colorado Revised Statutes requiring 80% Colorado labor to be employed on public works. Contractor shall, upon reasonable notice provided by the Owner, permit the Owner to inspect documentation of identification and residency required by C.R.S. §8-17-101(2)(a).

2.53.1. "Public project" is defined as:

(a) any construction, alteration, repair, demolition, or improvement of any land, building, structure, facility, road, highway, bridge, or other public improvement suitable for and intended for use in the promotion of the public health, welfare, or safety and any maintenance programs for the upkeep of such projects

(b) for which appropriate or expenditure of moneys may be reasonably expected to be $500,000.00 or more in the aggregate for any fiscal year

(c) except any project that receives federal moneys.

3. Statement of Work

3.1. General: The City of Grand Junction is soliciting competitive bids from qualified and interested companies for all labor, equipment, and materials required to provide

construction services for slough excavation, concrete demo, and nesting for the Las Colonias Project. All dimensions and scope of work should be verified by Contractors prior to submission of bids.

From a uranium mill tailings clean-up site to a regional riverfront park, the Las Colonias Park project will restore and revitalize over 130 acres on the banks of the Colorado River in the heart of Grand Junction. A major component of the Park is an outdoor Amphitheater that will serve as a regional draw and a catalyst for reinvestment and revitalization in the River and Rail Districts of the Greater Downtown Area. The project enjoys widespread support from the community, with many funding partners stepping up to make this project possible, including the Department of Local Affairs, Grand Junction Lions Club, the Downtown Development Authority, and the Riverfront Foundation, as well as others. This Construction and Site Work for the Las Colonias Park Amphitheater Project is one of three bids being advertised concurrently to achieve a complete phase for the outdoor Amphitheater. It is incumbent on the bidding contractor to understand and consider the overlap of work in this bid with the other two bids.

3.2. Project Description: Amphitheater site and building, including ten bid alternates. The Amphitheater is designed as a multi-functional venue for small, medium and large events, with easy access from the Riverside Parkway and the riverfront trail and surrounded by the perfect backdrop on the banks of the Colorado River with views of the Colorado National Monument, Grand Mesa, and Bookcliffs. The Amphitheater design includes a 40' x 60' stage with ample back of house amenities, such as a green room and side wings, as well as parking and gently sloped lawn seating that could comfortably seat a crowd of 5,000 to 6,000, with enough versatility to accommodate much smaller or larger events, and all necessary utilities and infrastructure to support the entire facility.

The ideal completion date for the Amphitheater is the fall of 2017 so that a small number of event can be conducted.

3.3. Special Conditions & Provisions:

3.3.1 Recommended Pre-Bid Briefing: Due to the complexity of the project, prospective bidders are ***highly encouraged*** to attend a pre-bid briefing on **August 30, 2016 at 9:00 a.m. at Grand Junction City Hall, 250 N. 5th Street in the Auditorium. Bidders are then invited to attend a walk through on the site at 925 Struthers Avenue immediately following the pre-bid briefing.** The purpose of this visit will be to inspect and to clarify the contents of this Invitation for Bids (IFB).

3.3.2 QUESTIONS REGUARDING SOLICIATION PROCESS/SCOPE OF WORK:
Duane Hoff Jr., Senior Buyer
City of Grand Junction
duaneh@gjcity.org

3.3.2 Project Manager: The Project Manager for the Project is Scott Hockins, Project Manager, who can be reached at (970)244-1484. During Construction, all notices,

letters, submittals, and other communications directed to the City shall be addressed and mailed or delivered to:

City of Grand Junction
Purchasing Division
Attn: Scott Hockins, Project Manager
250 North Fifth Street
Grand Junction, CO 81501

3.3.3 Affirmative Action: The Contractor is not required to submit a written Affirmative Action Program for the Project.

3.3.4 Pricing: Pricing shall be all inclusive to include but not be limited to: all labor, equipment, supplies, materials, freight (F.O.B. Destination – Freight Pre-paid and Allowed to each site), travel, mobilization costs, fuel, set-up and take down costs, and full-time inspection costs, and all other costs related to the successful completion of the project.

The Owner shall not pay nor be liable for any other additional costs including but not limited to: taxes, shipping charges, insurance, interest, penalties, termination payments, attorney fees, liquidated damages, etc.

3.3.5 Freight/Shipping: All freight/shipping shall be F.O.B. Destination – Freight Pre-Paid and Allowed to the project site(s), Grand Junction, CO.

3.3.6 Contractor must meet all federal, state, and local rules, regulations, and requirements for providing such services.

3.3.7 Contract: A binding contract shall consist of: (1) the IFB and any amendments thereto, (2) the bidder's response (bid) to the IFB, (3) clarification of the bid, if any, and (4) the City's Purchasing Department's acceptance of the bid by "Notice of Award" or by "Purchase Order". All Exhibits and Attachments included In the IFB shall be incorporated into the contract by reference.

A. The contract expresses the complete agreement of the parties and, performance shall be governed solely by the specifications and requirements contained therein.

B. Any change to the contract, whether by modification and/or supplementation, must be accomplished by a formal contract amendment signed and approved by and between the duly authorized representative of the bidder and the City Purchasing Division or by a modified Purchase Order prior to the effective date of such modification. The bidder expressly and explicitly understands and agrees that no other method and/or no other document, including acts and oral communications by or from any person, shall be used or construed as an amendment or modification to the contract.

3.3.8 Time of Completion: The scheduled time of Completion for the Project is November 11, 2016.

Completion is achieved when site cleanup and all punch list items (resulting from the final inspection) have been completed. Completion shall have the meaning set forth in Article I, Section 3 (Definitions and Terms) of the General Contract Conditions.

3.3.9 Working Days and Hours: The working days and hours shall be as stated in the General Contract Conditions, Section VI or as mutually agreed upon in the preconstruction meeting.

3.3.10 Licenses and Permits: Contractor is responsible for obtaining all necessary licenses and permits required for Construction, at Contractors expense. See Section 2.12. Contractor shall supply to Owner all copies of finalized permits.

3.3.11 Permits: See Section 01410 – Regulatory Requirements. The following permits, if required for the Project, will be obtained by the City at no cost to the Contractor:

- None.

The following permits, if required for the Project, shall be obtained and paid for by the Contractor, with the costs included in the total bid price for the Project:

- Dewatering Permit
- Building Permit
- State of Colorado Stormwater Construction Permit
- 5-2-1 Stormwater Construction Permit

3.3.12 City Furnished Materials: The City will furnish the following materials for the Project:

- AutoCAD drawings for survey stake-out. (Provided by Method Studio, Inc., upon request)

3.3.13 Project Newsletters: Project newsletters, if required, will be the responsibility of the City.

3.3.14 Project Sign: Project signs, if any, will be furnished and installed by the City.

3.3.15 Authorized Representatives of the City: Those authorized to represent the City shall include Purchasing Agent, Engineers, and Inspectors employed by the City, only.

3.3.16 Stockpiling Materials and Equipment: All stockpiling/storage shall be in accordance with General Contract Condition Section 51.

3.3.17 Stormwater Management Plan: All vehicle and equipment maintenance and fueling shall be performed within the projects designated staging and material stockpile area. The fueling area shall exhibit Best Management Practices in order to minimize and/or eliminate the potential of fuel spillage. Any spillage of fuel onto the ground shall be immediately cleaned up and any contaminated soil disposed of properly at the Mesa County Landfill. Documentation of spills, leaks and overflows that result in the discharge of pollutants, including logging and reporting of the spill is required to the Water Quality Control Division at their toll-free 24-hour environmental emergency spill reporting line – 1-877-518-5608.

The Contractor shall clear the site of all on-site waste daily, including scrap from construction materials.

Concrete trucks will be required to wash out in a portable concrete washout pool supplied by the Contractor or the concrete truck shall wait to washout back at the concrete batching facility. The Contractor will be responsible for maintaining the concrete washout pool. The washout pool shall be cleaned out and/or replaced when the washout pool reaches 50% of total capacity.

The Contractor shall clear the site of all trash and litter daily. Portable toilets will be maintained (cleaned and emptied) by a local supplier.

3.3.18 Clean-Up: The Contractor shall clear the construction site of all trash and on-site waste daily, including scrap from construction materials.

3.3.19 Construction Equipment Storage: Staging and material stockpile areas shall be coordinated with the City's Project Manager.

3.3.20 Existing Utilities and Structures: Utilities were **not** potholed during design of this project. The location of existing utilities and structures shown on the Plans is approximate with the information gathered during design. It is the responsibility of the Contractor to pothole/locate and protect all structures and utilities in accordance with General Contract Condition Section 37.

3.3.21 Incidental Items: Any item of work not specifically identified or paid for directly, but which is necessary for the satisfactory completion of any paid items of work, will be considered as incidental to those items, and will be included in the cost of those items.

3.3.22 Weekly Progress Meetings: The Contractor and City's Project Manager will schedule and hold regular progress meetings at least weekly and at other times as requested by the City's Project Manager. The purpose of the meetings will be to review the progress of the work, maintain coordination efforts, discuss changes in schedule, and resolve issues that may develop.

3.4. Scope of Work: See attached drawings containing scope of work and specifications.

3.5. IFB Tentative Time Schedule:

Invitation For Bids available	August 15, 2016
Recommended Pre-Bid Briefing	August 30, 2016
Inquiry deadline, no questions after this date	September 2, 2016
Addendum Posted	September 8, 2016
Submittal deadline for proposals	September 13, 2016
City Council Approval	October 5, 2016
Contract execution	October 6, 2016
Bonding & Insurance Cert due	October 12, 2016
Work begins no later than	October 17, 2016
Final Completion	September 31, 2017

3.6. Questions Regarding Scope of Services:

Duane Hoff Jr., Senior Buyer
City of Grand Junction
duaneh@gjcity.org

4. Contractor's Bid Form

Bid Date: _____

Project: IFB-4278-16-DH "Construction and Site Work for the Las Colonias Park Amphitheater"

Bidding Company: _____

Name of Authorized Agent: _____

Email _____

Telephone_____ **Address**_____

City_____**State**_____**Zip**_____

The undersigned Bidder, in compliance with the Invitation for Bids, having examined the Instruction to Bidders, General Contract Conditions, Statement of Work, Specifications, and any and all Addenda thereto, having investigated the location of, and conditions affecting the proposed work, hereby proposes to furnish all labor, materials and supplies, and to perform all work for the Project in accordance with Contract Documents, within the time set forth and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the Contract Documents, of which this Contractor's Bid Form is a part.

The undersigned Contractor does hereby declare and stipulate that this offer is made in good faith without collusion or connection to any person(s) providing an offer for the same work, and that it is made in pursuance of, and subject to, all terms and conditions of the Instructions to Bidders, the Specifications, and all other Solicitation Documents, all of which have been examined by the undersigned.

The Contractor also agrees that if awarded the Contract, to provide insurance certificates within ten (10) working days of the date of Notification of Award. Submittal of this offer will be taken by the Owner as a binding covenant that the Contractor will be prepared to complete the project in its entirety.

The Owner reserves the right to make the award on the basis of the offer deemed most favorable, to waive any formalities or technicalities and to reject any or all offers. It is further agreed that this offer may not be withdrawn for a period of sixty (60) calendar days after closing time. Submission of clarifications and revised offers automatically establish a new thirty day (30) period.

RECEIPT OF ADDENDA: the undersigned Contractor acknowledges receipt of Addenda to the Solicitation, Specifications, and other Contract Documents.

State number of Addenda received: _____.

It is the responsibility of the Bidder to ensure all Addenda have been received and acknowledged.

- Direct purchases by the City of Grand Junction are tax exempt from Colorado Sales or Use Tax. Tax exempt #98-903544.
- The undersigned certifies that no Federal, State, County or Municipal tax will be added to the above quoted prices.
- Prompt payment discount of _____percent of the net dollar amount will be offered to the Owner if the invoice is paid within _____ days after the receipt of the invoice.
- The undersigned certifies and agrees that this bid is submitted in accordance with all applicable Federal, State, County, and City laws.

By signing below, the Undersigned agree to comply with all terms and conditions contained herein.

Company: _____

Authorized Signature: _____

Title: _____

Bid Form Las Colonias Amphitheater - Grand Junction, CO
Bid Date: 09/13/2016

BUILDING						
	Section	Description	Quantity	Units	Bidder Name	Remarks
1	03 30 00	Cast-in-place Concrete	lump sum			
2	04 20 00	Unit Masonry	lump sum			
3	05 12 00	Misc. Structural Steel	lump sum			
4	05 50 00	Metal Fabrications	lump sum			
5	05 52 13	Pipe and Tube Steel Railings	lump sum			
6	07 13 26	Self-Adhering Sheet Waterproofing	lump sum			
7	07 19 00	Water Repellents	lump sum			
8	07 21 00	Insulation	lump sum			
9	07 41 13.16	Standing-Seam Metal Roof	3300	SF		
	07 54 23	TPO Roofing	2035	SF		
	07 62 00	Sheet Metal Flashing/Trim	lump sum			
10	07 42 13	Metal Wall Panels	lump sum			
11	07 71 00	Roof Specialties	lump sum			
12	07 92 00	Joint Sealants	lump sum			
13	08 11 13 08 33 23 08 71 00	Hollow Metal Frames/Doors, Overhead Coiling Doors and Hardware	lump sum			
14	09 22 16 09 29 00	Gypsum Board/Metal Wall Framing	lump sum			
15	09 30 00	Tiling	lump sum			
16	09 51 13	Acoustical Grid Ceilings	1812	SF		
17	09 65 13	Resilient Base and Accessories	lump sum			
18	09 91 23	Interior Painting	lump sum			
19	10 14 26	Signage	lump sum			
20	10 21 13	Toilet Compartments	lump sum			
21	10 28 00	Toilet, Bath and Laundry Accessories	lump sum			
22	10 44 13 10 44 16	Fire Extinguisher Cabinets and Extinguishers	lump sum			
23	11 13 00	Loading Dock Equipment	lump sum			
24	Division 22	Plumbing Piping, Specialties, Equipment, and Fixtures	lump sum			
25	Division 23	Mechanical and Natural Gas Piping, Insulation	lump sum			
26	Division 23	HVAC Instrumentation, Controls, Testing, and Balancing	lump sum			
27	Division 23	Ductwork, Air Terminal Devices, Diffusers/Registers/Grilles	lump sum			
28	Division 26	BUILDING Electrical Equipment, Conduit, Lighting, Controls, etc.	lump sum			
29	Division 26	SITE Electrical Utilities	lump sum			
30		General Conditions, Overhead, and Fees				
31		Builders Risk Insurance				
32		Final Cleaning				
33		Owner Contingency			$60,000.00	
34		Liability insurance				
35		Building Permits and Fees				Include Estimated amount
36	Other: anything else not included in categories	(a)				
		(b)				
		(c)				
		(d)				
TOTAL (sum of items 1-35 must equal Contractor's Fixed Lump Sum Base Bid)						

BUILDING ALTERNATES				
#1	Stagefront Electric ADA Lift	lump sum		
#2	On-stage Scissor Lift	lump sum		
#3	Folding Chairs and Rolling Carts	lump sum		
#4	Basic AV Equipment	lump sum		
#5	Phasing the East Wing Restroom Area	lump sum		
ADJUSTED TOTAL				

Project S.F. 4,328

SITE						
	Section	Description	Quantity	Units	Bidder Name	Remarks
37	03 30 00	Site Retaining Wall	280	LF		
38	05 52 13	Handrail	128	LF		
39	10 14 26	Sign and Attachment	4	EA		
40	DIV 26	Exterior Site Lighting	LUMP SUM			
41	32 15 40	Crushed Stone Aggregate (4" Depth)	82650	SF		
42	32 31 16	Site Fence	1603	LF		
43	32 31 16	Pedestrian Gate - Type 1 (Double)	3	EA		
44	32 31 16	Pedestrian Gate - Type 2 (Single)	2	EA		
45	32 31 16	Vehicular Gate - Type 1 (Slide)	2	EA		
46	32 31 16	Vehicular Gate - Type 2 (Double Swing)	2	EA		
47	32 31 16	Vehicular Gate - Type 3 (Swing)	1	EA		
48	32 31 19	Dumpster Enclosure	47	LF		
49	32 31 19	Dumpster Enclosure Gate	1	EA		
50	32 84 00	Irrigation	LUMP SUM			
51	32 92 00	Planting - Native Meadow Mix	64670	SF		
52	32 93 00	Metal Edger	918	LF		
53	33 46 00	Soundboard Trench Grate	53	LF		
54	32 92 00	Planting - Lawn (Seed)	62865	SF		
55		Owner Contingency			$40,000.00	
TOTAL (sum of items 37-55 must equal Contractor's Fixed Lump Sum Base Bid)						

SITE ALTERNATES						
#6	12 93 00	Benches (by others)	5	EA		
#7	12 93 00	Trash/Recycling Bins	12	EA		
#8	32 92 00	Planting - Lawn (Sod)	62,865	SF		
#9	32 93 00	Trees	80	EA		
ADJUSTED TOTAL						

Bid Schedule: Las Colonias Amphitheater Site Civil Work

Contractor: _____

Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
1	108.2	1" Water Pipe (Sch 40 PVC)	300.	LF	$ _____	$ _____
2	108.2	4" Water Pipe (C-900 PVC)	46.	LF	$ _____	$ _____
3	108.2	6" Water Pipe (C-900 PVC)	117.	LF	$ _____	$ _____
4	108.2	8" Water Pipe (C-900 PVC)	1,573.	LF	$ _____	$ _____
5	108.2	4" Gravity Sewer Pipe (SDR 35 PVC)	20.	LF	$ _____	$ _____
6	108.2	8" Gravity Sewer Pipe (SDR 35 PVC)	869.	LF	$ _____	$ _____
7	108.2	4" Storm Drain Pipe (SDR 35 PVC)	95.	LF	$ _____	$ _____
8	108.2	12" Storm Drain Pipe (SDR 35 PVC)	286.	LF	$ _____	$ _____
9	108.2	12" Storm Drain Pipe (SDR 26 PVC)	363.	LF	$ _____	$ _____
10	108.2	15" Storm Drain Pipe (SDR 35 PVC)	406.	LF	$ _____	$ _____
11	108.2	15" Culvert End Section (Storm Drain) (Galvanized Metal)	1.	EA	$ _____	$ _____
12	108.3	8" Gate Valve	1.	EA	$ _____	$ _____
13	108.3	6" Gate Valve	1.	EA	$ _____	$ _____
14	108.3	4" Gate Valve	1.	EA	$ _____	$ _____
15	108.3	24"x8" Tapping Sleeve and Valve	1.	EA	$ _____	$ _____
16	108.3	12"x4" Tee or Sewer Tap (Storm Drain)	2.	EA	$ _____	$ _____
17	108.3	8"x6" Tee	5.	EA	$ _____	$ _____
18	108.3	8"x4" Tee	1.	EA	$ _____	$ _____
19	108.3	1"x1" Tee	6.	EA	$ _____	$ _____
20	108.3	8" 45° Elbow	6.	EA	$ _____	$ _____
21	108.3	1" 90° Elbow	2.	EA		
22	108.3	6" End Cap/Plug	1.	EA	$ _____	$ _____
23	108.3	8" End Cap/Plug	1.	EA	$ _____	$ _____
24	108.3	Fire Hydrant Assembly	4.	EA	$ _____	$ _____
25	108.3	3/4" Yard Hydrant	8.	EA	$ _____	$ _____
26	108.3	4"x8" Sewer Service Tap	2.	EA	$ _____	$ _____
27	108.3	4" Cleanout (Roof Drains)	2.	EA	$ _____	$ _____
28	108.4	1 1/2" Water Service Line (Copper Type K)	45.	LF	$ _____	$ _____
29	108.4	2" Water Service Line (Copper Type K)	60.	LF	$ _____	$ _____
30	108.4	1 1/2" Water Service Assembly	1.	EA	$ _____	$ _____
31	108.4	2" Water Service Assembly	1.	EA	$ _____	$ _____
32	108.4	1" Curb Stop (Concession Water Supply)	2.	EA	$ _____	$ _____
33	108.5	Sanitary Sewer Basic Manhole (48" I.D.)	3.	EA	$ _____	$ _____
34	108.5	Manhole Barrel Section (D>5) (60" I.D.)	9.	VLF	$ _____	$ _____
35	108.5	Sanitary Sewer Basic Manhole (60" I.D.)(Cast In Place Base) Refer to detail in Standard Contract Documents, Sheet SS-02.	1.	EA	$ _____	$ _____
36	108.5	Manhole Barrel Section (D>5) (48" I.D.)	5.	VLF	$ _____	$ _____
37	108.6	Small Area Inlet with Concrete Collar	3.	EA		
38	108.6	Inlet Box Riser Section (<5')	6.	VLF	$ _____	$ _____
39	108.7	Aggregate Base Course - Granular Stabilization Material, Type B. (Unsuitable Trench)	516.	TON	$ _____	$ _____

Bid Schedule: Las Colonias Amphitheater Site Civil Work

Contractor: _____

Item No.	CDOT, City Ref.	Description	Quantity	Units	Unit Price	Total Price
40	202	Removal of Structures and Obstructions - Removal of C, G and SW (Struthers Access)	Lump	SUM	---	$ _____
41	207	Topsoil (18" Imported Clean Fill Topsoil)	5,890.	CY	$ _____	$ _____
42	208	Erosion Control (Complete in Place)	Lump	SUM	---	$ _____
43	210	Reset Structures - Reset Manhole Ring and Cover	2.	EA	$ _____	$ _____
44	304	Aggregate Base Course (14" thick Asphalt Millings)(City Supplied)	5,366.	SY	$ _____	$ _____
45	304	Aggregate Base Course (13" thick Asphalt Millings)(City Supplied)	1,946.	SY	$ _____	$ _____
46	304	Aggregate Base Course (12" thick Asphalt Millings)(City Supplied)	4,675.	SY	$ _____	$ _____
47	304	Aggregate Base Course (Class 6)(6" Thick)	7,092.	SY	$ _____	$ _____
48	304	Aggregate Base Course -Chipseal Surface	4,675.	SY	$ _____	$ _____
49	304	Subgrade Stabilization (Native Material Generated from Slough Excavation)(Complete in Place) See Detail on Plan Sheet C19.	2,500.	CY	$ _____	$ _____
50	306	Reconditioning (12" Deep)	12,055.	SY	$ _____	$ _____
51	401	Hot Mix Asphalt (4" Thick)(Grading SX, Binder Grade PG 64-22)	5,366.	SY	$ _____	$ _____
52	401	Hot Mix Asphalt (3" Thick)(Grading SX, Binder Grade PG 64-22)	1,946.	SY	$ _____	$ _____
53	608	Concrete Curb and Gutter (24" Wide)	619.	LF	$ _____	$ _____
54	608	Concrete Curb with Spill Gutter (24" wide)	586.	LF	$ _____	$ _____
55	608	Sidewalk Drain trough	5.	LF	$ _____	$ _____
56	608	Concrete Sidewalk (5" thick)	4,300.	SY	$ _____	$ _____
57	608	Concrete Paving (6" thick)	2,076.	SY	$ _____	$ _____
58	608	Concrete Stairs	72.	SY	$ _____	$ _____
59	608	Concrete Driveway Section (8" thick)	79.	SY	$ _____	$ _____
60	608	Concrete Curb Ramp	39.	SY	$ _____	$ _____
61	608	Concrete Intersection Corner	5.	SY	$ _____	$ _____
62	608	Detectable Warning (Cast Iron)(wet set)	110.	SF	$ _____	$ _____
63	625	Construction Surveying	Lump	SUM	---	$ _____
64	626	Mobilization	Lump	SUM	---	$ _____
65	BID ALTERNATE No. 10	Concrete Paving (6" Thick) In Place of HMA at South Concession Area.	834.	SY	$ _____	$ _____
MCR		Minor Contract Revisions	---	---	---	$ 50,000.00

Bid Amount: $ _____

Bid Amount:

_____ **dollars**

Bid Alternate No. 10 Bid Amount:

_____ **dollars**

Specification Manual for:

Las Colonias Park Amphitheater

City of Grand Junction

Grand Junction, Colorado

100% Construction Documents
July 15, 2016

Method Studio Project #: 14.050

Prepared by:

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work under separate contracts.
5. Access to site.
6. Coordination with occupants.
7. Work restrictions.
8. Specification and drawing conventions.
9. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: City of Grand Junction - New Las Colonias Park Amphitheater Building.

1. Project Location: Las Colonias Park, Grand Junction, CO.

B. Owner: City of Grand Junction.

1. Owner's Representative: Traci Wieland / Ted Ciavonne.

C. Architect: Method Studio Inc., 925 S. West Temple, Salt Lake City, UT 84101

D. Contractor: TBD

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project consists of the following:

1. New outdoor amphitheater building with an outdoor covered stage, enclosed side stage areas, loading dock, public restrooms, start and stage crew restrooms, small office, storage/mechanical/electrical rooms, and understage chair storage. The construction consists of: reinforced concrete footings and foundation walls, concrete floor slabs on grade and on deck, CMU walls, steel beam and metal deck roof structure, TPO membrane and standing seam roofing. Full mechanical system for back of house areas and electrical systems for house power and performance power. Hollow metal and overhead door systems both interior and exterior, interior gypsum board on steel stud walls, acoustic grid ceilings, architectural finishes of paint, resilient tile flooring, ceramic tile and minimal millwork.

B. Type of Contract:: Project will be constructed under a single prime contract.

1.4 WORK UNDER OTHER CONTRACTS

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

B. The Owner reserves the right to issue other contracts at appropriate times for items not specified as part of this work. The contratcor is required to cooperate with the Owner and any other contractors assigned to portions of the work separately. Additional, the Owner's own forces may perform certain portions of the work.

1. Other Contractors or Owner forces performing work on the project are not to be construed as employees or subcontractors, nor is th Contractor responsible for acts or omissions of those forces.

1.5 USE OF PREMISES

A. General: During the Construction Period the Contractor shall have full use of premises for construction operations, as indicated by the Contract Limit Line. The definition of the Contract Limit line, and the area to be used for project staging, temporary facilities, storage of a reasonable amount of materials is shown on the drawings.

B. Contractor assumes all liability within the limits of the Contract area.

C. Contractor shall install a 10'-0" high chain link fence and gates to fully secure and enclose the area within the Contract Limit Line to protect non-construction personnel (See specification Section 015000). All fencing materials are to be provided, installed and maintained by the General Contractor. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine constructions operations to contract limit line.
2. Owner Occupancy: Allow for Owner occupancy of Project site.

3. Driveways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances.

1.6 PERMITS AND FEES

A. The City of Grand Junction is the primary jurisdictional authority for this project with Mesa County as a secondary authority for certain scopes of work. The Owner is responsible for payment of all Plan Review and Building Permit fees.

B. Other fees required by municipal agencies or utility companies for connections or modification to utility serviced, etc., are the responsibility of the Contractor.

C. The Contractor is responsible to arrange and pick up permits for which the Owner makes payment. The Contractor is to make a copy of all permits and give a copy to the Owner's representative.

1.7 OWNER'S OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy: Owner does occupy the adjacent site during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

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

B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.

1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.

3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed during normal business working hours of 7:00 a.m. to 10:00 p.m., Monday through Friday, except otherwise indicated.

1. Weekend Hours: Saturday and Sunday, 7:00 a.m. to 10:00 p.m.

B. Existing Utility Interruptions: Whenever the work of this contract requires the temporary shutdown of any existing utilities, file a request for shutdown with the Owner at least three (3) working days in advance and obtain written permission from the Owner before shutting off any existing utilities. Minimize the interruption of existing mechanical, communications and electrical services which may affect other portions of the Owner's operations.

1. Shutdowns involving other existing facilities shall be limited to weekends and holidays.
2. Contractor is liable for correction of any deficiencies or problems, including health, safety or financial impacts when digging without prior authorization.

C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than seven days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

D. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Format: The specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.

1. Section identification: The specifications us Section numbers and titles to help cross-referencing in the Contract Documents. sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications

B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperitive mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

END OF SECTION 011000

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF BID ALTERNATES

A. **Bid Alternate #1**: STAGEFRONT ELECTRIC ADA LIFT

1. Refer to Architectural plan sheet AE101 for location and Basis-of-Design product. Alternate equal product may be submitted upon approval of Archtiect/Owner.

B. **Bid Alternate #2**: ON-STAGE SCISSOR LIFT

1. Refer to Architectural plan sheet AE101 for parked location of this equipment at the stage left area. Basis-of-Design product shall be Genie GS-2032, electric operation slab scissor lift or equal.

C. **Bid Alternate #3**: FOLDING CHAIRS AND ROLLING CARTS

1. Refer to Architectural plan sheet AE101 note at top center of page for specifics on Basis-of-Design for chair and rolling cart products. Alternate equal product may be submitted upon approval of Architect/Owner. See plans D1 and D4 for chair storage locations, utilizing rolling carts.

D. **Bid Alternate #4**: BASIC AV EQUIPMENT

1. A basic speaker system and microphones are desired by the City of Grand Junction for this venue. The Basis-of-Design for the speaker portion of this system is the "Bose F1 Model 812 Flexible Array with F1 Subwoofer" portable loudspeaker. A microphone specification will be provided for bidding ASAP. Alternate equal product may be submitted upon approval of Architect/Owner.

E. **Bid Alternate #5**: PHASING THE EAST WING RESTROOM AREA

1. As a cost saving measure the City of Grand Junction would like to provide an alternate cost savings for only shelling the east wing of the building. This would be from grid D to the east and would be comprised of Concessions A128, Men’s Restroom A118, Women’s Restroom A116, Unisex A120, Mop A122 and Storage A124. This would only receive the exterior CMU shell walls with their doors and concessions window and a floor slab with stubbed up plumbing penetrations. The concrete stairs and railings would also be included. No walls, fixtures, above ground fixture piping, lighting, ceilings, counters or floor materials would be included.

F. **Bid Alternate #6**: SITE BENCHES

1. Refer to the Site Materials Series L3-00 for site bench locations. The Basis-of-Design is per the City of Grand Junction. The base bid excludes site benches. This bid alternate is to procure and install site benches.

G. **Bid Alternate #7**: SITE TRASH/RECYCLING

1. Refer to the Site Materials Series L3-00 for site trash/recycling locations and L7-06 for Basis-of-Design. The base bid excludes site trash/recycling receptacles. This bid alternate is to procure and install site trash/recycling receptacles.

H. **Bid Alternate #8**: TURF

1. Refer to the Site Planting Series L8-00 and Site Planting Details L9-00 for turf locations. The base bid is for seeded turf. This bid alternate is to use sod in all defined turf areas.

I. **Bid Alternate #9**: TREES

1. Refer to the Site Planting Series L8-00 for tree locations. The base bid excludes the procurement and installation of trees. This bid alternate is for the contractor to procure and install all trees for the project.

J. **Bid Alternate #10**: ASPHALT SURFACING

1. Refer to Site Civil Series. The base bid is for the Struthers entrance road and south side concession surface to use asphalt millings. This bid alternate is to use asphalt.

END OF SECTION 012300

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may required adjustment to the Contract Sum or the Contract time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit cost, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Change Order Job Instruction: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicated applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly atributable to the change.
5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system specified.

C. Proposal Request Form: Use forms provided by Owner.

1.5 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Change Order Job Instruction, the Owner will issue a Change Order for signatures of Owner and Contractor, as provided in the Conditions of the Contract.

B. Change Order Form: The Change Order form is used to authorize a change that will increase or decrease the contract amount. The owner is responsible to write change orders. It is mandatory that this form is used and that all blanks be filled in accurately. Each Change Order form must be numbered consecutively, beginning with number one on each project. After necessary approvals and signatures are obtained, all copies of the Change Order form should be returned to the owner, who will then make the necessary distribution, including to the contractor, authorizing him to proceed with the change.

1.6 JOB INSTRUCTION FORM

A. Job Instruction Form: Job Instruction Form is used to transmit information and request prices. Under special circumstances, it can also be used to authorize construction changes, if followed by an approved change order form. The architect is responsible to write the job instructions. The job instruction form is mandatory for the purpose listed above. All forms should be numbered consecutively, beginning with number one on each project. When properly filled out and signed by the owner's representative, the Job Instruction Form will be give to the contractor, who will sign all copies and return the original. The Owner as indicated on the form will distribute the remaining copies.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Coordination drawings.
2. Requests for Information (RFIs).
3. Project Web site.
4. Project meetings.

B. Related Requirements:

1. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.

1.4 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

1.5 INFORMATIONAL SUBMITTALS

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

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

1.6 GENERAL COORDINATION PROCEDURES

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

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

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

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

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

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

8. Startup and adjustment of systems.

1.7 COORDINATION DRAWINGS

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

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

    a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.8 REQUESTS FOR INFORMATION (RFIs)

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

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

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

1. Project name.
2. Date.
3. Name of Contractor.
4. Name of Architect.
5. RFI number, numbered sequentially.
6. RFI subject.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies and attachments.

C. Hard-copy RFIs:

1. Identify each page of attachments with the RFI number and sequential page number.

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

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

E. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:

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

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

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Software log with not less than the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

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

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.9 PROJECT MEETINGS

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

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

B. Preconstruction Conference: Construction Manager will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, , Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Tentative construction schedule.
    b. Phasing.
    c. Critical work sequencing and long-lead items.
    d. Designation of key personnel and their duties.
    e. Procedures for processing field decisions and Change Orders.
    f. Procedures for RFIs.
    g. Procedures for testing and inspecting.
    h. Procedures for processing Applications for Payment.
    i. Distribution of the Contract Documents.
    j. Submittal procedures.
    k. Preparation of record documents.
    l. Use of the premises.
    m. Work restrictions.
    n. Working hours.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Procedures for moisture and mold control.
    r. Procedures for disruptions and shutdowns.
    s. Construction waste management and recycling.
    t. Parking availability.
    u. Office, work, and storage areas.
    v. Equipment deliveries and priorities.
    w. First aid.
    x. Security.
    y. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, Construction Manager , and Owner's Commissioning Authority of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related RFIs.
    d. Related Change Orders.
    e. Purchases.
    f. Deliveries.
    g. Submittals.
    h. Review of mockups.
    i. Possible conflicts.
    j. Compatibility problems.
    k. Time schedules.
    l. Weather limitations.
    m. Manufacturer's written instructions.
    n. Warranty requirements.
    o. Compatibility of materials.
    p. Acceptability of substrates.
    q. Temporary facilities and controls.
    r. Space and access limitations.
    s. Regulations of authorities having jurisdiction.
    t. Testing and inspecting requirements.
    u. Installation procedures.
    v. Coordination with other work.
    w. Required performance results.
    x. Protection of adjacent work.
    y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: See General Conditions

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final completion construction photographs.

B. Related Requirements:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
3. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For photographer.

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

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

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:

a. Name of Project.

b. Name and contact information for photographer.
c. Name of Architect.
d. Name of Contractor.
e. Date photograph was taken.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

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

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

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

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

1. Date and Time: Include date and time in file name for each image.

2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.

D. Preconstruction Photographs: Before commencement of excavation and starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

E. Periodic Construction Photographs: Take 20 photographs weekly or as appropriate to show major portions of construction, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

F. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.

1. Do not include date stamp.

H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work. e.

Extra record photographs at time of final acceptance.

e. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 013100 "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
6. Divisions 02 thru 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's and Construction Manager's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and Construction Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering,

manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and Construction Manager and additional time for handling and reviewing submittals required by those corrections.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect and Construction Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.

D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Construction Manager.
3. Include the following information for processing and recording action taken:

    a. Project name.

b. Date.
c. Name of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Submittal number or other unique identifier, including revision identifier.

    1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).

j. Number and title of appropriate Specification Section.
k. Drawing number and detail references, as appropriate.
l. Location(s) where product is to be installed, as appropriate.
m. Other necessary identification.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect or Construction Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

    a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect and Construction Manager.

5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect and Construction Manager will discard submittals received from sources other than Contractor.

    a. Transmittal Form for Paper Submittals: Use facsimile of sample form included in Project Manual.
    b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:

        1) Project name.
        2) Date.
        3) Destination (To:).
        4) Source (From:).
        5) Name and address of Architect.
        6) Name of Construction Manager.
        7) Name of Contractor.
        8) Name of firm or entity that prepared submittal.
        9) Names of subcontractor, manufacturer, and supplier.
        10) Category and type of submittal.
        11) Submittal purpose and description.
        12) Specification Section number and title.

13) Specification paragraph number or drawing designation and generic name for each of multiple items.
14) Drawing number and detail references, as appropriate.
15) Indication of full or partial submittal.
16) Transmittal number, numbered consecutively.
17) Submittal and transmittal distribution record.
18) Remarks.
19) Signature of transmitter.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect and Construction Manager.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner**,** containing the following information:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name of Construction Manager.
    e. Name of Contractor.
    f. Name of firm or entity that prepared submittal.
    g. Names of subcontractor, manufacturer, and supplier.
    h. Category and type of submittal.
    i. Submittal purpose and description.
    j. Specification Section number and title.
    k. Specification paragraph number or drawing designation and generic name for each of multiple items.
    l. Drawing number and detail references, as appropriate.
    m. Location(s) where product is to be installed, as appropriate.
    n. Related physical samples submitted directly.
    o. Indication of full or partial submittal.
    p. Transmittal number, numbered consecutively.
    q. Submittal and transmittal distribution record.
    r. Other necessary identification.
    s. Remarks.

5. Metadata: Include the following information as keywords in the electronic submittal file metadata:

    a. Project name.
    b. Number and title of appropriate Specification Section.
    c. Manufacturer name.
    d. Product name.

F. Options: Identify options requiring selection by Architect.

G. Deviations: Identify deviations from the Contract Documents on submittals.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:

1. Submit electronic submittals via email as PDF electronic files.

    a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect and Construction Manager will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign

documents on behalf of that entity.

a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

a. Wiring diagrams showing factory-installed wiring.
b. Printed performance curves.
c. Operational range diagrams.
d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

a. PDF electronic file.
b. Three paper copies of Product Data unless otherwise indicated. Architect, through Construction Manager, will return two copies.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

a. Identification of products.
b. Schedules.
c. Compliance with specified standards.
d. Notation of coordination requirements.
e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Number of copies: See General Conditions

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect and Construction Manager will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Submit product schedule in the following format:

a. PDF electronic file.
b. Three paper copies of product schedule or list unless otherwise indicated. Architect will return two copies.

F. Coordination Drawings Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures.

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying

that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

U. Schedule of Tests and Inspections: Comply with requirements specified in Section 014000 "Quality Requirements."

V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

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

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect and Construction Manager.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION - See General Conditions

A. General: Architect and Construction Manager will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Architect will review each submittal and will not return it, or

will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
3. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.
2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

A. Shop Drawings: For mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of Issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.

7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

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

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

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

G. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

H. Integrated Exterior Mockups: Construct integrated exterior mockup in accordance with approved Shop Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual specification sections, along with supporting materials.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency's Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates form requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

G. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

C. Concrete/Masonry Log: (See attached) - Document the location of the placement of all concrete and grout placed on site, including ticket numbers from trucks. These logs shall be turned over to the owner on a weekly basis.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

D. Logs: Follows at the end of this section.

END OF SECTION 014000

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for limitations on work restrictions and utility interruptions.
2. Section 013300 "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Section 017300 "Execution" for progress cleaning requirements.
4. Sections 02 thru 49 for temporary heat, ventilation, and humidity requirements for products in those Sections.
5. Division 32 Section "Dewatering" for disposal of ground water at Project Site.

1.3 DEFINITIONS

A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 USE CHARGES

A. General: See General Conditions for Temporary Construction Facilities.

B. Sewer Service: See General Conditions.

C. Water Service: See General Conditions.

D. Electric Power Service: See General Conditions.

E. Gas Service: Connect as needed to Questar Gas System. Metering shall be provided by

the CONTRACTOR. The Owner will bill the Contractor periodically for amounts used by all entities for construction operations.

F. Telephone Service: See General Conditions.

G. Steam Service: If steam or hot water is to be used for temporary heating, the Contractor is responsible to furnish and install meters. Owner will bill the Contractor periodically for amounts used by all entities for construction operations. See also General Conditions, Temporary Heating, Cooling and Ventilation.

H. Meters: The Contractor is responsible to provide and install all meters when connecting to the Owner's Utility services. If delay is made in installing meters, Owner will calculate use, with additional service charges, and bill the Contractor accordingly.

I. CHANGEOVER: At earliest feasible date, use permanent utility service installed for project, and disconnect and remove temporary service lines.

1.5 INFORMATIONAL SUBMITTALS

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

1.6 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.7 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pavement: Comply with Division 32 Section "Asphalt Paving."

B. Chain-Link Fencing: Minimum 2-inch, 11 gauge thick, galvanized-steel, chain-link fabric fencing with barbs on top; minimum 10 feethigh with galvanized-steel pipe

posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8" OD top rails. (Portable fencing is not allowed unless otherwise noted in drawings)

C. Lumber and Plywood: Comply with requirements in Division 06 Section "Rough Carpentry."

D. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 36.

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

F. Paint: Comply with requirements in Division 09 painting Sections.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 20 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
3. Drinking water and private toilet.
4. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
5. Lighting fixtures capable of maintaining average illumination of 20 fcat desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures. See also General Conditions, Fire Protection.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide

vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control. See also General Conditions, Temporary Heating, Cooling and Ventilation.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV 0 8 at each return air grille in system and remove at end of construction.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with Owner for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.

C. Water Service: Use of Owner's existing water service facilities shall be cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having

jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

G. Electric Power Service: Use of Owner's electric power service shall be maintained in a condition acceptable to Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

I. Telephone Service: Use of Owner's telephone service shall be coordinated with the owner. Contractor shall be billed monthly for this service. Telephone service shall be placed in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. At each telephone, post a list of operational and emergency numbers.
2. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

J. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail, in common-use facilities.

1. Provide DSL in primary field office.

a. Internet service is provided by the Owner.
b. The Contractor shall coordinate with the Owner.
c. The Contractor will be required to pay an installation or hook up fee and a monthly service fee.
d. The Owner will bill the contractor for these fees.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

C. Parking: Provide temporary or use designated areas of Owner's existing parking (**permit is required**) areas for construction personnel. The BYU Construction office will provide the Contractor permits for parking. The Contractor is to coordinate with the Owners Representative.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.
3. See also General Conditions, Surface Water Control, Protection from Snow and Ice.

E. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.

1. Provide temporary, directional signs for construction personnel and visitors.
2. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Section 015247300 "Execution" for progress cleaning requirements.

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
2. ain "Lifts and Hoists" Paragraph below for construction of more than two stories.
3. Subparagraph below could be important for cost-plus contracts.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

B. Temporary Erosion and Sedimentation Control: Comply with requirements specified in Division 31 "Site Clearing."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: See General Conditions, Tree & Plant Protection.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.Furnish two sets of keys to Owner. The Contractor is to coordinate with the Owners Representative to match keys with BYU standard locking requirements.

H. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

L. Temporary Site Access Roadways: As required, provide temporary site access roadways sufficient to support all construction traffic. Stabilization of sub-grades to support construction traffic is the responsibility of the contractor.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.

2. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 0163512300 "Alternates" for products selected under an alternate.
2. Section 017700 "Closeout Procedures" for submitting warranties for Contract closeout.
3. Divisions 02 thru 49 for specific requirements for warranties on products and installation specified to be warranted.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis-of-design," including make or model

number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 ACTION SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified prducts. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed list: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selection and a brief explanation of reasons for this action. Architect's response, or lack of response, dose not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use form provided by Owner.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses or architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for th Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Summ.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include

Specification Section number and title and Drawing numbers and titles. Provide side by side comparison of specified product and comparable product. Comparable product requests that do not provide a side by side comparison will be rejected.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

    a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between the contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly

protected.

C. Storage:

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

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 thru 49 for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01770 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.

B. Product Selection Procedures:

1. Products: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Par 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product, 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.

9. Visual matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color,k pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

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

1. Requested substitution offers owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction

Schedule.

6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 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 (Not Used)

END OF SECTION 016000

SECTION 017030 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General Installation of Products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work

B. Related Requirements:

1. Section 0113100 "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 01770 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional engineer.

B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

1.4 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities and other construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. General: Engage a professional engineer to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Check the location, level and plumb, of every major element as the Work progresses.
5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with

control lines and levels. Level foundations and piers from two or more locations.

E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners. The Contractor is to coordinate with the Owner's representative.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Final Property Survey: Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by professional engineer, that principal metes, bounds, lines and levels of Project are accurately positioned as shown on the survey.

1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inchesin spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and fasteners: Provide anchors and fasteners as required to securely anchor each component in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

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

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

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

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary

to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

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

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

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

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Warranties.
3. Final cleaning.

B. Related Requirements:

1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 0178139 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
3. Section 017820 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Section 01879200 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 SUBSTANTIAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete at time of request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit project record documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Complete startup and testing of systems and equipment.
8. Submit test/adjust/balance records.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Advise Owner of changeover in heat and other utilities.
11. Submit changeover information related to Owner's occupancy, use, operation and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION PROCEDURES

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01290 "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before

certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit 3 copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.6 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inchpaper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance

manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Remove snow and ice to provide safe access to building.
    f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    h. Sweep concrete floors broom clean in unoccupied spaces.
    i. Vacuum carpet and similar soft surfaces, removing debris and excess nap;

clean according to manufacturer's recommendations if visible soil or stains remain.

j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.

k. Remove labels that are not permanent.

l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

    1) Do not paint over "UL" and similar lables, including mechanical and electrical nameplates.

m. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

n. Replace parts subject to unusual operating conditions.

o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

q. Clean ducts, blowers, and coils if units were operated without filters during construction.

r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

s. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project Site and dispose of lawfully.

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

1.2 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.

2. Enable inserted reviewer comments on draft submittals.
3. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two copies.

C. Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days

of receipt of Architect's and Commissioning Authority'scomments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information.

B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

C. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

F. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

    a. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.2 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.

3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

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

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

2.4 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine

maintenance and service with standard time allotment.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

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

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.

F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

B. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. At completion of training, submit one complete training manual(s) for Owner's use.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Videos: Submit two copies within seven days of end of each training module.

F. Demonstration and Training Video Recordings: Submit two copies within seven days

of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

    a. Name of Project.
    b. Name and address of videographer.
    c. Name of Architect.
    d. Name of Contractor.
    e. Date of video recording.
    f. Describe vantage point, indicating location, direction (by compass point) and elevation or story of construction.

2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.

D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.
2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
3. Review required content of instruction.
4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

1. Motorized doors, including overhead coiling doors.
2. Equipment, including loading dock equipment, waste compactors, and or food-service equipment.
3. Fire-protection systems, including fire alarm and fire-extinguishing systems.
4. Intrusion detection systems.
5. Refrigeration systems, including chillers, condensers, pumps and distribution piping.
6. HVAC systems, including air-handling equipment, air distribution systems and terminal equipment and devices.
7. HVAC instrumentation and controls.
8. Electrical service and distribution, including transformers, switchboards, panelboards, uninterruptible power supplies and motor controls.
9. Packaged engine generators, including transfer switches.
10. Lighting equipment and controls.
11. Communication systems, including intercommunication, surveillance, clocks and programming, voice and data and television equipment.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.

d. Regulatory requirements.
e. Equipment function.
f. Operating characteristics.
g. Limiting conditions.
h. Performance curves.

2. Documentation: Review the following items in detail:

a. Emergency manuals.
b. Operations manuals.
c. Maintenance manuals.
d. Project record documents.
e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

a. Instructions on meaning of warnings, trouble indications, and error messages.
b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

    a. Diagnostic instructions.
    b. Test and inspection procedures.

7. Maintenance: Include the following:

    a. Inspection procedures.
    b. Types of cleaning agents to be used and methods of cleaning.
    c. List of cleaning agents and methods of cleaning detrimental to product.
    d. Procedures for routine cleaning
    e. Procedures for preventive maintenance.
    f. Procedures for routine maintenance.
    g. Instruction on use of special tools.

8. Repairs: Include the following:

    a. Diagnosis instructions.
    b. Repair instructions.
    c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
    d. Instructions for identifying parts and components.
    e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017820 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria and regulatory requirements.
2. Owner will furnish an instructor to describe Owner's operational philosophy.

3. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a written and demonstration performance-based test.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, **acceptable to authorities having jurisdiction,** qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.5 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301.
2. ACI 117.

2.2 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Limit water-soluble, chloride-ion content in hardened concrete to **0.15** percent by weight of cement.

PART 3 - EXECUTION

3.1 FORMWORK INSTALLATION

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be

applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.
2. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

H. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

I. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

J. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for **24** hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved **at least 75 percent of** its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material is not acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.3 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.4 MISCELLANEOUS CONCRETE ITEM INSTALLATION

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.5 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform,

plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

END OF SECTION 033000

SECTION 042000 - UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. CMU unit masonry.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed

masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.
2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches down face next to unconstructed wythe, and hold cover in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.1 COLORS

A. See keynoting on elevation drawings for which areas receive honed CMU integral color #1 and #2.

1. Color #1 (keynote 04.01): Based on “Moondust” color by Oldcastle Precast Masonry Products with sealer for richer color. Or approved color by Architect/Owner from alternate manufacturer.

2. Color #2 (keynote 04.02): Based on “Zuni” color by Oldcastle Precast Masonry Products with sealer for richer color. Or approved color by Architect/Owner from alternate manufacturer.

B. Some CMU walls shall receive paint and can be standard gray in finish. See elevations for keynoting of these areas.

2.2 MANUFACTURERS

A. Source Limitations 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 single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.3 PERFORMANCE REQUIREMENTS

A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.

1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.4 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work and will be within 20 feet vertically and horizontally of a walking surface.

C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.

1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.
4. Verify that substrates are free of substances that impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch**.**
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.

1. Install compressible filler in joint between top of partition and underside of structure above.
2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 32 inches o.c. unless otherwise indicated.
3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

3.5 MORTAR BEDDING AND JOINTING

A. Lay as follows:

1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.

B. Lay solid masonry units and hollow brick with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.

1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
2. Allow cleaned surfaces to dry before setting.
3. Wet joint surfaces thoroughly before applying mortar.
4. Rake out mortar joints for pointing with sealant.

D. Mortar Joints

1. All exterior horizontal joints to be raked ¼" deep.
2. All exterior vertical joints to be flush with block face.

3.6 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows. Verify with structural engineer if questions arise:

1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

C. Form expansion joints in brick as follows:

1. Build flanges of metal expansion strips into masonry. Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.
2. Build flanges of factory-fabricated, expansion-joint units into masonry.
3. Build in compressible joint fillers where indicated.
4. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."

D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch.

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.7 FLASHING, WEEP HOLES, AND CAVITY VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
2. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.8 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
2. Limit height of vertical grout pours to not more than 60 inches.

3.9 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at **7** days and at 28 days.

3.10 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.11 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

6. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
7. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
8. Clean stone trim to comply with stone supplier's written instructions.
9. Clean limestone units to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.12 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

SECTION 051200 - STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 DEFINITIONS

A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Seismic-Load-Resisting System: Elements of structural-steel frame designated as "SLRS" or along grid lines designated as "SLRS" on Drawings, including columns, beams, and braces and their connections.

C. Heavy Sections: Rolled and built-up sections as follows:

1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
2. Welded built-up members with plates thicker than 2 inches.
3. Column base plates thicker than 2 inches.

D. Protected Zone: Structural members or portions of structural members indicated as "Protected Zone" on Drawings. Connections of structural and nonstructural elements to protected zones are limited.

E. Demand Critical Welds: Those welds, the failure of which would result in significant degradation of the strength and stiffness of the Seismic-Load-Resisting System and which are indicated as "Demand Critical" or "Seismic Critical" on Drawings.

1.2 COORDINATION

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

1.3 QUALITY ASSURANCE

A. Comply with applicable provisions of the following specifications and documents:

1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. Channels, Angles, and other Shapes: As indicated in Structural notes.

2.2 PRIMER

A. Primer: SSPC-Paint 25, , zinc oxide, alkyd, linseed oil primer.

B. Primer: SSPC-Paint 25 BCS, , zinc oxide, alkyd, linseed oil primer.

2.3 FABRICATION

A. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

B. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
2. Weld threaded nuts to framing and other specialty items indicated to receive other work.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

1. Prepare a certified survey of existing conditions. Include bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 051200

SECTION 053100 - STEEL DECKING

PART 1 - GENERAL

1.1 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

1. Align cellular deck panels over full length of cell runs and align cells at ends of abutting panels.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 incheslong, and as follows:

1. Weld Diameter: 3/4 inch, nominal.
2. Weld Spacing: **as indicated**.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports as indicated in the general structural notes

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 2 inches, with end joints as follows:

1. End Joints: **Lapped 4 minimum**.

D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and **weld or mechanically fasten** flanges to top of deck. Space not more than 12 inchesapart with at least one **weld or fastener** at each corner.

1. Install reinforcing channels or zees in ribs to span between supports and **weld or mechanically fasten**.

E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. **Weld or mechanically fasten** to substrate to provide a complete deck installation.

1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: **Owner will engage** a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Prepare test and inspection reports.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

END OF SECTION 053100

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing wall framing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product test reports.

D. Research reports.

1.4 QUALITY ASSURANCE

A. Product Tests: Mill certificates or data from a qualified independent testing agency.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

C. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

D. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."

1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
2. Comply with AISI's "Standard for Cold-Fromed Steel Framing - Header Design."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AllSteel & Gypsum Products, Inc.
2. California Expanded Metal Products Company.
3. ClarkWestern Building Systems, Inc.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Mfg., Inc.
6. Custom Stud Inc.
7. Design Shapes in Steel.
8. Dietrich Metal Framing; a Worthington Industries company.
9. Formetal Co. Inc. (The).
10. MarinoWARE.
11. MBA Building Supplies, Inc.
12. Nuconsteel; a Nucor Company.
13. Olmar Supply, Inc.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. State Building Products, Inc.
18. Steel Construction Systems.
19. Steel Network, Inc. (The).
20. Steel Structural Systems.
21. Steeler, Inc.
22. Super Stud Building Products, Inc.
23. Telling Industries, LLC.
24. United Metal Products, Inc.
25. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

A. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H.
2. Coating: G60**,** A60**,** AZ50**,** or GF30.

B. Steel Sheet for Drift Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33.
2. Coating: G60.

2.4 NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0329 inch.
2. Flange Width: 1-5/8 inches.
3. Section Properties: Per architectural drawings.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and matching minimum base-metal thickness of steel studs.

C. Vertical Deflection Clips: Manufacturer's standard **bypass** clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AllSteel & Gypsum Products, Inc.
b. ClarkWestern Building Systems, Inc.
c. Dietrich Metal Framing; a Worthington Industries company.
d. MarinoWARE.
e. SCAFCO Corporation.
f. Steel Network, Inc. (The).
g. Steeler, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts headless bolts, with encased end threaded, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with

minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.2 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

D. Install framing members in one-piece lengths.

E. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

F. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

G. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings,

that are inaccessible on completion of framing work.

H. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

I. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.3 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.4 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

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

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Metal ladders.
4. Metal floor plate and supports.
5. Miscellaneous steel trim including sheet metal backing plates for cabinets, stair handrails and other items attached to the wall.
6. Metal bollards.
7. Downspout guards.
8. Abrasive metal nosings treads and thresholds.
9. Loose bearing and leveling plates.
10. Steel stair gate fabrication.

B. Products furnished, but not installed, under this Section:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design ladders, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Prefabricated building columns.

2. Metal nosings and treads.
3. Paint products.
4. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Samples: For each type and finish of extruded nosing and tread.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes.

B. Stainless Steel Metal Surfaces, General: Provide materials with smooth, flat surfaces without blemishes, grind all welds smooth. Provide Satin Finish.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

E. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.

1. Products:Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. IKG Industries, a division of Harsco Corporation; Mebac.
b. SlipNOT Metal Safety Flooring, a W. S. Molnar company; SlipNOT.

F. Steel Tubing: ASTM A 500, cold-formed steel tubing.

G. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise

indicated.

H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

1. Size of Channels: As indicated
2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.
3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; unfinished.

I. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M.

2.3 NONFERROUS METALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.

B. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

D. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

E. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

F. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.

1. Provide stainless-steel fasteners for fastening aluminum.
2. Provide stainless-steel fasteners for fastening stainless steel.
3. Provide stainless-steel fasteners for fastening nickel silver.
4. Provide bronze fasteners for fastening bronze.

B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

C. Post-Installed Anchors: See general structural notes sheet S001 and S002 for a list of

approved anchors.

D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting"and Section 099123 "Interior Painting."

B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

F. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 24 inches o.c.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

C. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.9 METAL LADDERS

A. General:

1. Comply with ANSI A14.3 unless otherwise indicated.

B. Steel Ladders:

1. Space siderails 18 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 1-inch- diameter steel bars.

4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip abrasive surfaces on top of each rung.
6. Galvanize exterior ladders, including brackets and fasteners.

2.10 METAL FLOOR PLATE

A. Fabricate from rolled-steel floor plate.

1. Thickness: As indicated.

B. Provide steel angle supports as indicated.

C. Provide flush steel bar drop handles for lifting removable sections, one at each end of each section.

2.11 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with zinc-rich primer.

E. 16 ga. sheet metal strips sized as indicated in the drawings as backing for wall-mounted items.

2.12 PIPE AND DOWNSPOUT GUARDS

A. Fabricate pipe and downspout guards from 3/8-inch- thick by 12-inch- wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.

B. Galvanize pipe and downspout guards.

2.13 ABRASIVE METAL NOSINGS TREADS AND THRESHOLDS

A. Cast-Metal Units: Cast iron, with an integral-abrasive, as-cast finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. American Safety Tread Co., Inc.
    b. Balco Inc.
    c. Barry Pattern & Foundry Co., Inc.
    d. Granite State Casting Co.
    e. Safe-T-Metal Company, Inc.
    f. Wooster Products Inc.

B. Extruded Units: Aluminum, with abrasive filler in an epoxy-resin binder.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ACL Industries, Inc.
    b. American Safety Tread Co., Inc.
    c. Amstep Products.
    d. Armstrong Products, Inc.
    e. Balco Inc.
    f. Granite State Casting Co.
    g. Wooster Products Inc.

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Drill for mechanical anchors and countersink. Locate holes not more than 4 inches from ends and not more than 12 inches o.c.

E. Apply bituminous paint to concealed surfaces of cast-metal units.

F. Apply clear lacquer to concealed surfaces of extruded units.

2.14 LOOSE BEARING AND LEVELING PLATES

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

2.15 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings

and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Prime loose steel lintels located in exterior walls with zinc-rich primer.

2.16 STEEL WELD PLATES AND ANGLES

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

2.17 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.18 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 099600 "High-Performance Coatings" are indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

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

3.2 INSTALLING BEARING AND LEVELING PLATES

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

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

C. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 ADJUSTING AND CLEANING

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

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and

repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel pipe railings.

B. See Section 055100 "Metal Stairs" for steel tube railings associated with metal stairs.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
b. Infill load and other loads need not be assumed to act concurrently.

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

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of mechanically connected railings.
2. Railing brackets.
3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Steel Pipe and Tube Railings:

a. Pisor Industries, Inc.
b. Wagner, R & B, Inc.; a division of the Wagner Companies.

2.2 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.3 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

D. Perforated Metal: Cold-rolled steel sheet, ASTM A 1008/A 1008M, or hot-rolled steel sheet, ASTM A 1011/A 1011M, commercial steel Type B, 0.060 inch thick, with 1/4-inch holes 3/8 inch o.c. in staggered rows>.

2.4 MISCELLANEOUS MATERIALS

A. Fasteners: Provide the following:

1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B

633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.

2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.

B. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

C. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

D. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting"

E. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

F. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION

A. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

B. Form work true to line and level with accurate angles and surfaces.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

D. Form changes in direction by bending or by inserting prefabricated elbow fittings.

E. Bend members in jigs to produce uniform curvature without buckling or otherwise deforming exposed surfaces.

F. Close exposed ends of railing members with prefabricated end fittings.

G. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers to transfer loads through wall finishes.

2.6 STEEL AND IRON FINISHES

A. All guardrail and hand rails shall receive a powder coat finish. Color as selected by Architect.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Anchor posts in concrete by inserting into **preset metal pipe sleeves** and grouting annular space.

C. Anchor posts to metal surfaces with oval flanges.

D. Anchor railing ends at walls with round flanges anchored to wall construction.

E. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces.

F. Attach railings to wall with wall brackets, except where end flanges are used. Use

type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.

G. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.2 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION 055213

SECTION 055213 - PIPE AND TUBE RAILINGS (LANDSCAPE SERIES)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Handrail.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:

1. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each type of exposed finish required.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ ft. applied in any direction.
b. Concentrated load of 200 lbf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

2.3 STEEL AND IRON

A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.

C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

D. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.

F. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.

G. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.

H. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for exterior applications.

I. Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.

1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide inconspicuous weep holes where water may accumulate.

F. Connections: Fabricate railings with welded connections unless otherwise indicated.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form Changes in Direction as Follows:

1. By bending.

I. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of railing members with prefabricated end fittings.

2.6 STEEL AND IRON FINISHES

A. Galvanized Railings:

1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
3. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

E. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

1. Color: Bronze.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

B. Adjust railings before anchoring to ensure matching alignment and compliance with Contract Documents and approved Shop Drawings.

3.2 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 1/2 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed with anchoring material flush with adjacent surface.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

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

3.5 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Handrail: Measurement will be made to the nearest linear foot for installation of handrails. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, galvanizing, priming and painting, furnishing and installation of handrails as defined herein.

END OF SECTION 055213

SECTION 071326 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review waterproofing requirements including surface preparation, substrate condition and pretreatment, minimum curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, testing and inspection procedures, and protection and repairs.

1.2 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.

1. Do not apply waterproofing in snow, rain, fog, or mist.

B. Maintain adequate ventilation during preparation and application of waterproofing materials.

1.3 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement waterproofing material for waterproofing that does not comply with requirements or that fails to remain watertight within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Carlisle CCW MiraDRI 860 or approved equal. Install per manufacturer's recommendations.

B. Other acceptable manufacturers, as approved by Architect, include but are not limited to:

1. Henry Company

2. Sika Sarnafil
3. TAMKO
4. W.R. Meadows

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.

1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.

E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.

1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of 1/16 inch(1.6 mm) or 1/8 inch for modified bituminous deck-paving waterproofing].

F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.

1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.

G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.

1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:

a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
b. At plaza-deck-to-wall intersections, extend liquid membrane or sheet strips onto deck waterproofing and to finished height of sheet flashing.

H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests.

B. Manufacturer's Field Service: Engage a site representative qualified by waterproofing membrane manufacturer to inspect substrate conditions, surface preparation, membrane application, flashings, protection, and drainage components; and to furnish daily reports to Architect.

C. Waterproofing will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.4 PROTECTION, REPAIR, AND CLEANING

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

D. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

E. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 071326

SECTION 071900 - WATER REPELLENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes penetrating water-repellent treatments for the following vertical and horizontal surfaces:

1. CMU masonry

B. Related Sections

1. Division 04 Section "Concrete Masonry Units" to be protected while spraying waterproofing on Clay brick masonry.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Water repellents shall meet performance requirements indicated without failure due to defective manufacture, fabrication, or installation.

1. Water Repellents: Comply with performance requirements specified, as determined by preconstruction testing on manufacturer's standard substrate assemblies representing those indicated for this Project.

B. Water Absorption: Minimum 90 percent reduction of water absorption after 24 hours in comparison of treated and untreated specimens.

1. Concrete Masonry Units: ASTM C 140.

C. Water-Vapor Transmission: Comply with one or both of the following:

1. Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, according to ASTM E 96/E 96M.
2. Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, according to ASTM D 1653.

D. Water Penetration and Leakage through Masonry: Minimum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, according to ASTM E 514.

E. Durability: Maximum 5 percent loss of water-repellent properties after 2500 hours of weathering according to ASTM G 154 in comparison to water-repellent-treated specimens before weathering.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.

1. Reduction of Water Absorption: 80 percent.
2. Reduction in Chloride Content: 80 percent.

1.4 SUBMITTALS

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

1. Include manufacturer's printed statement of VOC content.
2. Include manufacturer's standard colors.
3. Include manufacturer's recommended number of coats for each type of substrate and spreading rate for each separate coat.
4. Printout of current "MPI Approved Products List" for each product category specified in Part 2 that specifies water repellents approved by MPI, with the proposed product highlighted.

B. Product Certificates: For each type of water repellent, from manufacturer.

1.5 QUALITY ASSURANCE

A. Applicator Qualifications: An employer of workers trained and approved by manufacturer.

B. MPI Standards: Comply with MPI standards indicated and provide water repellents listed in its "MPI Approved Products List."

1.6 FIELD CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:

1. Concrete surfaces and mortar have cured for not less than 28 days.
2. Building has been closed in for not less than 30 days before treating wall assemblies.
3. Ambient temperature is above 40 deg F and below 100 deg F and will remain so for 24 hours.
4. Substrate is not frozen and substrate-surface temperature is above 40 deg F and below 100 deg F.
5. Rain or snow is not predicted within 24 hours.
6. Not less than 24 hours have passed since surfaces were last wet.

7. Windy conditions do not exist that might cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in "Performance Requirements" Article within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Clear, silane and siloxane blend with 400 g/L or less of VOC's.

1. Basis of Design Products: Subject to compliance with requirements, provide and incorporate into the work one of the following: (Alternates must be approved in writing by the Architect prior to bidding. Alternates that are not approved in writing prior to the bid opening will not be accepted and the Basis of Design product must be provided.

a. Weather Seal Siloxane WB
b. Weather Seal Siloxane
c. Hydrozo Enviroseal Double 7 for Brick.
d. Huls Chem-Trete BSM 20 and Aqua-Trete.

B. High Performance Acrylic (at Stone Veneer adjacent to Loading Dock - as noted on floor plan drawing)

1. Basis of Design Product: Subject to compliance with requirements, provide the product below or approved equal by Architect.

a. Sherwin Williams, Sher-Cryl HPA, High Performance Acrylic, B66-350 Semi-gloss.

1) 1 coat: SW Loxon 40% Silane Water Repellant, A31T40 (75-125 sq. ft./gal. Saturate or "flood," allowing the material to run down 8 to 10 inches. Work from the bottom up and in sections small enough to allow the run down to remain "wet" as application continues.

C. Pre-Qualification Criteria - The products specified above are the basis of design. The products performance and composition are specifically what is required. Other products must be approved in writing by the Architect prior to bidding. Alternatives that are not

approved in writing prior to the bid opening WILL NOT BE ACCEPTED and the Basis of Design Product must be provided.

1. The following items must be submitted to the Architect in order to be considered for approval:

    a. A written, side by side comparison of the proposed product performance and composition to demonstrate that the proposed product has the equivalent performance and composition to the Basis of Design products.

2. Retain "Chloride-Ion Intrusion in Concrete" Paragraph below for reinforced concrete surfaces if required, including traffic-bearing horizontal surfaces such as parking decks. NCHRP Report 244 is out of print but is the industry standard and includes tests as reported by manufacturers. Percentage values below are examples only; revise to suit Project. ASTM C 1543, "Test Method for Determining the Penetration of Chloride Ion into Concrete by Ponding," is another test to measure the penetration of chloride ions in concrete, but it is generally not reported in manufacturers' literature; revise paragraph if this test is required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements and conditions affecting performance of the Work.

1. Verify that surfaces are clean and dry according to water-repellent manufacturer's requirements. Check moisture content in three representative locations by method recommended by manufacturer.
2. Verify that there is no efflorescence or other removable residues that would be trapped beneath the application of water repellent.
3. Verify that required repairs are complete, cured, and dry before applying water repellent.

B. Test pH level according to water-repellent manufacturer's written instructions to ensure chemical bond to silica-containing or siliceous minerals.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. New Construction and Repairs: Allow concrete and other cementitious materials to age before application of water repellent, according to repellent manufacturer's written instructions.

B. Cleaning: Before application of water repellent, clean substrate of substances that could impair penetration or performance of product according to water-repellent manufacturer's written instructions.

1. Cast-in-Place Concrete Precast Concrete and Concrete Unit Masonry: Remove oil, curing compounds, laitance, and other substances that inhibit penetration or performance of water repellents.

C. Protect adjoining work, including mortar and sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is the possibility of water repellent being deposited on surfaces. Cover live vegetation.

1. Specifically, protect the CMU directly below the brick masonry from any possibility of water repellant being deposited on surfaces.

D. Coordination with Mortar Joints: Do not apply water repellent until pointing mortar for joints adjacent to surfaces receiving water-repellent treatment has been installed and cured.

E. Coordination with Sealant Joints: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.

1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those required.

3.3 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Apply a heavy-saturation coating of water repellent to the point of saturation on surfaces indicated for treatment, using low-pressure spray equipment. Apply coating in dual passes of uniform, overlapping strokes. Remove excess material; do not allow material to puddle beyond saturation. Comply with manufacturer's written instructions for application procedure unless otherwise indicated.

1. Precast Concrete: At Contractor's option, first application of water repellent on units may be completed before installing them. Mask mortar and sealant bond surfaces to prevent water repellent from migrating onto joint surfaces.

C. Apply a second saturation coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.4 FIELD QUALITY CONTROL

A. Testing of Water-Repellent Material: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when water repellent is being applied:

1. Owner will engage the services of a qualified testing agency to sample water-repellent material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance of water-repellent material with product requirements.
3. Owner may direct Contractor to stop applying water repellents if test results show material being used does not comply with product requirements. Contractor shall remove noncomplying material from Project site, pay for testing, and correct deficiency of surfaces treated with rejected materials, as approved by Architect.

B. Coverage Test: In the presence of Architect, hose down a dry, repellent-treated surface to verify complete and uniform product application. A change in surface color will indicate incomplete application.

1. Notify Architect seven days in advance of the dates and times when surfaces will be tested.
2. Reapply water repellent until coverage test indicates complete coverage.

3.5 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Correct damage to work of other trades caused by water-repellent application, as approved by Architect.

B. Comply with manufacturer's written cleaning instructions.

END OF SECTION 071900

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Foam-plastic board insulation.
2. Glass-fiber blanket insulation.
3. Vapor retarders.

1.2 SUBMITTALS

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

B. Product test reports.

C. research/evaluation reports.

PART 2 - PRODUCTS

2.1 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DiversiFoam Products.
b. Dow Chemical Company (The).
c. Owens Corning.
d. Pactiv Building Products.
e. InsulFoam LLC., (801) 554-8292.

2. Type IV, 25 psi.
3. Type VII, 60 psi.
4. All XPS insulation with gaps greater than 1/8" to be filled with expanding spray foam insulation both for above ground and below ground applications.

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.6 VAPOR RETARDERS

A. Fire-Retardant, Reinforced-Polyethylene Vapor retarders: Two outer layers of polylethylene film laminated to an inner reinforcing layer consisting of either nonwoven grid of nylon cord or polyester scrim and weighing not less than 22 lb/1000 sq. ft and with flame-spread and smoke-developed indexes of not more than 5 and 60, respectively, per ASTM E 84.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Raven Industries Inc.; DURA-SKRIM 2FR.
b. Reef Industries, Inc.; Griffolyn T-55 FR.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up

total thickness.

3.2 INSTALLATION OF BELOW-GRADE INSULATION

A. On vertical footing and foundation wall surfaces, set insulation units on inside wall surface using manufacturer's recommended adhesive according to manufacturer's written instructions.

1. If not otherwise indicated, extend insulation a minimum of 36 inches below exterior grade line.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Foam-Plastic Board Insulation: Seal joints between units that are larger than 1/4" wide by applying spray foam insulation.

C. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

D. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."
2. Install to the R-Value or thickness as indicated on the drawings.

E. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
2. Spray Polyurethane Insulation: Apply according to manufacturer's written

instructions.

3.4 INSTALLATION OF INSULATION FOR CONCRETE SUBSTRATES

A. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation to concrete substrates with insulation adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
2. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.

3.5 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping no fewer than two studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
2. Before installing vapor retarders, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
3. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

END OF SECTION 072100

SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes standing-seam metal roof panels.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review structural loading limitations of deck during and after roofing.
6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
8. Review temporary protection requirements for metal panel systems during and after installation.
9. Review procedures for repair of metal panels damaged after installation.
10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.4 FIELD CONDITIONS

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

1.5 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

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

1.6 WARRANTY

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

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

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

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

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

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

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

C. Special Weathertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain weathertight, including leaks, within specified warranty period.

1. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BasisBasis-of-Design: MBCI - Craftsman Series, Small Batten

A. Material:

1. 2 inch high x 3/8" wide battens x 16 inch wide panels
2. 22 gauge
3. Color by Architect as selected from manufacturer's full range

B. Or alternate manufacturer as approved by Architect

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

3.3 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Extend underlayment into gutter trough. Roll laps with roller. Cover underlayment within 14 days.

1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

3.4 METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.

D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.

1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
4. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied sealant are completely engaged.
5. Watertight Installation:

    a. Apply a continuous ribbon of sealant or tape to seal joints of metal panels, using sealant or tape as recommend in writing by manufacturer as needed to make panels watertight.
    b. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
    c. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Clipless Metal Panel Installation: Fasten metal panels to supports with screw fasteners at each lapped joint at location and spacing recommended by manufacturer.

G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.

H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

I. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

J. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

K. Roof Curbs: Install flashing around bases where they meet metal roof panels.

L. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.5 ERECTION TOLERANCES

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

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

SECTION 074213 - METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Weathered steel siding.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal wall panel assemblies capable of withstanding the effects the following loads and stresses within limits and under conditions indicated, based on testing according to ASTM E 1592:

1. Wind Loads: 90 mph.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish between factory-, shop- and field-assembled work.

C. Samples: Provide three 8”x10” pre-weathered steel sheets each with (4) holes drilled in the corners along with (8) torx screws with custom color finish applied. Sample sheets to be from the same batch of material to be installed on the building.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Exterior elevations drawn to scale and coordinating penetrations and wall-mounted items.

B. Product test reports.

C. Warranties: Samples of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and experienced installing similar metal wall panel systems.

B. Preinstallation Conference: Conduct conference at Project site

1.7 WARRANTY

A. Special Warranty: Installer's standard form in which installer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

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

PART 2 - PRODUCTS

2.1 PANEL MATERIALS

A. ASTM A606 Type 4 Hot Rolled High Strength Weathering Steel Sheet.

1. Provide original MTR (Metallurgical Test Reports) of coil used to produce material.
2. Thickness: 18ga.
3. Surface: Smooth, flat.
4. Exposed and concealed Finish:

a. Naturally occurring oxidized "skin" to match architects sample.
b. Coordinate with architect procedure for on-site pre-weathering of metal panels. Refer to section 3.2 ON SITE PRE-WEATHERING OF METAL PANELS.

2.2 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Base or Sill Z shaped furring sections: 0.064-inchnominal thickness.

C. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: 0.040 inch .
2. Depth: As indicated.

2.3 MISCELLANEOUS MATERIALS

A. Panel Fasteners: Self-tapping pan head torx screws, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners pre-finished with heads matching color of metal wall panels..

2.4 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, fillers, closure strips, and similar items.
   1. Backing Plates: Provide metal backing. behind hat channels as indicated.

B. Flashing and Trim: Formed from 0.018-inchminimum thickness, zinc-coated (galvanized) steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

2.5 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements. Comply with indicated profiles and with dimensional and structural requirements.

B. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of item indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Miscellaneous Framing: Install hat channels, Z furring, and other miscellaneous wall panel support members and anchorages according to ASTM C 754.

3.2 ON SITE PRE-WEATHERING OF METAL PANELS

A. A uniform weathered appearance within each panel and across the entire metal wall panel installation is desired. Provide on-site pre-weathering of panels:

   1. Procure metal panel sheet material at least 6 months prior to installation.

2. Arrange panels on site horizontally, with exposed face facing up. Elevate panels to protect bottom surface.
3. Water each panel evenly once a day for a 6-8 week period of time. Panels are to be kept horizontal and exposed to direct sunlight for this period of time. Document the level of weathering of a sample group of panels once a week while watering
4. Weathering period may be extended or reduced based on level of weathering achieved to match architects sample and as approved by Architect.

3.3 METAL WALL PANEL INSTALLATION

A. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing as indicated in the drawings.

1. Apply panels and associated items for a neat finish. Avoid "panel creep" or application not true to line.
2. Locate and space exposed fasteners in uniform vertical and horizontal alignment.
3. Install screw fasteners in predrilled holes.

3.4 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, flashings, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

3.5 CLEANING AND PROTECTION

A. On completion of metal wall panel installation, clean finished surfaces. Maintain in a clean condition during construction.

END OF SECTION 074213

SECTION 075423 - THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Adhered TPO membrane roofing system.
2. Mechanically fastened TPO membrane roofing system.
3. Vapor Retarder.
4. Roof Insulation.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 06 Section "Sheathing" for wood-based, structural-use roof deck panels.
3. Division 07 Section "Sheet Metal Flashing and Trim" for metal roof penetration flashings, flashings, and counterflashings.

1.3 DEFINITIONS

A. TPO: Thermoplastic polyolefin.

1.4 Roofing Terminology: See ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General Performance: Installed membrane roofing and base flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Provide roofing materials that are compatible with one

another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Provide membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE/SEI 7.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: SH

E. Solar Reflectance Index: Not less than 78 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.

F. Energy Performance: Provide roofing system that is listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low -slope roof products.

1.6 ACTION SUBMITTALS

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

B. Shop Drawings: For roofing system. Include plans, elevations, sections, details, and attachments to other work.

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Roof plan showing orientation of steel roof deck and orientation of membrane roofing and fastening spacings and patterns for mechanically fastened membrane roofing.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.

C. Samples for Verification: For the following products:

1. Sheet roofing, of color specified, including T-shaped side and end lap seam.
2. Roof insulation.
3. Metal termination bars.
4. Battens.
5. Six insulation fasteners of each type, length, and finish.
6. Six roof cover fasteners of each type, length, and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and manufacturer.

B. Manufacturer Certificates: Signed by roofing manufacturer certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for components of membrane roofing system.

D. Field quality-control reports.

E. Warranties: Sample of special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Manufacturer Qualifications: A qualified manufacturer that is UL listed for membrane roofing system identical to that used for this Project.

C. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by membrane roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

D. Source Limitations: Obtain components including roof insulation and fasteners for membrane roofing system from same manufacturer as membrane roofing.

E. Exterior Fire-Test Exposure: ASTM E 108, Class A; for application and roof slopes indicated, as determined by testing identical membrane roofing materials by a qualified testing agency. Materials shall be identified with appropriate markings of applicable testing agency.

F. Fire-Resistance Ratings: Where indicated, provide fire-resistance-rated roof assemblies identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

G. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review deck substrate requirements for conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that 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.

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

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

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer.

Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.10 PROJECT CONDITIONS

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

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard or customized form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes membrane roofing, base flashings, roof insulation, fasteners, cover boards, and other components of membrane roofing system.
2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, roof pavers, and walkway products, for the following warranty period:

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

PART 2 - PRODUCTS

2.1 TPO MEMBRANE ROOFING

A. Fabric-Reinforced Thermoplastic Polyolefin Sheet: ASTM D 6878, internally fabric or scrim reinforced, uniform, flexible fabric backed TPO sheet.

1. Manufacturers: Subject to compliance with requirements, available

manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Carlisle SynTec Incorporated.
b. Custom Seal Roofing.
c. Firestone Building Products Company.
d. GAF Materials Corporation.
e. GenFlex Roofing Systems.
f. Johns Manville.
g. Mule-Hide Products Co., Inc.
h. Stevens Roofing Systems; Division of JPS Elastomerics.
i. Versico Incorporated.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: White.

2.2 AUXILIARY MEMBRANE ROOFING MATERIALS

A. General: Auxiliary membrane roofing materials recommended by roofing system manufacturer for intended use, and compatible with membrane roofing.

1. Liquid-type auxiliary materials shall comply with VOC limits of authorities having jurisdiction.
2. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Single-Ply Roof Membrane Adhesives: 250 g/L.
f. Other Adhesives: 250 g/L.
g. Single-Ply Roof Membrane Sealants: 450 g/L.
h. Nonmembrane Roof Sealants: 300 g/L.
i. Sealant Primers for Nonporous Substrates: 250 g/L.
j. Sealant Primers for Porous Substrates: 775 g/L.

3. Adhesives and sealants that are not on the exterior side of weather barrier shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Sheet Flashing: Manufacturer's standard unreinforced thermoplastic polyolefin sheet flashing, 55 mils thick, minimum, of same color as sheet membrane.

C. Bonding Adhesive: Manufacturer's standard, water based.

D. Slip Sheet: Manufacturer's standard, of thickness required for application.

E. Metal Termination Bars: Manufacturer's standard, predrilled stainless-steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

F. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

G. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer.

H. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.3 SUBSTRATE BOARDS

A. Substrate Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, Type X, 5/8 inch thick.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.4 ROOF INSULATION

B. General: Preformed roof insulation boards manufactured[or approved] by TPO membrane roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

C. Tapered Insulation: Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches unless otherwise indicated.

D. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.5 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.

C. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphalt, asbestos-free, cold-applied adhesive formulated to attach roof insulation to substrate or to another insulation layer.

D. Bead-Applied Insulation Adhesive: Insulation manufacturer's recommended bead-applied, low- rise, one- or multicomponent urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

E. Full-Spread Applied Insulation Adhesive: Insulation manufacturer's recommended spray- applied, low-rise, two-component urethane adhesive formulated to attach roof insulation to substrate or to another insulation layer.

F. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric, water permeable and resistant to UV degradation, type and weight as recommended by roofing system manufacturer for application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Division 05 Section "Steel Decking."
4. Verify that minimum concrete drying period recommended by roofing system manufacturer has passed.
5. Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
6. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have been removed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

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

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Install acoustical roof deck rib insulation strips, specified in Division 05 Section "Steel Decking," according to acoustical roof deck manufacturer's written instructions, immediately before installation of overlying construction and to remain dry.

3.3 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated.

D. Install insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2.7 inches or greater, install two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

1. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Adhered Insulation: Install each layer of insulation and adhere to substrate as follows:

1. Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. and allow primer to dry.
2. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.

3. Set each layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
4. Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

H. Mechanically Fastened Insulation: Install each layer of insulation and secure to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten insulation to resist uplift pressure at corners, perimeter, and field of roof.

I. Mechanically Fastened and Adhered Insulation: Install each layer of insulation and secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type.

1. Fasten first layer of insulation according to requirements in FM Approvals' "RoofNav" for specified Windstorm Resistance Classification.
2. Fasten first layer of insulation to resist uplift pressure at corners, perimeter, and field of roof.
3. Set each subsequent layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature.
4. Set each subsequent layer of insulation in ribbons of bead-applied insulation adhesive, firmly pressing and maintaining insulation in place.
5. Set each subsequent layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

J. Install slip sheet over insulation and immediately beneath membrane roofing.

3.4 ADHERED MEMBRANE ROOFING INSTALLATION

A. Adhere membrane roofing over area to receive roofing and install according to membrane roofing system manufacturer's written instructions.

B. Start installation of membrane roofing in presence of membrane roofing system manufacturer's technical personnel.

C. Accurately align membrane roofing and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Bonding Adhesive: Apply to substrate and underside of membrane roofing at rate required by manufacturer and allow to partially dry before installing membrane roofing. Do not apply to splice area of membrane roofing.

E. In addition to adhering, mechanically fasten membrane roofing securely at terminations, penetrations, and perimeter of roofing.

F. Apply membrane roofing with side laps shingled with slope of roof deck where possible.

G. Seams: Clean seam areas, overlap membrane roofing, and hot-air weld side and end laps of membrane roofing and sheet flashings according to manufacturer's written instructions to ensure a watertight seam installation.

1. Test lap edges with probe to verify seam weld continuity. Apply lap sealant to seal cut edges of sheet membrane.
2. Verify field strength of seams a minimum of twice daily and repair seam sample areas.
3. Repair tears, voids, and lapped seams in roofing that does not comply with requirements.

H. Spread sealant bed over deck drain flange at roof drains and securely seal membrane roofing in place with clamping ring.

I. Install membrane roofing and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition and to not void warranty for existing membrane roofing system.

3.5 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.

E. Terminate and seal top of sheet flashings].

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion.

C. Repair or remove and replace components of membrane roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 ROOFING INSTALLER'S WARRANTY (To be completed by Contractor)

A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:

1. Owner: <Insert name of Owner>.
2. Address: <Insert address>.
3. Building Name/Type: <Insert information>.
4. Address: <Insert address>.
5. Area of Work: <Insert information>.
6. Acceptance Date: <Insert date>.
7. Warranty Period: <Insert time>.
8. Expiration Date: <Insert date>.

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

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

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

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:

a. Lightning;
b. Peak gust wind speed exceeding <Insert wind speed> mph;
c. Fire;
d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
f. Vapor condensation on bottom of roofing; and
g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.

2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost

and expense thereof have been paid by Owner or by another responsible party so designated.

3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this <Insert day> day of <Insert month>, <Insert year>.

1. Authorized Signature: <Insert signature>.
2. Name: <Insert name>.
3. Title: <Insert title>.

END OF SECTION 075423

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manufactured Products:

a. Manufactured through-wall flashing and counterflashing.
b. Manufactured reglets and counterflashing.

2. Formed Products:

a. Formed roof drainage sheet metal fabrications.
b. Formed low-slope roof sheet metal fabrications.
c. Formed steep-slope roof sheet metal fabrications.
d. Formed wall sheet metal fabrications.
e. Formed equipment support flashing.
f. Formed overhead-piping safety pans.

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Asphalt Shingles" for installing sheet metal flashing and trim integral with roofing.
3. Division 07 Section "TPO Roofing" for installing sheet metal flashing and trim integral with membrane roofing.
4. Division 07 Section "Metal Roof Panels" for sheet metal flashing and trim integral with metal roof panels.
5. Division 07 Section "Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
6. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

1.2 PERFORMANCE REQUIREMENTS

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

B. Fabricate and install roof edge flashing and copings capable of resisting the following

forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft.: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45- lbf/sq. ft. outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

B. Shop Drawings: Show fabrication and installation layouts of sheet metal flashing and trim, including plans, elevations, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Identification of material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for joining, supporting, and securing sheet metal flashing and trim, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
4. Details of termination points and assemblies, including fixed points.
5. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail formed flashing and trim at a scale of not less than 1-1/2 inches per 12 inches.

C. Samples for Initial Selection: For each type of sheet metal flashing, trim, and accessory indicated with factory-applied color finishes involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.

2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified fabricator.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing, trim, and accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" unless more stringent requirements are specified or shown on Drawings.

C. Copper Sheet Metal Standard: Comply with CDA's "Copper in Architecture Handbook." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including built-in gutter fascia fascia trim apron flashing, approximately 10 feet long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Review special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect sheet metal flashing.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

1.8 WARRANTY

A. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

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

   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 - PRODUCTS

2.1 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum Sheet: ASTM B 209, alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required.

1. Surface: Smooth, flat.
2. Factory Prime Coating: Where painting after installation is indicated, pre-treat with white or light-colored, factory-applied, baked-on epoxy primer coat; minimum dry film thickness of 0.2 mil.
3. Exposed Coil-Coated Finishes:

    a. Two-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight for the color coat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions. (Clear anodized aluminum at building entry canopies).
    b. Shop applied finish.

4. Color: Kynar 500 Sandstone or as selected by Architect from manufacturer's full range of colors and textures.
5. Concealed Finish: Pre-treat manufacturer's standard white or light-colored crylic or polyester backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

C. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304, dead soft, fully annealed.

1. Finish: 2B (bright, cold rolled).
2. Surface: Smooth, flat.

2.2 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

B. Felt: ASTM D 226, Type II, asphalt-saturated organic felt, nonperforated.

C. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS- modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
    b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
    c. Henry Company; Blueskin PE200 HT.

d. Metal-Fab Manufacturing, LLC; MetShield.
e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

4. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.3 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
3. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.4 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond. Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing or interlocking counterflashing on exterior face, of same metal as reglet.

1. Stainless Steel: 0.016 inch thick.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cheney Flashing Company; Cheney Flashing (Dovetail).
        2) Cheney Flashing Company; Cheney Flashing (Sawtooth).
        3) Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
        4) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
        5) Sandell Manufacturing Company, Inc.; Pre-Formed Metal Flashing.

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Cheney Flashing Company.
    b. Fry Reglet Corporation.
    c. Heckmann Building Products Inc.
    d. Hickman, W. P. Company.
    e. Hohmann & Barnard, Inc.; STF Sawtooth Flashing.
    f. Keystone Flashing Company, Inc.
    g. National Sheet Metal Systems, Inc.
    h. Sandell Manufacturing Company, Inc.

2. Material: Stainless steel, 0.019 inch thick, Copper, 16 oz./sq. ft., or Aluminum, 0.024 inch thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.

4. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
5. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
6. Accessories:

    a. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
    b. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

7. Finish: With manufacturer's standard color coating.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

E. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.

F. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

G. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual" for application, but not less than thickness of metal being secured.

H. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.

I. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

J. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

K. Do not use graphite pencils to mark metal surfaces.

2.6 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. All metal thickness's or gauges are as specified in section 077100 – Roof specialties and/or 077200 – Roof Accessories. Otherwise, they are specified here.

B. Roof-Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch-long, but not exceeding 10-foot- long, sections. Furnish with 6-inch- wide, joint cover plates.

1. Joint Style: As detailed.
2. Fabricate from the following materials:

    a. Aluminum: 0.050 inch thick.

C. Roof and Roof to Wall Transition, Roof to Roof Edge Flashing (Gravel Stop) Transition. Expansion-Joint Cover: Fabricate from the following materials:

1. Aluminum: 0.050 inch thick.

D. Base Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

E. Counterflashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.
2. Stainless Steel: 0.019 inch thick.

F. Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.
2. Stainless Steel: 0.016 inch thick.

G. Roof-Penetration Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

H. Roof-Drain Flashing: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

Colors to be selected by the architect from a standard range of colors.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- long, but not exceeding 12-foot- long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inchesbeyond each side of wall openings. Form with 2-inch- high, end dams where flashing is discontinuous. Fabricate from the following materials:

1. Stainless Steel: 0.016 inch thick.

B. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch- (50- mm-) high, end dams. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following materials:

1. Copper: 16 oz./sq. ft..
2. Stainless Steel: 0.019 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Install underlayment as indicated on Drawings.

B. Polyethylene Sheet: Install polyethylene sheet with adhesive for anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

C. Felt Underlayment: Install felt underlayment with adhesive for temporary anchorage to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

D. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

3.3 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
3. Space cleats not more than 12 inches apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous

coating or by other permanent separation as recommended by SMACNA.

1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate metal decking not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches, except reduce pre-tinning where pre-tinned surface would show in completed Work.

1. Do not solder metallic-coated steel and aluminum sheet.
2. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.
3. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.
4. Copper Soldering: Tin edges of uncoated copper sheets using solder for copper.

G. Rivets: Rivet joints in aluminum where indicated and where necessary for strength.

3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.

C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at 16-inch (400- mm) centers.

D. Copings: Anchor to resist uplift and outward forces according to recommendations in SMACNA's "Architectural Sheet Metal Manual" and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

E. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 16-inch centers.
2. Anchor interior leg of coping with screw fasteners and washers at 20-inch centers.

F. Pipe or Post Flashing and Counterflashing: Install flashing and counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending a minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

G. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant anchor and washer at 36-inch centers.

H. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.

3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of through-wall flashing is specified in Division 04 Section "Unit Masonry."

C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete."

D. Opening Flashings in Frame Construction: Install continuous head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings.

3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans independent from structure above as indicated on Drawings. Pipe and install drain line to plumbing waste or drainage system.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.7 ERECTION TOLERANCES

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

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean

finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077100 - ROOF SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All heavy guage roofing metal.
2. Roof-edge drainage systems.
3. Reglets and counterflashings.
4. Roof Copings

B. Related Sections:

1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Division 07 Section "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.
3. Division 07 Section "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint cover assemblies.
4. Division 07 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
5. Division 07 Section "Joint Sealants" for field-applied sealants between roof specialties and adjacent materials.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Roof specialties shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

B. FM Approvals' Listing: Manufacture and install copings and roof-edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with FM Approvals' markings.

C. SPRI Wind Design Standard: Manufacture and install copings and roof-edge flashings tested according to SPRI ES-1.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 Deg F, ambient; 180 deg F, material surfaces.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof specialties. Include plans, elevations, expansion-joint locations, keyed details, and attachments to other work. Distinguish between plant- and field-assembled work. Include the following:

1. Details for expansion and contraction; locations of expansion joints, including direction of expansion and contraction.
2. Pattern of seams and layout of fasteners, cleats, clips, and other attachments.
3. Details of termination points and assemblies, including fixed points.
4. Details of special conditions.

C. Samples for Initial Selection: For each type of roof specialty indicated with factory-applied color finishes.

D. Samples for Verification: For copings, roof-edge flashings, roof-edge drainage systems and reglets and counterflashings made from 12-inch lengths of full-size components including fasteners, cover joints, accessories, and attachments.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for copings and roof-edge flashings.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing specialties to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof edge, including fascia gutter and downspout, approximately 10 feet (3.0 m) long, including supporting construction, seams, attachments, underlayment, and accessories.
2. Build mockups of typical coping profiles, including supporting construction, seams, attachments, underlayment, and accessories.

3. Mockups may be constructed in conjunction with other mockups of adjacent materials for the purpose of seeing how they blend together.
4. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

B. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects roof specialties including installers of roofing materials and accessories.
2. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
3. Review special roof details, roof drainage, and condition of other construction that will affect roof specialties.

1.7 DELIVERY, STORAGE AND HANDLING

A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.

B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof specialties installation.

1.8 WARRANTY

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

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

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

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

PART 2 - PRODUCTS

2.1 COPINGS:

A. Copings: Fabricate in minimum 24-inch- long, but not exceeding 16-foot- long,

sections See construction documents for lengths. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, seal, and weld watertight.

1. Coping Profile: As detailed.
2. Joint Style: As detailed.
3. Attachment Method: As indicated on the drawings
4. Fabricate from the following materials:

    a. Aluminum: 0.090 inch thick.

B. Two-coat Fluoropolymer Finish for Copings:

1. Fluoropolymer finish meeting performance requirements of AAMA 2605: Exterior Architectural. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

    a. Product: Subject to compliance with requirements, provide a Fluoropolymer finish with not less than 70% of the PVDF resin system being fluoropolymer Kynar 500 proprietery resins and with a minimum dry film thickness (ASTM D1400) of 0.25 mil primer and 1.0 mil minimum color coat.

        1) Color and gloss to match architects sample and previous phase buildings. (PPG Duranar Sandstone UC85682)
        2) Pencil Hardness (ASTM D3363): F minimum.
        3) Salt Spray Resistance (ASTM B117): 4,000 hours.
        4) Humidity Resistance (ASTM D2247): 4,000 hours.
        5) Finish Warranty Period: 20 years from date of substantial completion.

2.2 CONCEALED METALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by manufacturer for type of use and structural performance indicated, mill finished.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II, asphalt-saturated organic felt, nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0

mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS- modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
    b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra. c.
    c. Henry Company; Blueskin PE200 HT.
    d. Metal-Fab Manufacturing, LLC; MetShield.
    e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

C. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.

D. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

2.4 MISCELLANEOUS MATERIALS

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

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to meet performance requirements. Furnish the following unless otherwise indicated:

1. Exposed Penetrating Fasteners: Gasketed screws with hex washer heads matching color of sheet metal.
2. Fasteners for Copper Sheet: Copper, hardware bronze, or passivated Series 300 stainless steel.
3. Fasteners for Aluminum: Aluminum or Series 300 stainless steel.
4. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
5. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot- dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

C. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane or silicone polymer sealant of type, grade, class, and use classifications required by roofing-specialty manufacturer for each application.

D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

F. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 EDGE FLASHINGS, ROOF EDGE FASCIA, GRAVEL STOPS,etc.

A. Roofing Metal: Manufactured metal systems consisting of formed-metal pieces in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as the rest.

1. Manufacturers: All roofing metal pieces are custom made. No pre-manufactured products are being specified. Construct as per drawings.

    a. If specific pieces are required and not detailed, submit the suggested detail for approval to the architect.

2. Roofing Metal Material:

    a. Copings, - See 2.1.A this section.
    b. Valley metal - Formed aluminum, 0.050 inch or 0.125 inch thick (as indicated on the plans)
    c. Edge metal, fascia,etc. - Formed aluminum 0.0320 inch or 0.125 inch thick (as indicated on the plans)
    d. Soffit vents – Formed aluminum perforated to free area as indicated on drawings – 0.0320 inch thick.
    e. Finish: Two-coat fluoropolymer. (Clear anodized aluminum at building entry canopies.)
    f. Color: Kynar 500 Sandstone or as selected by Architect from manufacturer's standard range of colors and textures.

3. Corners: Factory mitered and continuously welded.
4. Special Fabrications: As indicated in the drawings.
5. Attachment Method: As indicated on the drawings..
6. Snap-on-Anchor Plates: Concealed, galvanized-steel sheet, 12 inches wide, with integral cleats.

2.6 REGLETS AND COUNTERFLASHINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Castle Metal Products.
2. Cheney Flashing Company.
3. Fry Reglet Corporation.
4. Heckmann Building Products Inc.
5. Hickman Company, W. P.
6. Keystone Flashing Company, Inc.

7. Metal-Era, Inc.
8. Metal-Fab Manufacturing, LLC.
9. MM Systems Corporation.
10. National Sheet Metal Systems, Inc.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Formed Aluminum: 0.050 inch thick.
2. Stainless Steel: 0.025 inch thick.
3. Corners: Factory mitered and continuously welded.
4. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
5. Concrete Type, Embedded: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum: 0.050 inch thick.
2. Stainless Steel: 0.025 inch thick.

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

E. Aluminum Finish: Two-coat fluoropolymer. (Clear anodized Aluminum at building entry canopies).

1. Color: Kynar 500 Sandstone or as selected by Architect from manufacturer's standard range of colors and textures.

F. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.

C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

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

3.2 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.

C. Polyethylene Sheet: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped and taped joints of not less than 2 inches.

D. Slip Sheet: Install with tape or adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches.

3.3 INSTALLATION, GENERAL

A. General: Install roof specialties according to manufacturer's written instructions.

Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, sealants, and other miscellaneous items as required to complete roof-specialty systems.

1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
2. Provide uniform, neat seams with minimum exposure of solder and sealant.
3. Install roof specialties to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
4. Torch cutting of roof specialties is not permitted.
5. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Coat concealed side of uncoated aluminum and stainless-steel roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.

C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.

1. Space movement joints at a maximum of 12 feet with no joints within of corners or intersections unless otherwise shown on Drawings.
2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.

D. Fastener Sizes: Use fasteners of sizes that will penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints with elastomeric sealant as required by roofing-specialty manufacturer.

F. Seal joints as required for watertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.

G. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches except reduce pre-tinning where pre-tinned surface would show in completed Work. Tin edges of uncoated copper sheets using solder for copper. Do not use torches for soldering. Heat surfaces to receive solder and flow solder into joint. Fill joint completely. Completely remove flux and spatter from exposed surfaces.

3.4 COPING INSTALLATION

A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor copings to meet performance requirements.

3.5 ROOF-EDGE FLASHING INSTALLATION

A. Install cleats, cants, and other anchoring and attachment accessories and devices with concealed fasteners.

B. Anchor roof edgings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.

3.6 REGLET AND COUNTERFLASHING INSTALLATION

A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.

B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

C. Counterflashings: Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings.

3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.

D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:

1. Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
2. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
3. Interior joints in horizontal traffic surfaces.

B. See Division 08 Section "Glazing" for glazing sealants.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples: For each kind and color of joint sealant required.

C. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

D. Product test reports.

E. Preconstruction compatibility and adhesion test reports.

F. Preconstruction field-adhesion test reports.

G. Field-adhesion test reports.

H. Warranties.

1.3 QUALITY ASSURANCE

A. Preconstruction Compatibility and Adhesion Testing: Submit samples of materials that will contact or affect joint sealants to joint-sealant manufacturers for testing according to ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

B. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates according to the method in ASTM C 1193 that is appropriate for the types of Project joints.

C. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

1.4 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

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

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

B. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

2.2 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Single-Component Pourable Neutral-Curing Silicone Sealant:

1. Products:

    a. Dow Corning Corporation; 890-SL.
    b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
    c. Dow Corning Corporation; SL Parking Structure Sealant.

2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Uses Related to Exposure: NT and T (traffic).
5. Uses Related to Joint Substrates: M and O, as applicable to joint substrates indicated.

F. Single-Component Neutral- and Basic-Curing Silicone Sealant:

1. Products:

    a. Dow Corning Corporation; 795. To be used for but not limited to;

        1) Exterior

            a) Sealing gaps around the outside and inside of windows
            b) Expansion joints at masonry
            c) Gaps between coping and masonry
            d) Gaps between coping joints
            e) Gaps between louvers and masonry
            f) Gaps between pre-cast concrete and masonry.
            g) Gaps between pre-cast concrete and pre-cast concrete
            h) Gaps around granite sign above main entry

        2) Interior

a) Gaps between aluminum window frame and granite window sill.
b) Gaps between granite shower slab and granite shower slab.
c) Gaps between granite shower slab and ceramic shower floor tile.
d) Gaps between hollow metal door frame and painted gypsum board

3) Colors for each location to be selected by architect from standard colors.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 100/50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.
6. Stain-Test-Response Characteristics: Nonstainingto porous substrates per ASTM C 1248.

G. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant:

1. Products:

a. Dow Corning Corporation; 786 Mildew Resistant.
b. GE Silicones; Sanitary SCS1700.
c. Tremco; Tremsil 200 Clear.

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated,

H. General Purpose Polyurethane Sealant

1. Products:

a. Pecora corporation Dynatrol II or equivalent

1) Interior

a) Gaps between aluminum window frame and painted gypsum board.
b) Gaps between granite window sill and painted gypsum board.
c) Gaps between granite shower slab and painted gypsum board.

2) Colors for each location to be selected by architect from standard colors.

2. Type and Grade: D (dual component) and NS (nonsag).

2.3 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Comply withASTM C 834, Type OP, Grade NF.

1. Products

a. BASF Building Systems.
b. Pecora Corporation.
c. Schnee-Morehead, Inc.
d. Sone, Division of Chemorex Inc. Sonolac
e. Tremco Incorporated.

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. Hilti, Inc.; CP506 Smoke and Acoustic Sealant
d. Hilti, Inc.; CP 572 Smoke and Acoustic Spray

B. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. Products:

a. Pecora Corporation; BA-98.
b. Tremco; Tremco Acoustical Sealant.

2.5 JOINT SEALANT BACKING

A. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

B. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.

    a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

2. Remove laitance and form-release agents from concrete.
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint- sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.

F. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written recommendations

G. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard hollow metal doors and frames.

1.3 SUBMITTALS

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

B. Shop Drawings: Include elevations, door edge details, frame profiles, metal thicknesses, preparations for hardware, and other details.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification: For each type of exposed finish required.

E. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

1.4 QUALITY ASSURANCE

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

1. Temperature-Rise Limit: Where indicated , provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

C. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark; a division of Therma-Tru Corporation.
3. Ceco Door Products; an Assa Abloy Group company.
4. Curries Company; an Assa Abloy Group company.
5. Deansteel Manufacturing Company, Inc.
6. Fleming Door Products Ltd.; an Assa Abloy Group company.
7. Kewanee Corporation (The).
8. Mesker Door Inc.
9. Pioneer Industries, Inc.
10. Steelcraft; an Ingersoll-Rand company.
11. Robert I. Merrill
12. Beacon Metals

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, CS, Type B.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I.

H. Glazing: Division 08 Section "Glazing.

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 STANDARD HOLLOW METAL DOORS

A. General: Comply with ANSI/SDI A250.8.

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polyurethane core.

   a. Fire Door Core: As required to provide fire-protection ratings indicated.
   b. Thermal-Rated (Insulated) Doors: R-value of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.

3. Vertical Edges for Single-Acting Doors: Manufacturer's standard.
4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
5. Tolerances: SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from galvanized G-90 coated steel sheet. Comply with ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet and galvanized G-90 coated steel sheet as indicated. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush) .
2. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 1 (Full Flush).

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8.

B. Exterior Frames: Fabricated from metallic-coated steel sheet. Exterior frames are to be custom sized to fit masonry coursing inside and out see details in the construction documents.

1. Fabricate frames with mitered or coped corners.

2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 3 Steel Doors: -14 GA. thick steel sheet.

C. Interior Frames: Fabricated from cold-rolled steel sheet. Except where galvanized G-90 coated sheet is indicated. Interior frames are to be custom sizes to fit around the thickness of the wall after gypsum board installation as determined in the pre construction meeting without deforming.

1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as full profile welded unless otherwise indicated.
3. Frames for Level 2 Steel Doors: -16 GA. thick steel sheet.
4. Frames for Level 3 Steel Doors: -14 GA. thick steel sheet.
5. Frames for Wood Doors: 16GA. thick steel sheet.

D. Hardware Reinforcement: ANSI/SDI A250.6.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.6 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, same material as door face sheet.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch- wide steel.

C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.8 FABRICATION

A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

B. Hollow Metal Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors
3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated.

C. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Two anchors per jamb up to 60 inches high.
2) Three anchors per jamb from 60 to 90 inches high.
3) Four anchors per jamb from 90 to 120 inches high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and

bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb up to 60 inches high.
2) Four anchors per jamb from 60 to 90 inches high.
3) Five anchors per jamb from 90 to 96 inches high.
4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
5) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

c. Compression Type: Not less than two anchors in each jamb.
d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers.

a. Single-Door Frames: Three door silencers.
b. Double-Door Frames: Two door silencers.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.

2.9 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: ANSI/SDI A250.10

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable

wedged or bolted anchorage to frame jamb members.

9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

B. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

    a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
    c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.2 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer

C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Overhead coiling service doors.

B. Overhead coiling insulated doors.

1.2 RELATED SECTIONS

A. Section 055000 - Metal Fabrications: Support framing and framed opening.

B. Section 087100 - Door Hardware: Product Requirements for cylinder core and keys.

C. Division 09 - Painting: Field applied finish.

D. Section 260533 - Raceway and Boxes for Electrical Systems: Conduit from electric circuit to door operator and from door operator to control station.

E. Section 262726 - Wiring Devices: Power to disconnect.

1.3 REFERENCES

A. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

B. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.

C. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

D. ASTM A 653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

E. ASTM A 666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

F. ASTM A 924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

G. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

I. NEMA MG 1 - Motors and Generators.

1.4 DESIGN / PERFORMANCE REQUIREMENTS

A. Overhead coiling service doors:

1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components in conformance with ASTM E 330.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

B. Overhead coiling insulated doors:

1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components in conformance with ASTM E 330.
2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.

C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.

D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.5 SUBMITTALS

A. Submit under provisions of Section 013300.

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. Details of construction and fabrication.
4. Installation instructions.

C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.6 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 approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.

C. Store materials in a dry, warm, ventilated weathertight location.

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 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.10 WARRANTY

A. Warranty: Manufacturer’s limited door and operator system, except the counterbalance spring and finish, to be free from defects in materials and workmanship for 3 years or 20,000 cycles, whichever occurs first.

B. Warranty: Manufacturer’s limited door warranty for 5 years on door system materials and workmanship.

C. Warranty: Manufacturer's limited door system warranty for 2 years for all parts and components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: www.overheaddoor.com. E-mail: arcat@overheaddoor.com.

B. Substitutions: As approved by Architect.

2.2 OVERHEAD COILING SERVICE DOORS

A. Industrial Doors: Overhead Door Corporation, Model 610 Service Doors.

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

    a. Curved profile type C-187 for doors up to 15 feet 4 inches wide, fabricated of:

        1) 20 gauge stainless steel.

2. Finish:

    a. Stainless Steel: Slats and hood shall be stainless steel finished as follows.

        1) Finish: No. 4 satin finish.

3. Weatherseals:

    a. Vinyl bottom seal.
    b. Guide weatherseal.

4. Bottom Bar:

    a. Extruded aluminum for doors up to 15 feet 4 inches wide.

5. Guides: Three structural steel angles.

    a. Finish: PowderGuard Weathered finish with iron/black powder.
    b. Finish: PowderGuard Zinc Finish for guides, bottom bar and head plate.

6. Brackets:

a. Hot rolled steel to support counterbalance, curtain and hood.

7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
8. Hood:

a. Stainless steel, 24 gauge hood with intermediate supports as required.

9. Manual Operation:

a. Manual push up for doors up to 96 SF.

10. Locking:

a. Two interior bottom bar slide bolts for manually operated doors.

11. Wall Mounting Condition:

a. Between jambs mounting.

2.3 INSULATED OVERHEAD COILING SERVICE DOORS

A. Overhead Coiling Stormtite Insulated Service Doors: Overhead Door Corporation Model 625.

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

a. Flat profile type F-265i for doors up to 40 feet wide.
b. Front slat fabricated of:

1) 20 gauge stainless steel.

c. Back slat fabricated of:

1) 24 gauge stainless steel.

d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.

1) R-Value: 7.7, U-Value: 0.13.
2) Sound Rating: STC-21.

2. Performance:

a. Through Curtain Sound Rating: Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E 90.
b. Installed System Sound Rating: STC-21 as per ASTM E 90.

c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.

3. Finish:

   a. Stainless Steel: Slats and hood shall be stainless steel finished as follows.

      1) Finish: No. 4 satin finish.

4. Weatherseals:

   a. Vinyl bottom seal, exterior guide and internal hood seals.
   b. Interior guide weatherseal.
   c. Lintel weatherseal.

5. Bottom Bar:

   a. Two stainless steel angles minimum thickness 1/8 inch bolted back to back to reinforce curtain in the guides.

6. Guides: Three Structural steel angles

.

   a. Finish: PowderGuard Zinc Finish for guides, bottom bar and head plate.

7. Brackets:

   a. Stainless steel to support counterbalance, curtain and hood.

8. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
9. Hood: Provide with internal hood baffle weatherseal.

   a. Stainless steel, 24 gauge hood with intermediate supports as required.

10. Electric Motor Operation: Provide UL listed electric operator, size as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.

    a. Sensing Edge Protection:

       1) Pneumatic sensing edge.
       2) Electric sensing edge.

    b. Operator Controls:

       1) Push-button and key operated control stations with open, close, and stop buttons.
       2) Controls for interior location.

3) Controls flush mounted.

c. Motor Voltage: 115/230 single phase, 60 Hz.

11. Windload Design:

a. Standard windload shall be 20 PSF.

12. Locking:

a. Chain keeper locks for chain hoist operation.
b. Cylinder lock for electric operation with interlock switch.

13. Wall Mounting Condition:

a. Between jambs mounting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify opening sizes, tolerances and conditions are acceptable.

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. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.

G. Install perimeter trim and closures.

H. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

3.4 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.

3.5 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.

3.6 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 083323

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

a. Swinging doors.
b. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.

B. Related Sections include the following:

1. Division 08 Section "Hollow Metal Doors and Frames"
2. Division 08 Section "Overhead Coiling Doors"

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1.3 REFERENCED STANDARDS

A. Provide hardware in accordance with the following standards in addition to those specified in Division 01 Section “References”.

1. American National Standards Institute (ANSI), A117.1: Accessible and Usable Buildings and Facilities, edition as adopted by local Authority Having Jurisdiction (AHJ).
2. Builders Hardware Manufacturer’s Association (BHMA)

a. ANSI/BHMA A156.2: Bored and Preassembled Locks and Latches, 2011 edition
b. ANSI/BHMA A156.3: Exit Devices, 2008 edition
c. ANSI/BHMA A156.4: Door Controls - Closers, 2008 edition
d. ANSI/BHMA A156.18: Materials and Finishes, 2006 edition

3. Door and Hardware Institute (DHI)

    a. Recommended Locations for Architectural Hardware for Flush Wood Doors, 1993 edition
    b. Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames, 2004 edition
    c. Installation Guide for Doors and Hardware, 1994 edition
    d. Keying Systems and Nomenclature, 2003 edition
    e. Sequence and Format for the Hardware Schedule, 2001 edition

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. 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.

H. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

1.5 QUALITY ASSURANCE

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.

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 and UBC Standard 7-2.

1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.

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.

1.8 Warranty

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

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

a. Structural failures including excessive deflection, cracking, or breakage.
b. 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. Grade 1 Cylindrical Locks: Five (5) years from date of Substantial Completion.

b. Manual Closers: Ten (10) years from date of Substantial Completion.

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:

2.2	Hinges:	Ives, Hager, Stanley, McKinney, Bommer
2.3	Locks and Latches:	Best, Owner’s Standard
2.4	Cylinders and Cores:	Best
2.5	Mechanical Door Closers:	LCN, Falcon, Sargent, Stanley
2.6	Accessories and Trim:	Ives, Rockwood, Hager, Trimco
2.7	Saddle and Panic Thresholds:	Zero, National Guard, Pemko
2.8	Weather Strip and Gasket:	Zero, National Guard, Pemko
2.9	Miscellaneous Hardware:	Ives, Rockwood, Hager, Trimco
2.10	Emergency Access Key Box:	Knox, Inc
2.11	Key Cabinet:	Lund Equipment

A. Substitutions submitted in compliance with Division 01 Section “Substitutions” requirements will be reviewed for conformance to basis of design.

2.12 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.

2.13 MATERIALS and fabrication

A. General

1. Manufacturer's Name Plate: Do not use manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise acceptable to Architect.

    a. Manufacturer's identification will be permitted on rim of lock cylinders only.

2. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.
3. Provide hardware manufactured to conform to published templates generally prepared for machine screw installation. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

B. Fasteners

1. Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Furnish stainless steel (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.
2. Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners. Use through bolts only as indicated in this section unless their use is the only means of reinforcing the work adequately to fasten the hardware securely. Where thru-bolts are used as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

2.14 Hinges

A. Acceptable Products:

2.15 Ives:

2.16 Hager:

2.17 Stanley:

2.18 McKinney:

2.19 Bommer:

A. Requirements:

1. Quantity: Provide the following, unless otherwise indicated:

   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.

2. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
3. Hinge Weight: As indicated in hardware sets.
4. Hinge Base Metal: Unless otherwise indicated, provide the following:

   a. Exterior Hinges: Stainless steel with stainless-steel pin.
   b. Interior Hinges: Steel with steel pin.
   c. Hinges for Fire-Rated Assemblies: Steel with steel pin.

5. Hinge Options: Where indicated in door hardware sets or on Drawings:

a. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
b. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for out-swinging doors.
c. Corners: Square.

6. Fasteners: Comply with the following:

a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
b. Wood Screws: For wood doors and frames.
c. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

2.20 Operating Door Trim

A. Push Plates, Pull Plates, and Pulls

1. Acceptable Products:

B. Ives:
C. Rockwood:

D. Hager:

E. Trimco:

1. Requirements:

a. Push Plate: Provide 6 inch by 16 inch by .050 inch push plate constructed of stainless steel. Bevel all four edges.
b. Pull Plate: Provide 4 inch by 16 inch by .050 inch push plate constructed of stainless steel, bevel all four edges. Provide 10 inch center to center (CTC) pull constructed of stainless steel with a diameter of 1 inch.

2.21 Locks And Latches

A. General:

1. Lock Chassis: Shall be made from steel, with locking spindles of stainless steel.
2. Latch Bolt: Shall be constructed of stainless steel with 3/4 inch throw on mortise locks and 1/2 inch throw otherwise. Latch to be deadlocking on keyed functions.
3. Lever Trim: Shall be pressure cast brass, bronze, zinc, or steel with wrought rose design. Levers are to be solid with no voids or plastic inserts.
4. Fire Rating: Lock shall be listed for up to 3 hours.
5. Strike Plates: Provide ANSI 4-7/8 inch strike plates. At pairs of doors, provide strike with 7/8 inch flat lip. At single doors, provide round-lipped strike with lip length as required to minimally clear jamb and trim. Provide dust box at each strike location.

B. Grade 1 Bored Locks

1. Acceptable Products:
   C. Best: 9K Series, 15D Lever

   a. No Substitution, Match existing facility standard

D. Deadbolts

1. Requirements:

   a. Provide deadbolts by same manufacturer as the provided locksets.
   b. Provide chassis type, function, and grade as scheduled.

2.22 Cylinders And Cores

A. Acceptable Products:

2.23 Best:

1. No Substitution, Match existing facility standard

B. Requirements:

1. Small Format Interchangeable Cylinders: Provide cylinders of quantity and type and with the appropriate cam/tailpiece to be compatible with the locking hardware provided. Provide cylinder housings ready to accept 7-pin, Small Format Interchangeable Cores (SFIC).

   a. Disposable Temporary Cores: Provide each cylinder housing and/or lock lever with disposable construction cores during the construction period.

b. Keyed Temporary Cores: Provide each cylinder housing and/or lock lever with keyed construction core during the construction period. Cores will remain property of the contractor and will be returned upon installation of owner's permanent key system.

2. Keys: Provide cylinder manufacturer's standard keys. Keys shall be shipped separate from cores directly to owner's representative. For estimating purposes, provide keys in the following quantities:

C. Construction Control Keys: each
D. Construction Change Keys: each

E. Permanent Control Keys: each
F. Split Key Voiding Keys: each
G. Permanent Change Key Blanks: per core

2.24 Mechanical Door Closers

A. General:

1. Valves: Closers shall have separate valves for latch speed, main speed, and back check. Valves shall be staked to prevent accidental removal.
2. Provide the appropriate closer body, handing, and brackets to mount closer inside the building on the least-public side of the door.

a. Where closers are to be mounted parallel arm, provide with heavy duty, fully forged arms.
b. Where closers are to be mounted regular arm and the opening can otherwise be opened to 180 degrees, provide closer with the appropriate special templating to allow 180 degree door swing. Where a special template is not available for 180 degree swing, provide closer arm with integrated stop.

3. Integrated Stop Closer Arms: Where a closer with integrated stop is required, provide the appropriate closer and arm as follows:

a. Parallel arm with spring-cushioned stop arm: Provide where door is otherwise able to open to 95 degrees and requires a parallel arm mount closer.
b. Parallel arm with dead stop arm: Provide where door is obstructed from opening to 95 degrees and requires a parallel arm mount closer.
c. Regular arm with push side surface-mounted overhead stop: Provide where door closer should mount on pull side of door.

4. Hold Open Arms: Provide closer arms with mechanical hold-opens as scheduled.

5. Provide closers with any special templates, brackets, plates, or other accessories required for interface with header, door, wall, and other hardware. Provide closers with screw packs containing thru-bolts, machine screws, and wood screws.
6. Closers shall be provided with all-weather fluid and shall not require readjustment from 120 degrees F to -30 degrees F. Fluid shall be non-flaming and shall not fuel door or floor covering fires. Upon request, provide data indicating thermal properties of fluid.
7. Closers shall close and latch door when adjusted to meet accessibility requirements for door opening force: 8.5 lbs at exterior doors, 5 lbs at interior doors, and 15 lbs at labeled fire doors.

B. Heavy Duty Door Closers:

1. Acceptable Products:

C. LCN:

D. Falcon:

E. Sargent:

F. Stanley:

1. Requirements:

a. ANSI Grade: BHMA/ANSI A156.4, Grade 1.
b. Closer Construction: Closer shall have cast iron or aluminum alloy body with 1-1/2 inch steel piston, heat treated pinion, 5/8 inch bearing journals, and full complement needle or caged ball bearings. Closer shall be adjustable from sizes 1 through 6.

2.25 Architectural Door Trim

A. Protection Plates and Edge Guards

1. Acceptable Products:

B. Ives:

C. Rockwood:

D. Hager:

E. Trimco:

1. Requirements:

a. Provide .050 inch thick stainless steel protection plates with height as scheduled. Plate shall have four beveled edges and countersunk screws. Provide plate with width as follows:

1) Pairs of Doors: Provide plate to be 1 inch less door width.
2) Single Doors: Provide plate to be 2 inches less door width on push side, pull side mounted plates to be 1 inch less door width.
3) Where Specified with Edge Guards: Provide plate to be 2 inches less door width.

F. Door Stops and Holders

1. Acceptable Products:

G. Ives:
H. Rockwood:

I. Hager:

J. Trimco:

1. Requirements:

a. Provide stops and holders as indicated in the HW sets.
b. Where wall bumpers are scheduled, provide concave rubber bumper where the adjacent lever trim incorporates a push-button. Otherwise, provide convex rubber bumpers.

2.26 Saddle And Panic Thresholds

A. Acceptable Products:

2.27 Zero International:

2.28 National Guard:

2.29 Pemko:

A. Requirements:

1. Saddle thresholds: Provide with length equal to the width of the opening.
2. Panic thresholds: Provide with length equal to the overall frame width. Provide with mitered and welded ends.
3. Provide stainless steel machine screws and lead anchors for each threshold.

2.30 Weatherstrip And Gasket

A. General:

1. Provide weather strip and gasketing as scheduled.
2. Size weather strip and gasket to provide a continuous seal around opening and at meeting stiles.

B. Perimeter Seals

1. Acceptable Products:

C. Zero:
D. National Guard:

E. Pemko:

F. Astragals, Meeting Stiles, and Mullion Seals

1. Acceptable Products:

G. Zero:

H. National Guard:

I. Pemko:

1. Requirements

a. Where overlapping astragals are scheduled on exterior doors, provide with thru-bolts.
b. Where overlapping astragals are scheduled on out-swinging doors, provide for mounting on the pull-side of the active leaf. Otherwise, provide for mounting on the push-side of the inactive leaf.

J. Door Bottoms

1. Acceptable Products:

K. Zero:
L. National Guard:

M. Pemko:

2.31 Miscellaneous Hardware

A. Silencers

1. Acceptable Products:

B. Ives:
C. Rockwood:

D. Hager:

E. Trimco:

1. Requirements:

a. Where indicated on single openings, provide 3 each rubber silencers on lock jamb.

b. Where indicated on paired openings, provide 2 each rubber silencers on header.

2.32 High Security Emergency Key Box

A. Basis of Design:

2.33 Knox, Inc. 3200 Series x RMK

A. Requirements:

1. Provide recess-mounted emergency key box as approved by the local fire jurisdiction. Key box to be master-keyed as dictated by local fire jurisdiction.

2.34 Key Control Cabinet

A. Basis of Design:

2.35 Lund, Inc. 1200 Series

A. Requirements:

1. Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet.
2. Provide complete cross-index system set up by Owner, and place keys on markers and hooks in the cabinet as determined by the final key schedule.
3. Provide hinged-panel type cabinet for wall mounting with capacity for 250 unique keys.

2.36 FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and locksets (or push-pull units if no latch or locksets).

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. The designations used in schedules and elsewhere to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

D. The designations used in schedules and elsewhere to indicate hardware finishes are the industry-recognized standard commercial finishes, except as otherwise noted.

1. Brushed Chrome and/or Stainless Steel Appearance

    a. Brushed Stainless Steel, no coating: ANSI 630.
    b. Satin Chrome, Clear Coated: ANSI 626, ANSI 652.
    c. Powder Coated Aluminum finish: ANSI 689.
    d. Saddle and Panic Thresholds: Mill Aluminum finish.
    e. Weatherstrip and Gasket: Clear Anodized Aluminum finish.

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

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

3.3 INSTALLATION

A. 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.

B. Install hardware using only manufacturer supplied and approved fasteners in strict adherence with manufacturers published installation instructions.

C. 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.

D. Counter sink through bolt of door pull under push plate during installation.

E. Mounting Heights: Mount door hardware units at heights indicated, as follows, unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
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."

F. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

G. Furnish wiring diagrams to electrical contractor for use in installing electrical hardware products.

1. Electrical contractor to run all wiring and make all final connections for electrified hardware. Hardware supplier shall be responsible to furnish all wiring diagrams to operate electrified hardware. Access control material and electrified hardware to interface at junction boxes.

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 FIELD QUALITY CONTROL

A. Architectural Hardware Consultant: Architect shall engage a qualified Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

B. Architectural Hardware Consultant shall inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. 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 from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.7 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.

P

HW SET NO: 01

1 EA	CYL	AS REQ'D BY DOOR MFG	626	BES
	REMAINING HARDWARE	BY DOOR MFG		B/O

HW SET NO: 02

3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	STOREROOM LOCKSET	93K7D15DS3	626	BES
1 EA	SURFACE CLOSER	4050 HW/PA	689	LCN
1 EA	FLOOR STOP	FS439	630	IVE
1 EA	SEAL	429A	AL	ZER
1 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER

HW SET NO: 03

6 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 SET	AUTO FLUSH BOLT	FB31P	630	IVE
1 EA	DUST PROOF STRIKE	DP2	626	IVE
1 EA	STOREROOM LOCKSET	93K7D15DS3	626	BES
1 EA	COORDINATOR	COR X FL	628	IVE
2 EA	MOUNTING BRACKET	MB	689	IVE
2 EA	SURFACE CLOSER	4050 SHCUSH	689	LCN
2 EA	CUSH SHOE SUPPORT	4050-30	689	LCN
1 EA	SEAL	429A	AL	ZER
1 EA	SECURITY ASTRAGAL	43SP	600	ZER
2 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER
HW SET NO: 04				
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	CLASSROOM DEADBOLT	83T7S	626	BES
1 EA	PUSH PLATE	8200 6" X 16" CFC	630	IVE
1 EA	PULL PLATE	8305 8" 6" X 16" CFC	630	IVE
1 EA	SURFACE CLOSER	4050 RW/PA	689	LCN
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 EA	SEAL	429A	AL	ZER
1 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER
HW SET NO: 05				
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	KEYED PRIVACY W/ INDICATOR	L9456BD 06B L583-363 L283-722	626	SCH
1 EA	MORTISE CYLINDER	1E74	626	BES
1 EA	SURFACE CLOSER	4050 RW/PA	689	LCN
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 EA	SEAL	429A	AL	ZER
1 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER
HW SET NO: 06				
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1 EA	CLASSROOM LOCKSET	93K7R15DS3	626	BES
1 EA	SEAL	429A	AL	ZER
1 EA	DOOR SWEEP	39A	AL	ZER
1 EA	THRESHOLD	655A MSLA-10	AL	ZER
HW SET NO: 07				
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1 EA	CLASSROOM LOCKSET	93K7R15DS3	626	BES
1 EA	SURFACE CLOSER	4050 SHCUSH	689	LCN
1 EA	CUSH SHOE SUPPORT	4050-30	689	LCN
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 EA	SEAL	429A	AL	ZER
1 SET	SEAL	488S-BK		ZER
1 EA	DOOR BOTTOM	361AA	AL	ZER
1 EA	THRESHOLD	164STST	AL	ZER
HW SET NO: 08				
3 EA	HW HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1 EA	CLASSROOM LOCKSET	93K7R15DS3	626	BES
1 EA	WALL STOP	WS406/407CCV	630	IVE

3 EA	SILENCER	SR64	GY	IVE
HW SET NO: 09				
3 EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1 EA	STOREROOM LOCKSET	93K7D15DS3	626	BES
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64	GY	IVE
HW SET NO: 10	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
3 EA				
1 EA	STOREROOM LOCKSET	93K7D15DS3	626	BES
1 EA	WALL STOP	WS406/407CCV	630	IVE
1 EA	SEAL	429A	AL	ZER
1 SET	SEAL	488S-BK		ZER
1 EA	DOOR BOTTOM	361AA	AL	ZER
1 EA	THRESHOLD	164STST	AL	ZER
HW SET NO: 11				
3 EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1 EA	OFFICE LOCKSET	93K7AB15DS3	626	BES
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64	GY	IVE
HW SET NO: 12				
3 EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1 EA	PRIVACY LATCHSET	93K0L15DS3	626	BES
1 EA	SURFACE CLOSER	4050 RW/PA	689	LCN
1 EA	KICK PLATE	8400 10" X 2" LDW B4E	630	IVE
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64	GY	IVE
HW SET NO: 13				
3 EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1 EA	PRIVACY LATCHSET	93K0L15DS3	626	BES
1 EA	WALL STOP	WS406/407CCV	630	IVE
3 EA	SILENCER	SR64	GY	IVE

END OF SECTION

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes non-load-bearing steel framing members for the following applications:

1. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).
2. Interior suspension systems (e.g., supports for ceilings, suspended soffits, etc.).

1.2 SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non- load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. Sound Transmission Characteristics: For STC-rated assemblies that incorporate non-load- bearing steel framing, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

PART 2 - PRODUCTS

2.1 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
2. Protective Coating: ASTM A 653, G40 minimum, hot-dip galvanized zinc coating, unless otherwise indicated.

2.2 SUSPENSION SYSTEM COMPONENTS

A. Tie Wire: ASTM A 641, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

a. Type: Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion- resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.

D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.

E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings.

F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
2. Steel Studs: ASTM C 645.

a. Minimum Base-Metal Thickness: 18 gauge.
b. Depth: As indicated on Drawings

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep. a. Minimum Base Metal Thickness: 18 gauge.

G. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Fire Front 650-C Drywall Furring System.

c. USG Corporation; Drywall Suspension System.

2.3 STEEL FRAMING FOR FRAMED ASSEMBLIES

A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 20 gauge. Meet manufacturer's length/gauge requirements for carrying capacity.

B. Slip-Type Head Joints: Where indicated, provide the following:

1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
2) Superior Metal Trim; Superior Flex Track System (SFT).

C. Firestop Track: As specified in Division 07 Section "Fire-Resistive Joint Systems."

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 16 gauge.

E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 1-1/2 inches.
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.

F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base Metal Thickness: 20 gauge.
2. Depth: 7/8 inch.

G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical.

H. Cold-Rolled Furring Channels: 0.0538-inch bare-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: 3/4 inch.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum bare- steel thickness of 0.0312 inch.
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch- diameter wire.

I. Steel Studs Headers: ASTM C 645.

1. Minimum Base-Metal Thickness: 18 gauge, provide 18 gauge for runners top and bottom where needed. Reference structural typical exterior stud wall framing schedule with framed opening details,

J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.4 AUXILIARY MATERIALS

A. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

C. Continuous acoustical sealant at junction of steel stud track and concrete floor, and steel stud track and steel deck at all walls designated as a sound wall with required STC rating.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

3.2 INSTALLING SUSPENSION SYSTEMS

A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

B. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
5. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
6. Do not connect or suspend steel framing from ducts, pipes, or conduit.

C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

D. Seismic Bracing: Sway-brace suspension systems with hangers used for support.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.3 INSTALLING FRAMED ASSEMBLIES

A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

B. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts

penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb, unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

    a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance- rated assembly indicated.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs. b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of not less than 2 studs at ends of arcs, place studs 6 inches o.c.

C. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

D. Z-Furring Members:

1. Erect insulation (specified in Division 07 Section "Thermal Insulation") vertically and hold in place with Z-furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short

flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Tile backing panels.
3. Abuse resistant gypsum board.

B. Related Sections;

1. Division 6 - Sheathing - for exterior wall sheathing (Glass-Mat).

1.2 SUBMITTALS

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

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Tests: Testing to be performed will be determined by Owner's testing agency as follows:

1. Qualitative Testing: The Owner will be performing smoke tests in portions of the building after the installation of the interior vapor barrier, the exterior Fluid-Applied Membrane Air Barrier, and the roof vapor barrier. These tests will be done before the installation of the interior sheet rock or the exterior finish materials. Coordination on the timing of the testing will be required with the General Contractor. At the completion of the construction final smoke testing will also be done by the Owner. The testing will be done to determine the air

tightness of the various barriers in order to assist the Contractor in making adjustments to the installations of these barriers.

2. Smoke Test: Air barrier assemblies will be tested for evidence of air leakage by pressurizing the building or room and introducing smoke into the building or room. The exterior of the building will be observed to see if there are leaks that allow the pressurized air and smoke to escape. The leaks and deficiencies observed shall be corrected as necessary. Do not cover the air barrier, roof vapor barrier, or the interior vapor barrier until the owner has approved and accepted the integrity of the corrected air/vapor barrier systems.

D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:

   a. Each level of gypsum board finish indicated for use in exposed locations.
   b. Each texture finish indicated. Coordinate with Owner's representative regarding their desires for ceiling texture to help the applicator in creating the mock-up sample.

2. Apply or install final decoration indicated, including painting and wall coverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

A. General: Complying with ASTM C 36 or ASTM C 1396, as applicable to type of gypsum board indicated and whichever is more stringent.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BPB America Inc.
   b. G-P Gypsum.
   c. National Gypsum Company.
   d. USG Corporation.

B. Type X:

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

C. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.

1. Thickness: 5/8 inch.
2. Long Edges: Tapered.

D. Abuse-Resistant Type: Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.

1. Core: 5/8 inch, Type X.
2. Long Edges: Tapered.

2.2 TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Board:

1. Complying with ASTM C 1178.

a. Product: Subject to compliance with requirements, provide "DensShield Tile Guard" by G-P Gypsum.
b. Product: Subject to compliance with requirements, provide “Fiberock Aqua Tough” by USG.
c. Or approved equal by Architect.

2. Core: 5/8 inch and 1/2inch, Type X.

2.3 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. Expansion (Control) Joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fry Reglet Corp.
b. Gordon, Inc.
c. Pittcon Industries.

2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.4 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475.

B. Joint Tape:

1. Interior Gypsum Wallboard: Paper.
2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
3. Tile Backing Panels: 10-by-10 glass mesh or as recommended by panel manufacturer for water resistant joint.

C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying type, all purpose compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: Water resistant joint compound as recommended by backing panel manufacturer.

2.5 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealants."

E. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."

F. Provide zip strips “L” bead, that have a removable masking strip 5/16” wide at all window to gypsum board transitions. The zip strips will be used continuously around the sill, jambs, and head of each window. The zip strips will provide a clean finish on the inside of each window and will allow for backer rod and sealant at the window gypsum board transitions.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

D. Required backing to be installed and inspected before panel installation.

3.2 APPLYING INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Where required for fire-resistance-rated assembly.
2. Ceiling Type: Ceiling surfaces.
3. Abuse-Resistant Type: As indicated on Drawings and as follows:

    a. Install up to 6” above finish ceiling height, typical.

3.3 APPLYING TILE BACKING PANELS

A. Glass-Mat, Water-Resistant Backing Panel: Comply with manufacturer's written

installation instructions and install at showers, tubs, and where indicated and locations indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations. Tape and seal corners and joints according to manufactures water proofing recommendations.

B. Areas Not Subject to Wetting: Install regular-type gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.

C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

D. Required ¼" furring to be installed and inspected before panel installation. ¼" fire treated wood material to fir out tile backing panels in each of the showers. Provide 6" continuous strips at 16" on center surrounding the shower walls typical. See details in construction documents.

3.4 INSTALLING OF ABUSE-RESISTANT GYP. BD.

A. Use screws that are of sufficient length and size to securely fasten board to studs.

B. Use screws with heads of appropriate shape of heads to enable them to be screwed flush into gyp. board or more enabling mudding per manufacturer's instructions and recommendations.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners, unless otherwise indicated.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below:

1. Level 2: Panels that are substrate for tile panels where indicated on Drawings.

   a. All joints and interior angles shall have tape embedded in joint compound and one separate coat of joint compound applied over all joints, angles, fastener heads, and accessories.
   b. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.

2. Level 3: All Storage and Maintenance rooms.

   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all joints, angles, fastener heads, and accessories.
   b. All joint compound shall be smooth and free of tool marks and ridges.

3. Level 4: All other Gypsum Board surfaces.

   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all joints, angles, fastener heads, and accessories.
   b. All joint compound shall be smooth and free of tool marks and ridges.
   c. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

3.7 APPLYING TEXTURE FINISHES

A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.

B. Texture Finish Application: Mix and apply finish using method necessary to obtain the texture in the approved mock-up sample free of starved spots or other evidence of thin application or of application patterns.

C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.8 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.
2. Stone thresholds.
3. Waterproof membrane.
4. Metal edge strips.

1.2 SUBMITTALS

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

B. Samples for Initial Selection: Submit manufacturer's color charts consisting of actual tiles or sections of tile showing full range of colors, textures and patterns available for each type of tile indicated.

C. Samples for Initial Submittal:

1. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
2. Stone thresholds in 6-inch lengths - for approval of color and tone.

D. Provide samples for transition strips between tile and carpet and tile and concrete

1. See finish schedule.

1.3 QUALITY ASSURANCE

A. Standards: Mortar and grout materials and installation standards of the American National Standards Institute (ANSI) and Standard Specification for Ceramic Tile ANSI A137.1 apply to the work, except as otherwise indicated.

B. Source of Materials: Provide materials from a single source for each type and color of tile, grout, and setting materials

1.4 DELIVERY STORAGE AND HANDLING:

A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use. Prevent damage or contamination to materials by

water, freezing, foreign matter or other causes.

1.5 EXTRA MATERIALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 PROJECT CONDITIONS:

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at not less than 50 degrees F in tiled areas during installation and for 7 days after completion, unless higher temperatures required by referenced installation standard or manufacturer's instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Colors, Textures and Patterns: As selected by Architect from manufacturer's standard colors, textures and patterns.

1. Provide tile trim and accessories to match color and finish of adjacent flat tile.
2. Provide floor transition strips between tile and adjacent flooring as shown in the construction documents. Typical at each transition between tile and carpet, tile and vinyl and tile and concrete.

B. Size and Thicknesses: Manufacturer's standard and as indicated.

2.2 TILE PRODUCTS

A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.

B. Refer to finish schedule for all manufacturers, sizes, thicknesses, surfaces, finishes, and colors.

1. Grout: Epoxy Grout, Color as selected by Architect from manufacturer's full range .

2.3 THRESHOLDS

A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.

1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

B. Solid Surface Thresholds: ASTM C 503, with a minimum abrasion resistance of 12 per ASTM C 1353 or ASTM C 241 and with honed finish.

2.4 SETTING MATERIALS

A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4. used on floor surfaces and walls

B. EBM-Lite Epoxy Bonding Mortar - 100% Solids, used on tile to be set on stair treads and risers and mop sinks.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mapei Kerabond/Keralastic for Cement Bonding mortar and Kerapoxy 400, for Epoxy bonding Mortar or comparable product by one of the following:

a. C-Cure.
b. Custom Building Products.
c. Laticrete International, Inc.
d. MAPEI Corporation.
e. TEC; a subsidiary of H. B. Fuller Company.

2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site. or
3. Provide prepackaged, dry-mortar mix combined with acrylic resin or styrene-butadiene- rubber liquid-latex additive at Project site.
4. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.5 GROUT MATERIALS

A. Floor, and at stairs to receive base Grout: Water-Cleanable Epoxy Grout - ANSI A118.3, with a VOC content of 65 g/L or less when calculated according to 40 CFR 59, Subpart D.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mapei Kerapoxy IEG, CQ Colored Quartz or comparable product by one of the following:

a. C-Cure.
b. Custom Building Products.
c. Laticrete International, Inc.
d. MAPEI Corporation.
e. TEC; a subsidiary of H. B. Fuller Company.

B. Wall Grout: Polymer-Modified Grout: ANSI A 118.7:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Mapai Keracolor U or comparable product by one of the following:

a. C-Cure.
b. Custom Building Products.
c. Laticrete International, Inc.
d. MAPEI Corporation.
e. TEC; a subsidiary of H. B. Fuller Company.

2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.

2.6 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, provide one of the following

a. DAP Inc.; 100 percent Silicone Kitchen and Bath Sealant
b. Dow Corning Corporation; Dow Corning 786.
c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
f. Tremco Incorporated; Tremsil 600 White.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland

cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, stainless steel, ASTM A 666, 300 Series exposed-edge material. Used at all transitions from tile to concrete.

C. Provide transition strips per the finish schedule in drawings, to fit tile thickness of tile at all tile to carpet transitions.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout. Do not seal epoxy grout. Once cured, epoxy grout is nonabsorbent (impervious) and will not absorb the grout sealer.

1. Products: Subject to compliance with requirements, provide one of the following

a. Bonsal American, an Oldcastle company; Grout Sealer.
b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer .
c. C-Cure; Penetrating Sealer 978.
d. Custom Building Products; Surfaceguard Grout and Tile Sealer.
e. Jamo Inc.; Penetrating Sealer.
f. MAPEI Corporation; KER 003, Silicone Spray Sealer for Cementitious Tile Grout .
g. Southern Grouts & Mortars, Inc.; Silicone Grout Sealer.
h. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
i. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

E. Epoxy Grout Film Remover: Use manufacturers recommended epoxy grout film remover to clean all residual epoxy grout film from the tile surfaces. Test a small area before application to verify that the product does not cause discoloration of the tile material or grout material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.

C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

3.3 INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:

    a. Tile floors in wet areas.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:

1. Ceramic Mosaic Tile: 1/16 inch.

2. Glazed Wall Tile: 1/16 inch.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
3. Use Schluter DILEX-BWB color to match tile as selected by architect for lobby tile movement joint. See Entry Lobby Finish Plan for location.

H. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thin set).

I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.

J. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout- sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

K. Install glass mat water resistant backing board and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

L. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

M. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

N. Cleaning: Mechanically clean all tile surfaces at completion of installation in the following locations:

1. All Stairs
2. All Restrooms

3.4 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations at Public Bathroom, Concrete Subfloor:

1. Tile Installation F122: Thin-set mortar on waterproof membrane; TCA F122.

a. Tile Type: T1.
b. Thin-Set Mortar: Latex-portland cement mortar.
c. Grout: Epoxy grout.

B. Interior Wall Installations at drinking fountain, Metal Studs or Furring:

1. Tile Installation W245: Thin-set mortar on coated glass-mat, water-resistant gypsum backer board; TCA W245.

a. Tile Type: As indicated on drawings.
b. Thin-Set Mortar: Dry-set portland cement mortar.
c. Grout: Epoxy grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:

1. Acoustical panels and exposed suspension systems for ceilings.

1.2 SUBMITTALS

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

B. Coordination Drawings: Drawn to scale and coordinating acoustical panel ceiling installation with hanger attachment to building structure and ceiling mounted items:

C. Samples: For each exposed finish.

D. Product test reports.

E. Research/evaluation reports.

F. Maintenance data.

1.3 QUALITY ASSURANCE

A. Acoustical Testing Agency Qualifications: An independent testing laboratory or an NVLAP- accredited laboratory.

B. Fire-Test-Response Characteristics:

1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Acoustical panels complying with ASTM E 1264 for Class A materials, when tested per ASTM E 84.

a. Smoke-Developed Index: 450 or less.

C. Seismic Standard: Comply with the following:

1. Standard for Ceiling Suspension Systems Requiring Seismic Restraint: Comply with ASTM E 580.
2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
3. CISCA's Guidelines for Systems Requiring Seismic Restraint: Comply with CISCA's "Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies--Seismic Zones 3 & 4."
4. ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."

D. Preinstallation Conference: Conduct conference at Project site.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANEL CEILINGS, GENERAL

A. Acoustical Panel Standard: Comply with ASTM E 1264.

B. Metal Suspension System Standard: Comply with ASTM C 635.

C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Expansion anchors fabricated from corrosion-resistant materials, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with

capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.

D. Wire Hangers, Braces, and Ties: Zinc-coated carbon-steel wire; ASTM A 641/A 641M, Class 1 zinc coating, soft temper.

1. Size: Select wire diameter so its stress at 3 times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire.

E. Seismic perimeter stabilizer bars, seismic struts, and seismic clips.

Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

2.2 ACOUSTICAL PANELS: (Indicated in drawings as ACT-1)

A. Products: Subject to compliance with requirements, provide ONLY the following:

1. USG Interiors, Inc.; Frost 419

B. Color: Flat White 050

C. LR: Not less than 0.83.

D. NRC: Not less than 0.70

E. CAC: Not less than 38/40.

F. Edge/Joint Detail: FLB

G. Thickness: 5/8 inch

H. Modular Size: 24 by 24 inches.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING

A. Products: Subject to compliance with requirements, provide ONLY the following:

1. ACT-1 locations:

a. USG - Centricitee DXT Grid

B. Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating

designation, with prefinished 15/16-inch- wide metal caps on flanges.

1. Structural Classification: Heavy-duty system.
2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
3. Cap Material: Steel or aluminum cold-rolled sheet.
4. Cap Finish: Painted white.

2.4 METAL EDGE MOLDINGS AND TRIM

A. Products: Subject to compliance with requirements, provide one of the following:

1. Armstrong World Industries, Inc.
2. BPB USA
3. Chicago Metallic Corporation
4. USG Interiors, Inc.

B. Basis-of-Design Product: Subject to compliance with requirements, provide 7/8 inch Edge clip molding BERC 1940, 1 inch border as mfg by Armstrong.

C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.

1. Provide manfuacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners, unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

    a. Manufacterer's standard, factory-applied prime-coat finish ready for field painting.

4. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: Acid-chromate-fluoride-phosphate conversion coating; organic coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASTM C 636 and seismic design requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders.

C. Suspend ceiling hangers from building's structural members, plumb and free from contact with insulation or other objects within ceiling plenum. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers, use trapezes or equivalent devices. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.

1. Do not support ceilings directly from permanent metal forms or floor deck; anchor into concrete slabs.
2. Do not attach hangers to steel deck tabs.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.2 SUBMITTALS

A. Product Data: Submit 2 copies of manufacturer's technical data and installation instructions for each type of resilient flooring and accessory.

B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 2.5" inches long, of each resilient product color, texture, and pattern required.

1. For initial selection of colors and patterns submit samples in form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.

1.3 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

B. Manufacturer: Provide each type of resilient base and accessories produced by a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

C. Maintenance Instructions: Submit copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

B. Until Substantial Completion, maintain ambient temperatures within range

recommended by manufacturer.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE (RB-1)

A. Resilient Base:

1. Manufacturers: Subject to compliance with requirements, provide the following:

a. Basis of Design Roppe Corporation, USA.

B. Resilient Base Standard: ASTM F 1861.

1. Material Requirement: Type TP (rubber, thermoplastic) .
2. Manufacturing Method: Group I (solid, homogeneous) .
3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: As selected in finish schedule.

I. Colors and Patterns: As selected in finish schedule.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Moisture Testing: Perform tests recommended by manufacturer. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

3.3 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.

1. Apply two coat(s).

C. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates: Includes but is not limited to the specific locations listed below.

1. Concrete masonry units (CMU)
2. Steel
3. Gypsum board.

1.2 SUBMITTALS

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

B. Samples: For each finish and for each color and texture required.

C. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.3 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples 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. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.

3. Final approval of color selections will be based on benchmark samples.

    a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

1.4 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

    1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied, up to 400 gallons.

PART 2 - PRODUCTS

2.1 PAINT, GENERAL

A. Field Applied Interior and Exterior Paints and Coatings

    1. Preferred Manufacturers: Subject to compliance with requirements, provide products by the following:

        a. ICI Paints.
        b. Devoe Paints.
        c. Sherwin Williams.
        d. Kwal and Comex Paint.

B. Material Compatibility:

    1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
    2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

    1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
    2. Nonflat Paints, Coatings, and Primers: VOC content of not more than 150 g/L.
    3. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more

than 250 g/L.
4. Floor Coatings: VOC not more than 100 g/L.
5. Shellacs, Clear: VOC not more than 730 g/L.
6. Shellacs, Pigmented: VOC not more than 550 g/L.
7. Flat Topcoat Paints: VOC content of not more than 50 g/L.
8. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
9. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC not more than 250 g/L.
10. Floor Coatings: VOC not more than 100 g/L.
11. Shellacs, Clear: VOC not more than 730 g/L.
12. Shellacs, Pigmented: VOC not more than 550 g/L.
13. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
14. Dry-Fog Coatings: VOC content of not more than 400 g/L.
15. Zinc-Rich Industrial Maintenance Primers: VOC content of not more than 340 g/L.
16. Pre-Treatment Wash Primers: VOC content of not more than 420 g/L.

D. Chemical Components of Field-Applied Interior Paints and Coatings: Provide topcoat paints and anti-corrosive and anti-rust paints applied to ferrous metals that comply with the following chemical restrictions; these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:

1. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
2. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.

v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.
y. Vinyl chloride.

E. Colors: As designated in the finish schedule and approved by submittal by the Architect.

2.2 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

1. VOC Content: E Range of E3.
2. Provide 2 coats of Latex Block Filler primer on all exposed and painted CMU.

2.3 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 1.

B. Interior Alkyd Primer/Sealer: MPI #45.

1. VOC Content: E Range of E2.

2.4 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of E1.

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of E2.

C. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

D. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of E1.
2. Environmental Performance Rating: EPR 2.
3. For all interior and exterior stair railing and guardrails, see Specifications section 099600-3.5,C

E. Vinyl Wash Primer: MPI #80.

1. VOC Content: E Range of E2.

2.5 LATEX PAINTS

A. Interior Latex (Satin): MPI #44 (Gloss Level 2)

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 3.

B. Interior Latex (High Side Satin): MPI #52 (Gloss Level 3)

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

C. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 3.

D. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 6.

E. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of E2.

F. Interior Epoxy-Modified Latex (Gloss): MPI #115 (Gloss Level 6).

2.6 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of E2.

2.7 DRY FOG/FALL COATINGS

A. Latex Dry Fog/Fall: MPI #118.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

B. Waterborne Dry Fall: MPI #133.

1. VOC Content: E Range of E2.
2. Environmental Performance Rating: EPR 2.

C. Interior Alkyd Dry Fog/Fall: MPI #55.

1. VOC Content: E Range of E2.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION AND APPLICATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and re-prime substrate with compatible primers as required to produce paint systems indicated.

C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

D. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.

2. Electrical Work:

a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.

E. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

F. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.3 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System: MPI INT 3.2G.

a. First Coat: Interior/exterior clear concrete floor sealer (water based).
b. Topcoat: Interior/exterior clear concrete floor sealer (water based).

B. CMU Substrates:

1. High-Performance Architectural Latex System: MPI INT 4.2D.

a. Prime Coat: 1 coats of Interior/exterior C302 Ultratech 100% acrylic block filler.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Kwall Builders select vinyl acrylic eggshell stipple enamel 3070.

C. Steel Substrates: Interior frames

1. High-Performance Architectural Latex System: MPI INT 5.1R.

a. Prime Coat: Zinsser High Hide Cover Stain Oil Based Primer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex (semigloss).

D. Gypsum Board Substrates:

1. Architectural Latex System for Walls :

a. Prime Coat Basis of design: Comex UltraTech Interior Latex Multi-Solution Primer/Sealer C152.
b. Intermediate Coat: Architectural latex matching topcoat. c. Topcoat:

1) At accent walls Basis of design: Comex UltraTech Interior Latesx Eggshell Enamel C106
2) At other walls Basis of design: Kwal Builders Select Vinyl Acrylic Eggshell Stipple Enamel 3070.

2. Architectural Latex System for Walls (gloss): Bathroom walls and ceilings

a. Prime Coat Basis of design: Comex UltraTech Interior latex Multi-Solution Primer/Sealer C152.
b. Intermediate Coat: Architectural latex matching topcoat.

E. Topcoat Basis of design: Comex Waterborne Acrylic Epoxy Enamel E-7000.Fire Treated Plywood/ wood Substrates in Electrical Main BDF Room:

1. Interior Latex (Semigloss): MPI #54 (Gloss Level)

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex (satin).
d. Leave fire treated stamp exposed.

END OF SECTION 099123

SECTION 101426 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Signs – No Parking and Event Staff Only.

1.3 QUALITY ASSURANCE

A. Action Submittals for the following:

1. Product Data: For each sign attachment system.
2. Shop Drawings: For each sign type.
3. Samples: For each sign type.

PART 2 - PRODUCTS

2.1 SIGNS

A. Signs to be provided according to the designs on Sheet L7-05.

1. Aluminum-Sheet Sign Panels: Aluminum sheet with vinyl film graphics.
2. Graphics: Reflective white engineering grade vinyl film background with translucent and opaque vinyl film overly graphics according to the specifications on the drawing.
3. Hardware: Vandal resistant stainless steel hardware on the back side with no exposed fasteners visible from the front.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using installation methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to accessibility standard.
3. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
4. Remove temporary protective coverings and strippable films as signs are installed.
5. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish only if approved by Owner’s Representative. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Sign – No Parking: Measurement will be made per each for installation of sign – no parking. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation, including anchors, of sign – no parking as defined herein.

B. Sign – Event Staff Only: Measurement will be made per each for installation of sign – event staff only. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation, including anchors, of sign – event staff only as defined herein.

END OF SECTION 101426

SECTION 102113 – TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-color, solid-plastic, high-density Polyethylene, pilaster-type toilet compartments configured as toilet enclosures and urinal screens.

B. Related Sections:

1. Division 10 Section "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.

1. Show locations of cutouts for compartment-mounted toilet accessories.
2. Show locations of reinforcements for compartment-mounted grab bars.
3. Show locations of centerlines of toilet fixtures.

C. Samples for Initial Selection: For each type of unit indicated. Include Samples of hardware and accessories involving material and color selection

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated: square Samples of same thickness and material indicated for Work.

1. Each type of material, color, and finish required for units, prepared on 6-inch square samples of the same thickness and material indicated for work.
2. Each type of hardware and accessory.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of toilet compartment, from manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 200 or less.
2. Smoke-Developed Index: 450 or less.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stiles, Panels, Doors and Screens

1. Stiles, Panels, Doors, and Screens shall be all manufactured from solid-plastic, high-density, polyethylene material.

B. Toilet Partition Material

1. Toilet partitions shall be constructed of solid-plastic, high-density, polyethylene material. Material shall have a non-ghosting, graffiti resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface.

2. Subject to compliance with the material performance requirements, provide a product by one of the following or approved equal by Architect/Owner:

a. Bradley Corporation
b. Hadrian Inc.
c. Manning Materials Inc.
d. Metpar Corporation
e. Scranton Products

C. Finish: Colors as selected from manufacturer's standard range.

D. Hardware

1. Solid plastic pilaster shoes and full continuous plastic wall brackets, color to coordinate with system.
2. Hardware: Manufacturer's standard design, heavy-duty operating hardware and accessories, cast aluminum.
3. Anchorages and fasteners: Manufacturer's standard exposed fasteners of finish to match hardware, with security screw-type heads and nuts.

E. For each stall, pull, heavy slide bar latch, rubber-tipped bumpers, gravity hinges with concealed ball-bearing rollers. Coordinate, prepare as required for other accessories as specified in this section.

2.2 FABRICATION

A. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.

B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.

C. Urinal-Screen Posts: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment at tops and bottoms of posts. Provide shoes and sleeves (caps) at posts to conceal anchorage.

D. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide, in-swinging doors for standard toilet compartments and 36-inch- wide, out-swinging doors with a minimum 32-inch- wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.

1. Maximum Clearances:

a. Pilasters and Panels: 1/2 inch.
b. Panels and Walls: 1 inch.

2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
b. Align brackets at pilasters with brackets at walls.

B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches (44 mm) into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.

C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 102113

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Public-use toilet room accessories:
   a. Grab Bars
   b. Wall-Mounted Mirrors
   c. Warm-air dryers
   d. Paper Towel Dispensers
   e. Toilet Paper Dispensers
   f. Hand Soap Dispensers
   g. Female Napkin Disposals
   h. Wall Hooks
   i. ADA shower inserts

2. Broom / Mop Hanger Units
3. Underlavatory guards
4. Baby Changing Stations

1.3 SUBMITTALS

A. Product Data: Submit manufacturer product data for each item specified including details of construction relative to materials, dimensions, operations, gages, profiles, method of mounting and finishes.

B. Product Schedule: Indicating types, quantities, sizes.

C. Maintenance data.

D. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in

NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PUBLIC-USE TOILET ROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

B. Grab Bar:

1. Basis-of-Design Product: Bradley Model 812 or approved equal.
2. Mounting: Flanges with concealed fasteners.

a. Ensure installation of grab bar manufacturer’s recommended blocking

3. Material: ASTM A167 Type 304, Stainless Steel.

a. Finish: Smooth, No. 4 finish (satin).
b. Escutcheons: 22 gauge stainless steel
c. Flanges: 3-1/8” diameter 13 gauge stainless steel
d. Tubing: 18 gauge stainless steel

4. Outside Diameter: 1-1/2 inches.
5. Configuration and Length: As indicated on Drawings.

C. Wall Mounted Mirror Unit (provide one at every sink within the project and one at start dressing counter):

1. Basis-of-Design Product: Bradley Model 781 or approved equal.

2. Frame: Stainless-steel channel.

    a. Corners: Manufacturer's standard, 90° Mitered.

3. Materials: Manufacturer's Standard.

    a. Frame: Stainless Steel channel, 3/4" x 3/4" 7/16".
    b. Mirror: ASTM C 1036 1/4" float glass triple-silver-plated with electro-copper-plated layer.
    c. Backing: galvanized steel backing sheet not less than 0.034 inch and full mirror size, with non-absorptive filler material.
    d. Unique Mirror Trim Detail: See drawings for detail at restroom mirrors that extend above the tile wainscot. An MDF board shall be used as a filler behind the mirror together with the tile Schluter trim. Coordinate typical mirror hardware with this detail.

4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.

    a. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts. Mirror must not rest on any horizontal surface.

5. Size: 36" high x 24" wide at sinks.
6. Size: 36" high x 96" wide at star dressing counter.

D. Warm-Air Dryer: World Hand Dryer, model XA5 surface mount or approved equal. See plans for locations. Provided and installed by Contractor.
    1. White porcelain enamel cast iron cover
    2. 115 AC, 20 amp, 2300 watts, 60 Hz

E. Paper Towel Dispenser – Provided by Owner, installed by Contractor. See plans for locations.

    1. Georgia Pacific GPC 543-38 Hygienic Push-Paddle roll towel dispenser, Translucent Smoke color.

F. Toilet Paper Dispenser – Provided by Owner, installed by Contractor.

    1. Georgia Pacific GPC 565-13 Professional SofPull Mini Coreless Centerpull bath tissue dispenser, Smoke color.

G. Hand Soap Dispenser: (Provide one at each sink location within project) Uline Bulk Foaming Soap Dispenser, H-3476, 46 oz. or approved equal.

H. Female Napkin Disposals - (Provide at each Women's toilet and Star WC, WC1 and WC2), Bradley 4722-15 or approved equal.

I. Wall Hooks: (Provide one at each restroom stall enclosure on back of door, ADA stalls will require this to be mounted no more than 48" above finish floor) Bobrick, model B-212, or approved equal.

J. ADA transfer shower inserts: Provide (1) each at Star WC and WC2 per plans. Basis-of-Design to be Kohler K-12101-C-0 Freewill, one-piece barrier-free transfer commercial shower stall in White, or approved equal. Please note that the Star WC location is a left-hand seat orientation and the WC2 is a right-hand seat.

2.2 BROOM / MOP HANGER UNITS

A. Manufacturer: Bradley Model 9933, Satin Finish Stainless Steel, or approved equal.

B. Provide (1) at each of the Custodial/Mop rooms.

2.3 UNDERLAVATORY GUARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Plumberex Specialty Products, Inc.
2. Truebro by IPS Corporation.

B. Underlavatory Guard:

1. Basis-of-Design Product: Plumberex; Handy-Shield Maxx.
2. Description: Insulating pipe covering for supply and drain piping assemblies that prevent direct contact with and burns from piping; allow service access without removing coverings.
3. Material and Finish: Antimicrobial, molded plastic, white.

2.4 BABY CHANGING STATION

A. Manufacturer: Koala Kare KB112-01RE, or approved equal.

B. Provide where indicated on drawings.

2.5 FABRICATION

A. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

1. Install backing around all toilets in preparation for the possible installation of grab bars at some time in the future.

END OF SECTION 102800

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Fire protection cabinets for fire extinguishers.
2. Exterior Key Boxes

1.2 SUBMITTALS

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

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each exposed product and for each color and texture specified. D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304 #4 finish

B. Full Gl

2.2 FIRE PROTECTION CABINET (FEC)

A. Cabinet Type: Suitable for fire extinguisher.

1. Products: Subject to compliance with requirements, provide one of the following

a. J. L. Industries, Inc., a division of Activar Construction Products Group;
b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc;
c. Larsen's Manufacturing Company;
d. Potter Roemer LLC;
e. Watrous Division, American Specialties, Inc.;

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Stainless-steel #4 finish.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.

1. Rolled-Edge Trim: 2-1/2-inch backbend depth.

E. Cabinet Trim Material: Steel sheet.

F. Door Material: Stainless-steel #4 finish.

G. Door Style: Fully glazed panel with frame.

H. Door Glazing: Clear tempered

I. Door Hardware: Manufacturer's standard door-operating hardware with breakaway latch of proper type for cabinet type, trim style, and door material and style indicated.

J. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Door Lock: Cylinder lock, keyed alike to other cabinets. Cabinets must include locks that have a keyway that fits ILCO key 01122.
3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as directed by Architect .

a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door.
2) Application Process: Decals.
3) Lettering Color: Red.

4) Orientation: Horizontal.

2.3 EXTERIOR KEY BOXES

A. Manufacturers:

1. Knox Company – Phoenix, AZ (800) 552-5669
2. Others as approved by the Architect prior to bidding

B. Box Type: Knox Box 3200 Series

C. Mounting: Recessed

D. Finish Color: Stainless Steel or Aluminum

E. Key boxes shall meet City of Grand Junction Keying requirements. Locate key box on building per authority having jurisdiction's recommendation.

2.4 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Miter and weld joints and grind smooth.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed and prepare recesses as required by type and size of cabinet and trim style.

B. Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.

C. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

D. Identification: Apply decals at locations indicated.

E. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

F. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers.

1.2 SUBMITTALS

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

B. Operation and maintenance data.

C. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

C. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

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

a. Failure of hydrostatic test according to NFPA 10.
b. Faulty operation of valves or release levers.

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

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amerex Corporation.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: Amerex model #A456, with aluminum heads. UL-rated 4-A: 60-B:C 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

1. Include locks that have a keyway that fits ILCO key 01122. Examples: All-Lock Cam lock code numbers AC8499, AC8599, AC8699.

C. Wet Chemical Stored Pressure Class "K" Kitchen Type: Amerex model #B260, with aluminum heads. UL-rated 2-A, with potassium acetate-based agent in manufacturer's standard stainless steel container.

D. Include locks that have a keyway that fits ILCO key 01122. Examples: All-Lock Cam lock code numbers AC8499, AC8599, AC8699.

2.2 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers in locations indicated and in compliance with requirements of authorities having jurisdiction.

END OF SECTION 104416

SECTION 111300 - LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Dock Bumpers

1.2 RELATED SECTIONS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 055000 - Metal Fabrications.

1.3 SUBMITTALS

A. Submit under provisions of Section 013000 - Administrative Requirements.

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: Showing overall dimensions (width, height) and location of electrical service panels and motor locations. Supporting construction requirements and equipment structural attachment. Operating range and required clearances.

D. Closeout Submittals: Submit manufacturer's owner's manual, maintenance manual and master service manual. Submit manufacturer's warranty for each product.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square, representing actual product, color, and patterns.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Providing sole source for design, engineering, manufacturing and warranty claims handling. Company specializing in manufacturing products specified with a minimum 20 years experience.

B. Installer Qualifications: Trained, certified and approved by manufacturer, with documented experience on similar projects.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.6 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 limits.

1.7 WARRANTY

A. Manufacturer's Warrantees: Subject to standard limitations on liability.

1. Customer Satisfaction Warranty Period: Twelve month money-back warranty.
2. Warranty Period for Parts: Five years, standard.
3. Warranty Period for Labor: One year, standard.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Manufacturer: Rite-Hite, which is located at: 8900 N. Arbon Dr.; Milwaukee, WI 53223; Toll Free Tel: 888-214-0882; Tel: 414-355-2600; Fax: 414-355-9248; Email: request info (info@ritehite.com); Web: www.ritehite.com

B. Substitutions: Permitted as approved by Architect.

2.2 DOCK BUMPERS

A. Laminated-Tread Bumpers

1. Fabricated from multiple, uniformly thick plies cut from fabric-reinforced rubber tires. Laminate plies under pressure on not less than two 3/4-inch- diameter, steel supporting rods that are welded at one end to 1/4-inch- thick, structural-steel end angle and secured with a nut and angle at the other end. Fabricate angles with predrilled anchor holes and sized to provide not less than 1 inch of tread plies extending beyond the face of closure angles.
2. Thickness: 4-1/2 inches.
3. Horizontal Style:

a. 12 inches high by 15 inches long.

B. Anchorage Devices

1. Hot-dip galvanized steel anchor bolts, nuts, washers, bolts, sleeves, cast-in-place plates, and other anchorage devices as required to fasten bumpers securely in place and to suit installation type indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installer shall examine the opening and conditions under which dock equipment is to be installed and notify the Architect and Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

B. Do not begin installation until openings have been properly prepared.

C. If 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, and in proper relationship with adjacent construction.

B. Before acceptance, a demonstration shall be conducted in the presence of the Owner's representative that all equipment operates properly in every aspect. Conduct a detailed user/operator training session at time and place agreed upon by Owner's representative.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 111300

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Trash/recycling receptacles.

2. Benches

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Trash/Recycling Receptacle Inner Containers: Two full-size units.

PART 2 - PRODUCTS

2.1 TRASH/RECYCLE RECEPTACLES

A. Basis of Design Product: Provide 32 gallon painted metal trash/recycling bins with arch lid and square plastic liners, Model: Diamond, Item #166-1377, as supplied by Highland Products Group, LLC, Boca Raton, FL, 800-695-3503 or approved equal.

1. Frame: 11 gauge steel, with text cut into hinged and latched front door, lock – standard, to be selected by Owner's Representative.
2. Finish: Thermoplastic, copolymer-based, 25-30 mils, color – standard, to be selected by Owner's Representative.
3. Liner: Heavy-duty, square polyethylene plastic, color – black.

4. Mounting: Surface.

2.2 BENCHES

A. Basis of Design Product: To be specified by the City of Grand Junction.

2.3 MATERIALS

A. Steel and Iron: Free of surface blemishes and complying with the following:

1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513/A 513M, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
6. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
7. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.

B. Anchors, Fasteners, Fittings, and Hardware: Stainless steel; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

1. Angle Anchors: For inconspicuously bolting legs of site furnishings to on or below-grade substrate; one per leg.
2. Antitheft Hold-Down Brackets: For securing site furnishings to substrate; two per unit.

2.4 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.5 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard thermoplastic powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.7 IRON FINISHES

A. Powder-Coat Finish: Manufacturer's standard thermoplastic powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

1. If not supplied by Manufacturer, Contractor to provide anchoring hardware and fasteners as required at no additional cost to the Owner.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Benches: Benches and installation of benches shall be specified by the City of Grand Junction.

B. Trash/Recycling Receptacles: Measurement will be made per each for installation of trash/recycling receptacles. Payment will be made at the contract unit price per each and shall include all costs associated with the satisfactory furnishing and installation, including anchors, of trash/recycling receptacles as defined herein, and the furnishing of two additional liners for the Owner.

END OF SECTION 129300

SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 230519 - METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.
5. Test plugs.
6. Test-plug kits.

B. Related Sections:

1. Division 15 Section "Facility Fire-Suppression Water-Service Piping" for fire-protection water-service meters outside the building.
2. Division 15 fire-suppression piping Sections for fire-protection pressure gages.
3. Division 15 Section "Facility Water Distribution Piping" for domestic water meters and combined domestic and fire-protection water-service meters outside the building.
4. Division 15 Section " Domestic Water Piping" for water meters inside the building.

1.3 SUBMITTALS

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

B. Product Certificates: For each type of meter and gage, from manufacturer.

C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Flo Fab Inc.
   b. Miljoco Corporation.
   c. Palmer Wahl Instrumentation Group.
   d. Tel-Tru Manufacturing Company.
   e. Trerice, H. O. Co.
   f. Weiss Instruments, Inc.
   g. Winters Instruments - U.S.

2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue[**or red**] organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.

   a. Design for Thermowell Installation: Bare stem.

9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMETEK, Inc.; U.S. Gauge.
   b. Ashcroft Inc.
   c. Trerice, H. O. Co.
   d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.

4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.3 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/4, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/4, ASME B1.20.1 pipe threads.

2.4 TEST PLUGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Miljoco Corporation.
3. National Meter, Inc.
4. Peterson Equipment Co., Inc.
5. Sisco Manufacturing Company, Inc.
6. Trerice, H. O. Co.
7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
8. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/4, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.5 TEST-PLUG KITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. Peterson Equipment Co., Inc.
3. Trerice, H. O. Co.
4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
5. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending a minimum of 2 inches into fluid and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.

2. Inlets and outlets of each domestic water heat exchanger.
3. Inlet and outlet of each domestic hot-water storage tank.
4. Inlet and outlet of each remote domestic water chiller.

J. Install pressure gages in the following locations:

1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION 220519

SECTION 220523.12 - BALL VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

   1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.18 for solder-joint connections.
3. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4.

H. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRONZE BALL VALVES

A. Two-Piece, Bronze Ball Valves with Full Port, and Bronze or Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Crane; Crane Energy Flow Solutions.
c. Hammond Valve.
d. NIBCO INC.
e. Watts; a Watts Water Technologies company.
f. Zurn Industries, LLC.

2. Description:

   a. Standard: MSS SP-110.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded and soldered.
   f. Seats: PTFE.
   g. Stem: Bronze or brass.
   h. Ball: Chrome-plated brass.
   i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Copper Tubing, NPS 5 and Larger: Flanged ends.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Two-piece, bronze ball valves with full port and bronze or brass trim.

END OF SECTION 220523.12

SECTION 220523.14 - CHECK VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Bronze lift check valves.
2. Iron, center-guided check valves.
3. Iron, plate-type check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

1. Maintain valve end protection.

2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.18 for solder joint.
4. ASME B31.9 for building services piping valves.

C. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.

D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.

E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE LIFT CHECK VALVES

A. Class 125, Lift Check Valves with Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane; Crane Energy Flow Solutions.
b. Jenkins Valves; Crane Energy Flow Solutions.
c. Stockham; Crane Energy Flow Solutions.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Design: Vertical flow.
d. Body Material: ASTM B 61 or ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

2.3 IRON, CENTER-GUIDED, SPRING-LOADED CHECK VALVES

A. Class 125, Iron, Globe, Center-Guided Check Valves with Metal Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DFT Inc.
b. Hammond Valve.
c. Metraflex Company (The).
d. Mueller Steam Specialty.
e. NIBCO INC.
f. Watts; a Watts Water Technologies company.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Globe, spring loaded.
e. Ends: Flanged.
f. Seat: Bronze.

B. Class 125, Iron, Compact-Wafer, Center-Guided Check Valves with Resilient Seat:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DFT Inc.
b. Hammond Valve.
c. NIBCO INC.
d. Val-Matic Valve & Manufacturing Corp.

2. Description:

a. Standard: MSS SP-125.
b. CWP Rating: 200 psig.
c. Body Material: ASTM A 126, gray iron.
d. Style: Compact wafer, spring loaded.
e. Seat: EPDM.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:
   1. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
   2. Lift Check Valves: With stem upright and plumb.

F. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

    a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
    b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or spring; or iron, center-guided, metal-seat or resilient-seat check valves.
    c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged or threaded.
3. For Copper Tubing, NPS 5 and Larger: Flanged.
4. For Steel Piping, NPS 2 and Smaller: Threaded.
5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged or threaded.
6. For Steel Piping, NPS 5 and Larger: Flanged.
7. For Grooved-End Copper Tubing: Grooved.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Bronze swing check valves, Class 125, bronze disc with soldered or threaded end connections.

B. Pipe NPS 2-1/2 and Larger:
1. Iron, center-guided check valves, Class 125, compact wafer.

END OF SECTION 220523.14

SECTION 220539 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 15 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to [AWS D1.1, "Structural Welding Code--Steel."] [AWS D1.4, "Structural Welding Code--Reinforcing Steel."] [ASME Boiler and Pressure Vessel Code: Section IX.]

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Grinnell Corp.
4. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Thomas & Betts Corporation.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate] [Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass] [ASTM C 552, Type II cellular glass] with vapor barrier.

D. Insulation-Insert Material for Hot Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate] [Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass] [ASTM C 552, Type II cellular glass].

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 220529

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Warning signs and labels.
   3. Pipe labels.
   4. Stencils.
   5. Valve tags.
   6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
   2. Letter Color: White.
   3. Background Color: Black.
   4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless-steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
   1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
   2. Lettering Size: At least 1-1/2 inches high.

2.4 STENCILS

A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
   1. Stencil Material: Fiberboard or metal.
   2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
   3. Identification Paint: Exterior, in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
   1. Size: 3 by 5-1/4 inches minimum.
   2. Fasteners: Brass grommet and wire.
   3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
   4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.
   1. Identification Paint: Use for contrasting background.
   2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Near each valve and control device.
   2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
   3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220719 - PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Insulation Materials:
   a. Mineral fiber.

2. Insulating cements.
3. Sealants.
4. Factory-applied jackets.
5. Field-applied jackets.
6. Tapes.
7. Corner angles.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

B. Shop Drawings:

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.
8. Detail field application for each equipment type.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Mockups: Before installing insulation, build mockups for each type of insulation and finish listed below to demonstrate quality of insulation application and finishes. Build mockups in the location indicated or, if not indicated, as directed by Architect. Use materials indicated for the completed Work.

1. Piping Mockups:

a. One 10-foot section of NPS 2 straight pipe.
b. One each of a 90-degree threaded, welded, and flanged elbow.
c. One each of a threaded, welded, and flanged tee fitting.
d. One NPS 2 or smaller valve, and one NPS 2-1/2 or larger valve.
e. Four support hangers including hanger shield and insert.
f. One threaded strainer and one flanged strainer with removable portion of insulation.
g. One threaded reducer and one welded reducer.
h. One pressure temperature tap.
i. One mechanical coupling.

2. Equipment Mockups: One tank or vessel.
3. For each mockup, fabricate cutaway sections to allow observation of application details for insulation materials, adhesives, mastics, attachments, and jackets.
4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
5. Obtain Architect's approval of mockups before starting insulation application.
6. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Johns Manville; Micro-Lok.
   b. Knauf Insulation; 1000(Pipe Insulation.
   c. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.3 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
b. Compac Corp.; 104 and 105.
c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

1. Verify that systems and equipment to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at [**2 inches**] [**4 inches**] o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Division 07 Section "Penetration Firestopping"irestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

3.6 MINERAL-FIBER INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.

3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.8 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2 and Larger: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:
   a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
2. Encasement for piping.

1.3 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.4 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

1.5 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect no fewer than two days in advance of proposed interruption of water service.
2. Do not interrupt water service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61 Annex G. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type K water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.4 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

Unions in "Dielectric Unions" Paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. A.Y. McDonald Mfg. Co.
    b. Capitol Manufacturing Company.
    c. Central Plastics Company.
    d. HART Industrial Unions, LLC.
    e. Jomar Valve.
    f. Watts; a Watts Water Technologies company.
    g. Wilkins.
    h. Zurn Industries, LLC.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Elster Perfection Corporation.
    b. Grinnell Mechanical Products.
    c. Precision Plumbing Products.
    d. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

D. Install shutoff valve immediately upstream of each dielectric fitting.

E. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

F. Install domestic water piping level without pitch and plumb.

G. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

L. Install piping to permit valve servicing.

M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

R. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

S. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.

G. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

3.4 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples unions.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.

2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.7 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.11 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:

1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

D. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.12 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly, ball valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following domestic water piping specialties:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Strainers.
6. Outlet boxes.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water hammer arresters.
11. Air vents.
12. Trap-seal primer valves.
13. Trap-seal primer systems.

B. Related Sections include the following:

1. Division 15 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
2. Division 15 Section "Domestic Water Piping" for water meters.
3. Division 15 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

1.3 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

1.4 SUBMITTALS

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

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. NSF Compliance:

1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers AVB:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Conbraco Industries, Inc.
    b. FEBCO; SPX Valves & Controls.
    c. Watts Industries, Inc.; Water Products Div.
    d. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1001.
3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Chrome plated.

B. Hose-Connection Vacuum Breakers VB:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Arrowhead Brass Products, Inc.

b. Cash Acme.
c. Conbraco Industries, Inc.
d. Legend Valve.
e. MIFAB, Inc.
f. Prier Products, Inc.
g. Watts Industries, Inc.; Water Products Div.
h. Woodford Manufacturing Company.
i. Zurn Plumbing Products Group; Light Commercial Operation.
j. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1011.
3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers PVB:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Co.
b. Conbraco Industries, Inc.
c. FEBCO; SPX Valves & Controls.
d. Flomatic Corporation.
e. Toro Company (The); Irrigation Div.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Accessories:

a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers SPVB:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Watts Industries, Inc.; Water Products Div.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:

a. Valves: Ball type, on inlet and outlet.

2.2 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers **RPZ**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Co.
    b. Conbraco Industries, Inc.
    c. FEBCO; SPX Valves & Controls.
    d. Flomatic Corporation.
    e. Watts Industries, Inc.; Water Products Div.
    f. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for vertical inlet, horizontal center section, and vertical outlet.
8. Accessories:

    a. Valves: Ball type with threaded ends on inlet and outlet ofNPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
    b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators **WPR**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme.
    b. Conbraco Industries, Inc.
    c. Honeywell Water Controls.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Body: Bronze for NPS 2 and smaller; cast iron for NPS 2-1/2 and NPS 3.
5. Valves for Booster Heater Water Supply: Include integral bypass.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves **BV**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. ITT Industries; Bell & Gossett Div.
    c. Watts Industries, Inc.; Water Products Div.

2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
3. Body: bronze,
4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:

    a. StrainersNPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Factory-installed, hose-end drain valve.

2.6 OUTLET BOXES

A. Icemaker Outlet Boxes **ICE**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Acorn Engineering Company.
    b. IPS Corporation.
    c. LSP Products Group, Inc.
    d. Oatey.
    e. Plastic Oddities; a division of Diverse Corporate Technologies.

2. Mounting: Recessed.
3. Material and Finish: Stainless-steel box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.7 HOSE BIBBS

A. Hose Bibbs **HB**:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants <**NFWH>**:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Josam Company.
    b. MIFAB, Inc.
    c. Prier Products, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Tyler Pipe; Wade Div.
    f. Watts Drainage Products Inc.
    g. Woodford Manufacturing Company.
    h. Zurn Plumbing Products Group; Light Commercial Operation.

i. Zurn Plumbing Products Group; Specification Drainage Operation.

3. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig.
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 3/4 or NPS 1.
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Polished nickel bronze.
11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
12. Nozzle and Wall-Plate Finish: Polished nickel bronze.
13. Operating Keys(s): Two with each wall hydrant.

2.9 WATER HAMMER ARRESTERS

A. Water Hammer Arresters <**WHA**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. AMTROL, Inc.
   b. Josam Company.
   c. MIFAB, Inc.
   d. PPP Inc.
   e. Sioux Chief Manufacturing Company, Inc.
   f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   g. Tyler Pipe; Wade Div.
   h. Watts Drainage Products Inc.
   i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.10 TRAP-SEAL PRIMER VALVES

A. Drainage-Type, Trap-Seal Primer Valves <**TP-D**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1044, lavatory P-trap with NPS 3/8 minimum, trap makeup connection.
3. Size: NPS 1-1/4 minimum.
4. Material: Chrome-plated, cast brass.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to Division 15 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
3. Do not install bypass piping around backflow preventers.

C. Install water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install thermometers and water regulators if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."

I. Install water hammer arresters in water piping according to PDI-WH 201.

J. Install drainage-type, trap-seal primer valves as lavatory trap with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Reduced-pressure-principle backflow preventers.
2. Water pressure-reducing valves.
3. Calibrated balancing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221123 - DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. In-line, sealless centrifugal pumps.

1.3 DEFINITIONS

A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include materials of construction, rated capacities, certified performance curves with operating points plotted on curves, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water pumps to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Retain shipping flange protective covers and protective coatings during storage.

B. Protect bearings and couplings against damage.

C. Comply with pump manufacturer's written rigging instructions for handling.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Armstrong Pumps, Inc.
2. Bell & Gossett; a Xylem brand.
3. Grundfos Pumps Corp.
4. WILO USA LLC - WILO Canada Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, sealless, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of domestic-water-piping system to verify actual locations of connections before pump installation.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install thermostats in hot-water return piping.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

a. Horizontally mounted, in-line, separately coupled centrifugal pumps.
b. Horizontally mounted, in-line, close-coupled centrifugal pumps.
c. Vertically mounted, in-line, close-coupled centrifugal pumps.
d. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

D. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."

1. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

E. Connect thermostats, [**timers**] to pumps that they control.

F. Interlock pump between water heater and hot-water storage tank with water heater burner and time-delay relay.

3.4 IDENTIFICATION

A. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" for identification of pumps.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Set thermostats, for automatic starting and stopping operation of pumps.
5. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

6. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
7. Start motor.
8. Open discharge valve slowly.
9. Adjust temperature settings on thermostats.
10. Adjust timer settings.

3.6 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following for soil, waste, and vent piping inside the building:

1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. LLDPE: Linear, low-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

G. TPE: Thermoplastic elastomer.

1.4 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.
2. Sanitary Sewer, Force-Main Piping: 50 psig.

B. Seismic Performance: Soil, waste, and vent piping and support and installation shall be capable of withstanding the effects of seismic events determined according to ASCE 7, "Minimum Design Loads for Buildings and Other Structures."

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. Field quality-control inspection and test reports.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PVC PIPE AND FITTINGS

A. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

B. Solvent Cement and Adhesive Primer:

1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXCAVATION

A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, soil and waste piping NPS 5 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Aboveground, vent piping NPS 5 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil, waste, and vent piping NPS 4 and smaller shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

G. Underground, soil and waste piping NPS 5 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

3.3 PIPING INSTALLATION

A. Sanitary sewer piping outside the building is specified in Division 22 Section "Facility Sanitary Sewers."

B. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

C. Install seismic restraints on piping. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

D. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

E. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

F. Install underground, steel, force-main piping.

G. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install engineered soil and waste drainage and vent piping systems as follows:

1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

L. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.

M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.4 JOINT CONSTRUCTION

A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."

3.5 HANGER AND SUPPORT INSTALLATION

A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:

1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs according to the following:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8 to NPS 12: 48 inches with 7/8-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.8 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.9 PROTECTION

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.
   2. Floor drains.
   3. Air-admittance valves.
   4. Miscellaneous sanitary drainage piping specialties.
   5. Flashing materials.

B. Related Sections include the following:

   1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
   2. Division 22 Section "Plumbing Fixtures" for hair interceptors.

1.3 DEFINITIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic.

B. FOG: Fats, oils, and greases.

C. FRP: Fiberglass-reinforced plastic.

D. HDPE: High-density polyethylene plastic.

E. PE: Polyethylene plastic.

F. PP: Polypropylene plastic.

G. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for the following:

1. Oil interceptors.

B. Shop Drawings: Show fabrication and installation details for frost-resistant vent terminals.

C. Manufacturer Seismic Qualification Certification: Submit certification that oil interceptors, accessories, and components will withstand seismic forces defined in Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment." Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Field quality-control test reports.

E. Operation and Maintenance Data: For drainage piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic sanitary piping specialty components.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate size and location of roof penetrations.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Metal Cleanouts; **CO**:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. MIFAB, Inc.
      c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      d. Tyler Pipe; Wade Div.
      e. Watts Drainage Products Inc.
      f. Zurn Plumbing Products Group; Specification Drainage Operation.

   2. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
   3. Size: Same as connected drainage piping
   4. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
   5. Closure: Countersunk or raised-head, cast-iron plug.
   6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Metal Floor Cleanouts; **FCO**:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule heavy-duty, adjustable housing cleanout.
   3. Size: Same as connected branch.
   4. Type: Heavy-duty, adjustable housing.
   5. Body or Ferrule: Cast iron.
   6. Clamping Device: Not required.
   7. Outlet Connection: Inside calk.
   8. Closure: Brass plug with straight threads and gasket.
   9. Adjustable Housing Material: Cast iron with threads.
   10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   11. Frame and Cover Shape: Round.
   12. Top Loading Classification: Extra Heavy Duty.
   13. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts: **WCO**:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      a. Josam Company; Josam Div.
      b. MIFAB, Inc.

c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains; **FD, FD-T**:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Tyler Pipe; Wade Div.
e. Watts Drainage Products Inc.
f. Zurn Plumbing Products Group; Light Commercial Operation.
g. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Top or Strainer Material: Nickel bronze.
7. Top Shape: Round.
8. Trap Material: Cast iron.
9. Trap Pattern: Deep-seal P-trap.

B. Cast-Iron Floor Drains; **FD-S**:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Josam Company; Josam Div.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.
e. Zurn Plumbing Products Group; Light Commercial Operation.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.

5. Outlet: Bottom.
6. Sediment Bucket: Gray iron.
7. Top or Strainer Material: Nickel bronze.
8. Top Shape: Round.
9. Top Loading Classification: Heavy Duty.
10. Trap Material: Cast iron.
11. Trap Pattern: Deep-seal P-trap.

C. Cast-Iron Floor Sink; **FS-N**:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Commercial Enameling Co.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
d. Watts Drainage Products Inc.

2. Standard: ASME A112.6.3.
3. Pattern: Sanitary drain.
4. Body Material: Gray iron.
5. Outlet: Bottom.
6. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
7. Sediment Bucket: Dome strainer.
8. Top or Strainer Material: Gray iron.
9. Top Shape: Square.
10. Trap Material: Cast iron.
11. Trap Pattern: Deep-seal P-trap.

2.3 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves; AAV:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Durgo, Inc.
b. Oatey.
c. ProSet Systems Inc.
d. RectorSeal.
e. Studor, Inc.

2. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
3. Housing: Plastic.
4. Operation: Mechanical sealing diaphragm.
5. Size: Same as connected fixture or branch vent piping.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.

    a. NPS 2: 4-inch- minimum water seal.
    b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

B. Vent Caps: VTR

1. Description: Cast-iron body with threaded or hub inlet and vandal-proof design. Include vented hood and setscrews to secure to vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Copper Sheet: ASTM B 152/B 152M, of the following minimum weights and thicknesses, unless otherwise indicated:

1. General Applications: 12 oz./sq. ft..
2. Vent Pipe Flashing: 8 oz./sq. ft..

C. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness, unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

D. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

E. Fasteners: Metal compatible with material and substrate being fastened.

F. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

G. Solder: ASTM B 32, lead-free alloy.

H. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

2.6 MOTORS

A. General requirements for motors are specified in Division 22 Section "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

PART 3 - EXECUTION

3.1 CONCRETE BASES

A. Anchor grease removal devices to concrete bases.

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 19-inch centers around full perimeter of base.
2. For installed equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be imbedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Concrete base construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
6. Cast-in-place concrete materials and placement requirements are specified in Division 03.

3.2 INSTALLATION

A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

F. Install fixture air-admittance valves on fixture drain piping.

G. Install deep-seal traps on floor drains and other waste outlets, if indicated.

H. Install vent caps on each vent pipe passing through roof.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

K. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Grease Removal Devices: Connect controls, electrical power, factory-furnished accessories, and inlet, outlet, and vent piping to unit.

D. Oil Interceptors: Connect inlet, outlet, vent, and gravity drawoff piping to unit; flow-control fitting and vent to unit inlet piping; and gravity drawoff and suction piping to oil storage tank.

E. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.4 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 Section "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

G. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain grease removal devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 221319

SECTION 221413 - FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.3 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

B. Seismic Performance: Storm drainage piping and support and installation shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For storm drainage piping, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

Pipe and fittings in this article are available in NPS 1-1/4 to NPS 12 (DN 32 to DN 300). Retain one or both of first two paragraphs below and coordinate with "Piping Schedule" Article.

A. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

K. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

M. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm-Drainage Piping: 1 percent Insert slope downward in direction of flow.

N. Install aboveground PVC piping according to ASTM D 2665.

O. Install underground PVC piping according to ASTM D 2321.

P. Install force mains at elevations indicated.

Q. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

R. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

B. Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 VALVE INSTALLATION

A. General valve installation requirements are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Shutoff Valves: Install shutoff valve on each sump pump discharge.

1. Install gate or full-port ball valve for piping NPS 2 and smaller.
2. Install gate valve for piping NPS 2-1/2 and larger.

C. Check Valves: Install swing-check valve, between pump and shutoff valve, on each sump pump discharge.

D. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
4. Vertical Piping: MSS Type 8 or Type 42, clamps.
5. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

6. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
7. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting[**, valve,**] and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.

D. Connect force-main piping to the following:

1. Sump Pumps: To sump pump discharge.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

F. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

E. Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
2. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
3. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
4. Prepare reports for tests and required corrective action.

3.9 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground storm drainage piping NPS 6 and smaller shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, storm drainage piping NPS 8 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground storm drainage piping NPS 6 and smaller shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, storm drainage piping NPS 8 and larger shall be the following:

1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Cellular-core, sewer and drain series, PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 221413

SECTION 221423 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Backwater valves.
5. Flashing materials.

1.3 ACTION SUBMITTALS

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

1.4 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains [RD, SRD]:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Tyler Pipe.

e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.4, for general-purpose roof drains.
3. Body Material: Cast iron.
4. Dimension of Body: Nominal 14-inch diameter.
5. Combination Flashing Ring and Gravel Stop: Required.
6. Underdeck Clamp: Required.
7. Dome Material: Aluminum.
8. Water Dam: 2 inches high.

2.2 CLEANOUTS

A. Floor Cleanouts [FCO]:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Josam Company.
b. Smith, Jay R. Mfg. Co.
c. Tyler Pipe.
d. Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M, for adjustable housing cleanouts.
3. Size: Same as connected branch.
4. Closure: Brass plug with tapered threads.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install downspout adapters on outlet of back-outlet parapet roof drains and connect to sheet metal downspouts.

C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

F. Install horizontal backwater valves in floor with cover flush with floor.

G. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 223400 - FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Commercial, gas-fired, high-efficiency, storage, domestic-water heaters.
2. Domestic-water heater accessories.

1.3 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Commercial domestic-water heaters shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For fuel-fired, domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of commercial, gas-fired, domestic-water heater, from manufacturer.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

D. Source quality-control reports.

E. Field quality-control reports.

F. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic-water heaters to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

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

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: Two year(s).

b. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Gas-Fired, High-Efficiency, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Bradford White Corporation.
b. Lochinvar, LLC.
c. PVI Industries, LLC.
d. Smith, A. O. Corporation.
e. State Industries.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Description: Manufacturer's proprietary design to provide at least 95 percent combustion efficiency at optimum operating conditions.
4. Storage-Tank Construction: ASME-code steel with 150-psig minimum working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

5. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
g. Temperature Control: Adjustable thermostat.
h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

2.2 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL, Inc.
b. Bell & Gossett
c. Flexcon Industries.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

B. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

1. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

C. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

D. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 2-psig pressure rating as required to match gas supply.

E. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

F. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.

2.3 SOURCE QUALITY CONTROL

Retain first paragraph below for factory-assembled domestic-water heaters and storage tanks. Factory tests are an added cost option and may not be available from some manufacturers. Verify requirement with Owner.

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

Retain options in first paragraph below if testing of only commercial domestic-water heaters and storage tanks is required.

B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Residential, Domestic-Water Heater Mounting: Install residential domestic-water heaters on floor.

1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 221123 "Facility Natural-Gas Piping."

D. Install commercial domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping,"and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for fuel-oil piping specified in Section 231113 "Facility Fuel-Oil Piping."

C. Comply with requirements for gas piping specified in Section 221123 "Facility Natural-Gas Piping."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400

SECTION 224213.13 - COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves[**and electronic sensors**] to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

A. Water Closets <**WC**>: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard America.
b. Kohler Co.
c. TOTO USA, INC.
d. Zurn Industries, LLC.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.6 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.
i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
4. Flushometer Valve: <**WC-FV**>.
5. Toilet Seat: <**WC-SEAT**>.

B. Water Closets <**WC-A**>: Floor mounted, bottom outlet, top spud.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard America.
b. Kohler Co.
c. TOTO USA, INC.
d. Zurn Industries, LLC.

2. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Handicapped/elderly, complying with ICC/ANSI A117.1.
f. Rim Contour: Elongated.
g. Water Consumption: 1.6 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.
i. Color: White.

3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.
4. Flushometer Valve: <**WC-FV**>.
5. Toilet Seat: <**WC-SEAT**>.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves <**WC-FV**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Sloan Valve Company.
    b. Zurn Industries, LLC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Consumption: 1.6 gal. per flush.
9. Minimum Inlet: NPS 1.
10. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats <**WC-SEAT**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Standard America.
    b. Bemis Manufacturing Company.
    c. Church Seats; Bemis Manufacturing Company.
    d. Kohler Co.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial (Heavy duty).
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

B. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

C. Install toilet seats on water closets.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.13

SECTION 224213.16 - COMMERCIAL URINALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals Wall hung, back outlet, washout, accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard America.
b. Kohler Co.

c. TOTO USA, INC.
d. Zurn Industries, LLC.

2. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Washout with extended shields.
d. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
e. Water Consumption: Water saving.
f. Spud Size and Location: NPS 3/4, top.
g. Outlet Size and Location: NPS 2, back.
h. Color: White.

3. Flushometer Valve:
4. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2.

5. Support: ASME A112.6.1M, Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.

2.2 URINAL FLUSHOMETER VALVES

A. Battery-Powered, Solenoid-Actuator, Diaphragm Flushometer Valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sloan Valve Company.
b. Zurn Industries, LLC.

2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Style: Exposed.
8. Actuator: Solenoid complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
9. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951; listed and labeled as defined in NFPA 70, by a qualified testing agency; and marked for intended location and application.
10. Consumption: 1.0 gal. per flush.
11. Minimum Inlet: NPS 3/4.
12. Minimum Outlet: NPS 3/4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.
3. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.
3. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 224213.16

SECTION 224216.13 - COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory <**L-WA**>: Oval, self-rimming, vitreous china, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard America.
b. Kohler Co.
c. TOTO USA, INC.
d. Zurn Industries, LLC.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Self-rimming for above-counter mounting.
c. Nominal Size: Oval, 19 by 17 inches.
d. Faucet-Hole Punching: One hole.
e. Faucet-Hole Location: Top.
f. Color: White .
g. Mounting Material: Sealant.

3. Faucet: <**LAV FAUCET**>.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory <**L-WA**>: Vitreous china, wall mounted, with back.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Standard America.
b. Kohler Co.
c. Zurn Industries, LLC.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Rectangular, 19 by 16 inches.
d. Faucet-Hole Punching: One hole.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

3. Faucet: <**LAV-FAUCET**>.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier. Include rectangular, steel uprights.

2.3 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets <**LAV-FAUCET**>: Automatic-type, battery-powered, electronic-sensor-operated, mixing, solid-brass valve.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Chicago Faucets; Geberit Company.
    b. Sloan Valve Company.
    c. Symmons.
    d. T & S Brass and Bronze Works, Inc.

2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 0.5 gpm.
9. Mounting Type: Deck, concealed.
10. Spout: Rigid type.
11. Spout Outlet: Laminar flow Insert type.
12. Drain: Not part of faucet.

2.4 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Chronomite Laboratories, Inc.
2. NEOPERL, Inc.

C. Description: Chrome-plated-brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.5 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Risers:

1. NPS 3/8.
2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces riser.

2.6 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.
3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16 - COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Service sinks.
2. Sink faucets.
3. Laminar-flow, faucet-spout outlets.
4. Supply fittings.
5. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
2. Include rated capacities, operating characteristics and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins Plastic, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Mustee
b. FiatFiat.
c. Zurn

2. Material: [Cast polymer] <Insert material>.

a. Nominal Size: 24 by 24 by 10 inches.
b. Tiling Flange: On two sides.
c. Rim Guard: On front top surfaces.
d. Color: Not applicable.
e. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: .

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets <MS-FAUCET>: Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Chicago Faucets; Geberit Company.
2) T & S Brass and Bronze Works, Inc.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.2 gpm.
8. Handle(s): Lever.
9. Mounting Type: Deck, exposed.
10. Spout Type: Rigid, solid brass with wall brace.
11. Vacuum Breaker: Required for hose outlet.
12. Spout Outlet: Aerator Laminar flow.

2.3 LAMINAR-FLOW, FAUCET-SPOUT OUTLETS

A. NSF Standard: Comply with NSF/ANSI 61 Annex 61, "Drinking Water System Components - Health Effects," for faucet-spout-outlet materials that will be in contact with potable water.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AM Conservation Group, Inc.
2. Chronomite Laboratories, Inc.
3. NEOPERL, Inc.

C. Description: Chrome-plated brass, faucet-spout outlet that produces non-aerating, laminar stream. Include external or internal thread that mates with faucet outlet for attachment to faucets where indicated and flow-rate range that includes flow of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Set floor-mounted sinks in leveling bed of cement grout.

D. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

F. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

G. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224716 - PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers Wall mounted , wheelchair accessible.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkay Manufacturing Co.
b. Halsey Taylor.
c. Haws Corporation.

2. Cabinet: Bi-level with two attached cabinets and with a bi-level skirt kit, vinyl-covered steel with stainless-steel top.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push button.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

10. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:

        1) Motor Horsepower: 1/4.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F.

J. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.

2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.3 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type.
h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
i. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
j. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated finish.
k. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230539 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following hangers and supports for plumbing system piping and equipment:

1. Steel pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Pipe positioning systems.
8. Equipment supports.

B. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 13 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
3. Division 15 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: For the following:

1. Steel pipe hangers and supports.
2. Thermal-hanger shield inserts.
3. Powder-actuated fastener systems.
4. Pipe positioning systems.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.
3. Pipe stands. Include Product Data for components.
4. Equipment supports.

C. Welding certificates.

1.6 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to [AWS D1.1, "Structural Welding Code--Steel."] [AWS D1.4, "Structural Welding Code--Reinforcing Steel."] [ASME Boiler and Pressure Vessel Code: Section IX.]

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
4. ASME Boiler and Pressure Vessel Code: Section IX.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.
3. Grinnell Corp.
4. PHD Manufacturing, Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. Thomas & Betts Corporation.
4. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate] [Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass] [ASTM C 552, Type II cellular glass] with vapor barrier.

D. Insulation-Insert Material for Hot Piping: [Water-repellent treated, ASTM C 533, Type I calcium silicate] [Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass] [ASTM C 552, Type II cellular glass].

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.6 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. Hilti, Inc.
b. ITW Ramset/Red Head.
c. Masterset Fastening Systems, Inc.
d. MKT Fastening, LLC.
e. Powers Fasteners.

B. Mechanical-Expansion Anchors: Insert-wedge-type stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers:

a. B-Line Systems, Inc.; a division of Cooper Industries.
b. Empire Industries, Inc.
c. Hilti, Inc.
d. ITW Ramset/Red Head.
e. MKT Fastening, LLC.
f. Powers Fasteners.

2.7 PIPE STAND FABRICATION

A. Pipe Stands, General: Shop or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod-roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

1. Manufacturers:

a. ERICO/Michigan Hanger Co.
b. MIRO Industries.

C. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe support made from structural-steel shape, continuous-thread rods, and rollers for mounting on permanent stationary roof curb.

2.8 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.

B. Manufacturers:

1. C & S Mfg. Corp.
2. HOLDRITE Corp.; Hubbard Enterprises.

2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.10 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use padded hangers for piping that is subject to scratching.

F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.

13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.

5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.

N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.

G. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.

H. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

J. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Install lateral bracing with pipe hangers and supports to prevent swaying.

L. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

M. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

N. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.

O. Insulated Piping: Comply with the following:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.

C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 230529

SECTION 230548 - VIBRATION & SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Isolation pads.
2. Isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Restrained spring isolators.
5. Housed spring mounts.
6. Elastomeric hangers.
7. Spring hangers.
8. Spring hangers with vertical-limit stops.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Seismic snubbers.
12. Restraining braces and cables.

1.3 DEFINITIONS

A. IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: See Structural Drawings.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.

a. Component Importance Factor: 1.5.
b. Component Response Modification Factor: See Structural Drawings.
c. Component Amplification Factor: See Structural Drawings

3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See Structural drawings.
4. Design Spectral Response Acceleration at 1-Second Period: See structural drawings

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators, seismic restraints, and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details:

    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

c. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

C. Coordination Drawings: Show coordination of seismic bracing for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Welding certificates.

E. Qualification Data: For professional engineer and testing agency.

1.6 QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

1. Resilient Material: Oil- and water-resistant neoprene.

C. Mounts: Double-deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All-directional mountings with seismic restraint.

1. Materials: Cast-ductile-iron or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.

H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch- thick neoprene. Where clearances are not readily visible, a factory-set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation.
3. Cooper B-Line, Inc.; a division of Cooper Industries.
4. Hilti, Inc.
5. Kinetics Noise Control.
6. Loos & Co.; Cableware Division.
7. Mason Industries.
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch- thick resilient cushion.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

G. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.

1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install seismic snubbers on plumbing equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches.
3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

F. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

G. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

H. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Division 22 Section "Domestic Water Piping" for piping flexible connections.

3.5 ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of sprint isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 230548

SECTION 230553- IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Stencils.
5. Valve tags.
6. Warning tags.

1.3 SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater

viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link or beaded chain; or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

2.5 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Division 09 Section "Interior Painting."

B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, on each piping system.

1. Identification Paint: Use for contrasting background.
2. Stencil Paint: Use for pipe marking.

C. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

3.5 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. Certified TAB reports.

E. Sample report forms.

F. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC NEBB or TABB as a TAB technician.

B. TAB Conference: Meet with Architect, Owner, and Construction Manager on approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Require the participation of the TAB field supervisor and technicians. Provide seven days' advance notice of scheduled meeting time and location.

1. Agenda Items:

a. The Contract Documents examination report.
b. The TAB plan.
c. Coordination and cooperation of trades and subcontractors.
d. Coordination of documentation and communication flow.

C. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

D. TAB Report Forms: Use standard TAB contractor's forms approved by Architect.

E. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

F. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

G. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

1.7 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

1.8 COORDINATION

A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements,:
1. Any Testing Adjusting and Balancing (TAB) sub-contractor certified by the Associated Air Balance Council (AABC), the National Environmental Balancing Bureau (NEBB), or the Testing, Adjusting, and Balancing Bureau (TABB) are permitted to bid on this project.

3.2 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.3 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Hydronic systems are filled, clean, and free of air.
3. Automatic temperature-control systems are operational.
4. Equipment and duct access doors are securely closed.
5. Balance, smoke, and fire dampers are open.
6. Isolating and balancing valves are open and control valves are operational.
7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
8. Windows and doors can be closed so indicated conditions for system operations can be met.

3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance"; ASHRAE 111; NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in [**inch-pound (IP)**] [**and**] [**metric (SI)**] units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.
    c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

    a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.7 PROCEDURES FOR MOTORS

A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Efficiency rating.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter thermal-protection-element rating.

B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.

4. Cooling-Water Flow Rate: Plus or minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.

11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Gas-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Fuel type in input data.
    g. Output capacity in Btu/h.
    h. Ignition type.
    i. Burner-control types.
    j. Motor horsepower and rpm.
    k. Motor volts, phase, and hertz.

l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total air flow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave, and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.

b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft..
g. Indicated air flow rate in cfm.
h. Indicated velocity in fpm.
i. Actual air flow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

H. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.

c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

I. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.11 INSPECTIONS

A. Initial Inspection:

1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:

a. Measure airflow of at least 10 percent of air outlets.
b. Measure water flow of at least 5 percent of terminals.
c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
d. Verify that balancing devices are marked with final balance position.
e. Note deviations from the Contract Documents in the final report.

B. Final Inspection:

1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Architect.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Architect.
3. Architect shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:

1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.

D. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713 - DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.

B. Related Sections:
1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

C. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:

1. Sheet Form Insulation Materials: 12 inches square.

2. Sheet Jacket Materials: 12 inches square.
3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a [**1**] [**2**]-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M.
    b. CertainTeed Corporation.
    c. Johns Manville; a Berkshire Hathaway company.
    d. Nelson Firestop; a brand of Emerson Industrial Automation.
    e. Thermal Ceramics.
    f. Unifrax Corporation.

2.3 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.4 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Avery Dennison Corporation, Specialty Tapes Division.
    b. Compac Corporation.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.
    e. Venture Tape.

2. Width: 3 inches.

3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping"irestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.7 FIELD QUALITY CONTROL

Inspections in this article are destructive. Retain if workmanship quality is an important requirement. Architect should be prepared to reject all work if defective work is discovered in sample inspection.

Retain one of first two paragraphs below to identify who shall perform tests and inspections. If retaining second option in first paragraph, or if retaining second paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Outdoor, concealed supply and return.
10. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

END OF SECTION 230713

SECTION 231123- FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.
6. Service meters.
7. Mechanical sleeve seals.
8. Grout.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.
3. Minimum Operating Pressure of Service Meter: 5 psig.

B. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

1.5 SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
3. Pressure regulators. Indicate pressure ratings and capacities.
4. Dielectric fittings.
5. Mechanical sleeve seals.
6. Escutcheons.

B. Qualification Data: For qualified professional engineer.

C. Welding certificates.

D. Field quality-control reports.

E. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

C. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

1.9 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

    a. Material Group: 1.1.
    b. End Connections: Threaded or butt welding to match pipe.
    c. Lapped Face: Not permitted underground.
    d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.

5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

6. Mechanical Couplings:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Dresser Piping Specialties; Division of Dresser, Inc.
        2) Smith-Blair, Inc.

    b. Steel flanges and tube with epoxy finish.
    c. Buna-nitrile seals.
    d. Stainless-steel bolts, washers, and nuts.
    e. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    f. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

2.2 PIPING SPECIALTIES

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.

1. CWP Rating: 125 psig.
2. Flanged Ends: Comply with ASME B16.5 for steel flanges.

3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Service Mark: Initials "WOG" shall be permanently marked on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BrassCraft Manufacturing Company; a Masco company.
   b. Conbraco Industries, Inc.; Apollo Div.
   c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

2.5 EARTHQUAKE VALVES

A. Earthquake Valves: Comply with ASCE 25.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Vanguard Valves, Inc.

2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
3. Maximum Operating Pressure: 5 psig.
4. Cast-aluminum body with nickel-plated chrome steel internal parts.
5. Nitrile-rubber valve washer.
6. Sight windows for visual indication of valve position.
7. Threaded end connections complying with ASME B1.20.1.
8. Wall mounting bracket with bubble level indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.

3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. American Meter Company.
   b. Fisher Control Valves and Regulators; Division of Emerson Process Management.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 100 psig.

C. Line and Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Eaton Corporation; Controls Div.
   b. Harper Wyman Co.
   c. Maxitrol Company.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.7 DIELECTRIC FITTINGS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
    f. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

B. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
    d. Wilkins; Zurn Plumbing Products Group.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

C. Dielectric-Flange Kits:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Advance Products & Systems, Inc.
    b. Calpico Inc.
    c. Central Plastics Company.
    d. Pipeline Seal and Insulator, Inc.

2. Minimum Operating-Pressure Rating: 150 psig.
3. Companion-flange assembly for field assembly.
4. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
5. Insulating materials suitable for natural gas.
6. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.8 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.9 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

B. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

E. Install fittings for changes in direction and branch connections.

F. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.

G. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

H. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

I. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 23 Section "Meters and Gages for HVAC Piping."

3.5 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

3.7 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

B. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
5. NPS 4 and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Comply with requirements in Division 23 Section "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Alkyd System: MPI EXT 5.1D.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
c. Topcoat: Exterior alkyd enamel (semigloss).
d. Color: Gray.

C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.11 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.13 OUTDOOR PIPING SCHEDULE

A. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.14 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

A. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with steel welding fittings and welded joints.

3.16 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

B. Valves for pipe sizes NPS 2-1/2 and larger at service meter shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

C. Distribution piping valves for pipe sizes NPS 2 and smaller shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

D. Distribution piping valves for pipe sizes NPS 2-1/2 and larger shall be one of the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

E. Valves in branch piping for single appliance shall be the following:

1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 231123

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.
7. Seismic-restraint devices.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports and seismic restraints.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: [**G60**] [**G90**].
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed Corporation.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Owens Corning.

1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, [**0.106-inch-**] [**0.135-inch-**] diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.

7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

    a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.

4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

2.7 SEISMIC-RESTRAINT DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. B-line, an Eaton business.
2. Ductmate Industries, Inc.
3. Hilti, Inc.
4. Kinetics Noise Control, Inc.
5. Mason Industries, Inc.
6. TOLCO.
7. Unistrut; Part of Atkore International.

B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of the ICC Evaluation Service.

1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.

D. Restraint Cables: ASTM A 492, stainless-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.

E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 SEISMIC-RESTRAINT-DEVICE INSTALLATION

A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.

1. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
2. Brace a change of direction longer than 12 feet.

B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install cable restraints on ducts that are suspended with vibration isolators.

E. Install seismic-restraint devices using methods approved by an evaluation service member of the ICC Evaluation Service.

F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.

G. Drilling for and Setting Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during

drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Set anchors to manufacturer's recommended torque, using a torque wrench.
5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

3.7 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.10 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.11 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Air, Return Air, Outside Air, and Exhaust Air Ducts:

1. Pressure Class: Positive 2-inch wg.
2. Minimum SMACNA Seal Class: A.
3. SMACNA Leakage Class for Rectangular: 24.
4. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.
2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Match duct material.

D. Liner:

1. Supply Air Ducts: Fibrous glass, Type I, 2 inches thick.
2. Return Air Ducts: Fibrous glass, Type I, 2 inches thick.

E. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm:

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

END OF SECTION 233113

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Manual volume dampers.
2. Turning vanes.
3. Flexible connectors.
4. Flexible ducts.
5. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise

indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. American Warming and Ventilating; a Mestek Architectural Group company.
    b. Flexmaster U.S.A., Inc.
    c. Pottorff.
    d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames:

    a. Frame: Hat-shaped, 0.05-inch-thick stainless steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.

7. Bearings:

   a. Molded synthetic.
   b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.4 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. Ductmate Industries, Inc.
3. Duro Dyne Inc.
4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single wall.

F. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.5 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.

3. Ventfabrics, Inc.
4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd..
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd..
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.

1. Minimum Weight: 16 oz./sq. yd..
2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

2.6 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. Ward Industries; a brand of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

2.7 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

D. Set dampers to fully open position before testing, adjusting, and balancing.

E. Install test holes at fan inlets and outlets and elsewhere as indicated.

F. Install flexible connectors to connect ducts to equipment.

G. Connect diffusers or light troffer boots to ducts with maximum 36-inch lengths of flexible duct clamped or strapped in place.

H. Connect flexible ducts to metal ducts with draw bands.

I. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.

2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300

SECTION 233713.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Krueger.
2. Price Industries.
3. Titus.
4. Tuttle & Bailey.

B. Devices shall be specifically designed for variable-air-volume flows.

C. See drawings for complete description

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install ceiling diffusers level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install ceiling diffusres with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust ceiling diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.12

SECTION 233713.23 - AIR REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Related Requirements:

1. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to registers and grilles.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 REGISTERS AND GRILLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Krueger.
b. Price Industries.
c. Titus.
d. Tuttle & Bailey.

2. See drawings for complete description

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

SECTION 233715 - LOUVERS AND VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fixed, extruded-aluminum louvers.

B. Related Sections:

1. Section 099113 "Exterior Painting" for field painting louvers.

1.3 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.

C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

E. Storm-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.4 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.

1. Wind Loads: Determine loads based on pressures as indicated on Drawings.

B. Seismic Performance: Louvers, including attachments to other construction, shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes, without buckling, opening of joints, overstressing of components, failure of connections, or other detrimental effects.

D. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.

1.5 ACTION SUBMITTALS

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

1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.

1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
2. Show mullion profiles and locations.
3. Wiring Diagrams: For power, signal, and control wiring for motorized adjustable louvers.

1.6 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.

1.7 QUALITY ASSURANCE

A. Source Limitations: Obtain louvers and vents from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Extrusions: ASTM B 221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B 209, Alloy 3003 or 5005 with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Aluminum Castings: ASTM B 26/B 26M, Alloy 319.

D. Fasteners: Use types and sizes to suit unit installation conditions.

1. Use hex-head or Phillips pan-head tamper-resistant screws for exposed fasteners unless otherwise indicated.
2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
4. For fastening stainless steel, use 300 series stainless-steel fasteners.
5. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed, for masonry, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

2.2 FABRICATION, GENERAL

A. Assemble louvers in factory to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.

1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern.
2. Horizontal Mullions: Provide horizontal mullions at joints.

C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than recommended by manufacturer, or 72 inches o.c., whichever is less.

1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

G. Provide subsills made of same material as louvers for recessed louvers.

H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

A. Horizontal, Drainable-Blade Louver:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Air Balance Inc.; a Mestek company.
b. Airolite Company, LLC (The)).
c. American Warming and Ventilating, Inc.; a Mestek company.
d. Louvers & Dampers, Inc.; a division of Mestek, Inc.
e. Ruskin Company; Tomkins PLC.
f. United Enertech Corp.

2. Louver Depth: 4 inches.
3. Frame and Blade Nominal Thickness: Not less than 0.080 inch.
4. Mullion Type: Exposed.
5. Louver Performance Ratings:

a. Free Area: Not less than 8.0 sq. ft. for 48-inch- wide by 48-inch- high louver.
b. Point of Beginning Water Penetration: Not less than 900 fpm 950 fpm 1050 fpm 1100 fpm Insert velocity.
c. Air Performance: Not more than 0.10-inch wg static pressure drop at 800-fpm free-area intake velocity.

6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.5 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers and vents level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

F. Protect unpainted galvanized and nonferrous-metal surfaces that will be in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

G. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Test operation of adjustable louvers and adjust as needed to produce fully functioning units that comply with requirements.

B. Clean exposed surfaces of louvers and vents that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

C. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

D. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.

1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 233715

SECTION 234100 - PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Pleated panel filters.
   2. Filter gages.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include dimensions; operating characteristics; required clearances and access; rated flow capacity, including initial and final pressure drop at rated airflow; efficiency and test method; fire classification; furnished specialties; and accessories for each model indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of filter and rack to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Provide one complete set(s) of filters for each filter bank. If system includes prefilters, provide only prefilters.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:

1. Comply with applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality"; Section 5 - "Systems and Equipment"; and Section 7 - "Construction and Startup."
2. Comply with ASHRAE 52.2 for MERV for methods of testing and rating air-filter units.

B. Comply with NFPA 90A and NFPA 90B.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PLEATED PANEL FILTERS

A. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters with holding frames.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AAF International.
b. Airguard.
c. Camfil Farr.

B. Media: Interlaced glass or synthetic fibers coated with nonflammable adhesive.

1. Adhesive: As recommended by air-filter manufacturer and with a VOC content of 80 g/L or less.
2. Adhesive: As recommended by air-filter manufacturer and that complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
3. Media shall be coated with an antimicrobial agent.
4. Separators shall be bonded to the media to maintain pleat configuration.
5. Welded-wire grid shall be on downstream side to maintain pleat.
6. Media shall be bonded to frame to prevent air bypass.
7. Support members on upstream and downstream sides to maintain pleat spacing.

C. Filter-Media Frame: Cardboard frame with perforated metal retainer sealed or bonded to the media.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Position each filter unit with clearance for normal service and maintenance. Anchor filter holding frames to substrate.

B. Install filters in position to prevent passage of unfiltered air.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

D. Coordinate filter installations with duct and air-handling-unit installations.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Test for leakage of unfiltered air while system is operating.

B. Air filter will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 CLEANING

A. After completing system installation and testing, adjusting, and balancing of air-handling and air-distribution systems, clean filter housings and install new filter media.

END OF SECTION 234100

SECTION 235123 - GAS VENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Listed double-wall vents.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

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

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents.

B. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hart & Cooley Inc.
2. Heat-Fab, Inc.
3. Metal-Fab, Inc.
4. Schebler Co. (The).
5. Selkirk Corporation.

B. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F continuously for Type B or 550 deg F continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

C. Construction: Inner shell and outer jacket separated by at least a 1/4-inch airspace.

D. Inner Shell: ASTM B 209, Type 1100 aluminum.

E. Outer Jacket: Galvanized steel.

F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.

1. Termination: Antibackdraft.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions 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.

3.2 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.3 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 235123

SECTION 235416.13 - GAS-FIRED FURNACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Gas-fired, condensing furnaces and accessories complete with controls.
2. Air filters.
3. Refrigeration components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each furnace to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

a. Furnace and accessories complete with controls.
b. Air filter.
c. Refrigeration components.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

C. Comply with NFPA 70.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace the following components of furnaces that fail in materials or workmanship within specified warranty period:

1. Warranty Period, Commencing on Date of Substantial Completion:

a. Furnace Heat Exchanger: 10 years.
b. Integrated Ignition and Blower Control Circuit Board: Five years.
c. Draft-Inducer Motor: Five years.
d. Refrigeration Compressors: 10 years.
e. Evaporator and Condenser Coils: Five years.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a qualified testing agency, and marked for intended location and application.

B. General Requirements for Noncondensing Gas-Fired Furnaces: Factory assembled, piped, wired, and tested; complying with ANSI Z21.47/CSA 2.3 and NFPA 54.

2.2 GAS-FIRED FURNACES, CONDENSING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bryant Heating & Cooling Systems; a unit of United Technologies Corp.
2. Carrier Corporation; a unit of United Technologies Corp.

3. Lennox Industries, Inc.; Lennox International.
4. Trane.
5. YORK; a Johnson Controls company.

B. Cabinet: Steel.

1. Cabinet interior around heat exchanger shall be factory-installed insulation.
2. Lift-out panels shall expose burners and all other items requiring access for maintenance.
3. Factory paint external cabinets in manufacturer's standard color.
4. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Fan: Centrifugal, factory balanced, resilient mounted, direct drive.

1. Fan Motors: Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Special Motor Features: Multitapped, multispeed with internal thermal protection and permanent lubrication.

D. Type of Gas: Natural.

E. Heat Exchanger:

1. Primary: Aluminized steel.
2. Secondary: Stainless steel.

F. Burner:

1. Gas Valve: 100 percent safety main gas valve, main shutoff valve, pressure regulator, safety pilot with electronic flame sensor, limit control, transformer, and combination ignition/fan timer control board.
2. Ignition: Electric pilot ignition, with hot-surface igniter or electric spark ignition.

G. Gas-Burner Safety Controls:

1. Electronic Flame Sensor: Prevents gas valve from opening until pilot flame is proven; stops gas flow on ignition failure.
2. Flame Rollout Switch: Installed on burner box; prevents burner operation.
3. Limit Control: Fixed stop at maximum permissible setting; de-energizes burner on excessive bonnet temperature; automatic reset.

H. Combustion-Air Inducer: Centrifugal fan with thermally protected motor and sleeve bearings prepurges heat exchanger and vents combustion products; pressure switch prevents furnace operation if combustion-air inlet or flue outlet is blocked.

I. Furnace Controls: Solid-state board integrates ignition, heat, cooling, and fan speeds; adjustable fan-on and fan-off timing; terminals for connection to accessories; diagnostic light with viewport.

J. Accessories:

1. Combination Combustion-Air Intake and Vent: PVC plastic fitting to combine combustion-air inlet and vent through outside wall.
2. CPVC Plastic Vent Materials:

    a. CPVC Plastic Pipe: Schedule 40, complying with ASTM F 441/F 441M.
    b. CPVC Plastic Fittings: Schedule 40, complying with ASTM F 438, socket type.
    c. CPVC Solvent Cement: ASTM F 493.

3. PVC Plastic Vent Materials:

    a. PVC Plastic Pipe: Schedule 40, complying with ASTM D 1785.
    b. PVC Plastic Fittings: Schedule 40, complying with ASTM D 2466, socket type.
    c. PVC Solvent Cement: ASTM D 2564.

2.3 THERMOSTATS

A. Controls shall comply with requirements in ASHRAE/IES 90.1, "Controls."

B. Solid-State Thermostat: Wall-mounted, programmable, microprocessor-based unit with manual switching from heating to cooling, preferential rate control, seven-day programmability with minimum of four temperature presets per day,and battery backup protection against power failure for program settings.

C. Control Wiring: Unshielded twisted-pair cabling.

1. No. 24 AWG, 100 ohm, four pair.
2. Cable Jacket Color: Blue.

2.4 AIR FILTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aprilaire; Research Products Corp.
2. Filtrete Home Filtration Products; a 3M brand.
3. General Filters, Inc.
4. Permatron Corporation.

B. Disposable Filters: 1-inch- thick fiberglass media with ASHRAE 52.2 MERV rating of 6 or higher, in sheet metal frame.

2.5 REFRIGERATION COMPONENTS

A. General Refrigeration Component Requirements:

1. Refrigeration compressor, coils, and specialties shall be designed to operate with CFC-free refrigerants.
2. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IES 90.1.

B. Refrigerant Coil: Copper tubes mechanically expanded into aluminum fins. Comply with AHRI 210/240. Match size with furnace. Include condensate drain pan with accessible drain outlet complying with ASHRAE 62.1.

1. Refrigerant Coil Enclosure: Steel, matching furnace and evaporator coil, with access panel and flanges for integral mounting at or on furnace cabinet and galvanized sheet metal drain pan coated with black asphaltic base paint.

C. Refrigerant Line Kits: Annealed-copper suction and liquid lines factory cleaned, dried, pressurized with nitrogen, sealed, and with suction line insulated. Provide in standard lengths for installation without joints, except at equipment connections.

1. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534/C 534M, Type I, 1/2 inch thick.

D. Refrigerant Piping: Comply with requirements in Section 232300 "Refrigerant Piping."

E. Air-Cooled Compressor-Condenser Unit:

1. Casing: Steel, finished with baked enamel, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed reciprocating or scroll type.

    a. Crankcase heater.
    b. Restrained vibration isolation mounts for compressor.
    c. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
    d. Two-speed compressor motors shall have manual-reset high-pressure switch and automatic-reset low-pressure switch.
    e. Refrigerant Charge: R-410A.

3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins, complying with AHRI 210/240, and with liquid subcooler.
4. Heat-Pump Components: Reversing valve and low-temperature air cut-off thermostat.
5. Fan: Aluminum-propeller type, directly connected to motor.
6. Motor: Permanently lubricated, with integral thermal-overload protection.
7. Low Ambient Kit: Permits operation down to 45 deg F.
8. Mounting Base: Polyethylene.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine factory-installed insulation before furnace installation. Reject units that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for gas and refrigerant piping systems to verify actual locations of piping connections before equipment installation.

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

3.2 INSTALLATION

A. Install gas-fired furnaces and associated fuel and vent features and systems according to NFPA 54.

B. Suspended Units: Suspend from structure using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

1. Install seismic restraints to limit movement of furnace by resisting code-required seismic acceleration.

C. Base-Mounted Units: Secure units to substrate. Provide optional bottom closure base if required by installation conditions.

1. Anchor furnace to substrate to resist code-required seismic acceleration.

D. Controls: Install thermostats and humidistats at mounting height of 60 inches above floor.

E. Wiring Method: Install control wiring in accessible ceiling spaces and in gypsum board partitions where unenclosed wiring method may be used. Conceal control wiring except in unfinished spaces.

F. Install ground-mounted, compressor-condenser components on 4-inch-thick, reinforced concrete base; 4 inches larger on each side than unit. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete." Coordinate anchor installation with concrete base.

G. Install ground-mounted compressor-condenser components on polyethylene mounting base.

3.3 CONNECTIONS

A. Gas piping installation requirements are specified in Section 231123 "Facility Natural-Gas Piping." Drawings indicate general arrangement of piping, fittings, and specialties. Connect gas piping with union or flange and appliance connector valve.

B. Install piping adjacent to equipment to allow service and maintenance.

C. Vent and Outside-Air Connection, Condensing, Gas-Fired Furnaces: Connect plastic piping vent material to furnace connections and extend outdoors. Terminate vent outdoors with a cap and in an arrangement that will protect against entry of birds, insects, and dirt.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

    a. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
    b. CPVC Piping: Join according to ASTM D 2846/D 2846M, Appendix.
    c. PVC Pressure Piping: Join schedule number ASTM D 1785 PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.

4. Slope pipe vent back to furnace or to outside terminal.

D. Connect ducts to furnace with flexible connector. Comply with requirements in Section 233300 "Air Duct Accessories."

E. Connect refrigerant tubing kits to refrigerant coil in furnace and to air-cooled compressor-condenser unit.

1. Flared Joints: Use ASME B16.26 fitting and flared ends, following procedures in CDA's "Copper Tube Handbook."
2. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
3. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.

F. Comply with requirements in Section 232300 "Refrigerant Piping" for installation and joint construction of refrigerant piping.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform electrical test and visual and mechanical inspection.
2. Leak Test: After installation, charge systems with refrigerant and test for leaks. Repair leaks, replace lost refrigerant, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation, product capability, and compliance with requirements.
4. Verify that fan wheel is rotating in the correct direction and is not vibrating or binding.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

3.5 STARTUP SERVICE

A. Complete installation and startup checks according to manufacturer's written instructions and perform the following:

1. Inspect for physical damage to unit casings.
2. Verify that access doors move freely and are weathertight.
3. Clean units and inspect for construction debris.
4. Verify that all bolts and screws are tight.
5. Adjust vibration isolation and flexible connections.
6. Verify that controls are connected and operational.

B. Adjust fan belts to proper alignment and tension.

C. Start unit according to manufacturer's written instructions and complete manufacturer's operational checklist.

D. Measure and record airflows.

E. Verify proper operation of capacity control device.

F. After startup and performance test, lubricate bearings and adjust belt tension.

3.6 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set controls, burner, and other adjustments for optimum heating performance and efficiency. Adjust heat-distribution features, including shutters, dampers, and relays, to provide optimum heating performance and system efficiency.

3.7 CLEANING

A. After completing installation, clean furnaces internally according to manufacturer's written instructions.

B. Install new filters in each furnace within 14 days after Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain condensing units. Refer to Section 017900 "Demonstration and Training."

END OF SECTION 235416.13

SECTION 237200 - AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Fixed-plate total heat exchangers.
2. Packaged energy recovery units.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design vibration isolation and seismic-restraint details, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Seismic Performance: Air-to-air energy recovery equipment shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Delegated-Design Submittal: For air-to-air energy recovery equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of air-to-air energy recovery equipment.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
3. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Data: Certificates, for air-to-air energy recovery equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ARI Compliance:

1. Capacity ratings for air-to-air energy recovery equipment shall comply with ARI 1060, "Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment."
2. Capacity ratings for air coils shall comply with ARI 410, "Forced-Circulation Air-Cooling and Air-Heating Coils."

C. ASHRAE Compliance:

1. Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat Exchangers."

D. NRCA Compliance: Roof curbs for roof-mounted equipment shall be constructed according to recommendations of NRCA.

E. UL Compliance:

1. Packaged heat recovery ventilators shall comply with requirements in UL 1812, "Ducted Heat Recovery Ventilators"; or UL 1815, "Nonducted Heat Recovery Ventilators."
2. Electric coils shall comply with requirements in UL 1995, "Heating and Cooling Equipment."

1.8 COORDINATION

A. Coordinate layout and installation of air-to-air energy recovery equipment and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate sizes and locations of concrete bases with actual equipment provided.

C. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.9 WARRANTY

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

1. Warranty Period for Packaged Energy Recovery Units: Two years.
2. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 PACKAGED ENERGY RECOVERY UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Loren Cook Company.
3. RenewAire LLC.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, gasketed and calked weathertight, with neoprene gaskets for inspection and access to internal parts, minimum 1-inch- thick thermal insulation, knockouts for electrical and piping connections, exterior drain connection, and lifting lugs.

1. Inlet: Weatherproof hood, with damper for exhaust and supply.

    a. Exhaust: Gravity backdraft damper.
    b. Supply: Spring-return, two-position, motor-operated damper.

2. Roof Curb: Refer to Section 077200 "Roof Accessories" for roof curbs and equipment supports.

D. Heat Recovery Device: Fixed-plate heat exchanger.

E. Supply and Exhaust Fans: Forward-curved, centrifugal fan with restrained, spring isolators and flexible duct connections.

1. Motor and Drive: Belt driven with adjustable sheaves, motor mounted on adjustable base.
2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
4. Spring isolators on each fan having 1-inch static deflection.

F. Extended-Surface, Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Filter Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lift out from access plenum.
3. Factory-fabricated, dry, extended-surface type.
4. Thickness: 2 inches.
5. Minimum Arrestance: 90, according to ASHRAE 52.1.
6. MERV: 7, according to ASHRAE 52.2.
7. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.
8. Media-Grid Frame: Nonflammable cardboard.
9. Mounting Frames: Welded, galvanized steel with gaskets and fasteners, suitable for bolting together into built-up filter banks.

G. Piping and Wiring: Fabricate units with space within housing for piping and electrical conduits. Wire motors and controls so only external connections are required during installation.

1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.

2. Outdoor Enclosure: NEMA 250, Type 3R enclosure contains relays, starters, and terminal strip.
3. Include nonfused disconnect switches.

H. Accessories:

1. Roof Curb: Galvanized steel with gasketing, and factory-installed wood nailer; complying with NRCA standards; minimum height of 14 inches.
2. Intake weather hood with 2-inch-thick filters.
3. Louvered intake weather hood with 2-inch-thick filters in V-bank configuration.
4. Exhaust weather hood with birdscreen.
5. Hinged access doors with quarter-turn latches.

2.2 CONTROLS

A. Time Clock: Solid-state, programmable, microprocessor-based unit for wall mounting with up to eight on/off cycles per day and battery backup protection of program settings against power failure to energize unit.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before air-to-air energy recovery equipment installation. Reject insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for electrical services to verify actual locations of connections before installation.

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

3.2 INSTALLATION

A. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger. Access doors and panels are specified in Section 233300 "Air Duct Accessories."

B. Equipment Mounting:

C. Roof Curb: Install on roof structure or concrete base, level and secure, according to The NRCA "Roofing and Waterproofing Manual - Volume 4: Construction Details - Low-Slope Roofing," Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install air-to-air energy recovery equipment on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure air-to-air energy recovery equipment to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts.

D. Install wind and seismic restraints according to manufacturers' written instructions. Wind and seismically restrained vibration isolation roof-curb rails are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

3.3 CONNECTIONS

A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping" and Section 232116 Hydronic Piping Specialties." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to unit to allow service and maintenance.

C. Comply with requirements for ductwork specified in Section 233113 "Metal Ducts."

D. Install electrical devices furnished with units but not factory mounted.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Adjust seals and purge.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

4. Set initial temperature and humidity set points.
5. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

D. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy recovery units.

END OF SECTION 237200

SECTION 238126 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For units with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

B. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division.
2. SANYO North America Corporation; SANYO Fisher Company.

3. LG.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Wall-Mounted, Evaporator-Fan Components:

1. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
2. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
3. Fan: Direct drive, centrifugal.
4. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Enclosure Type: Totally enclosed, fan cooled.
    d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1.
    e. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
    f. Mount unit-mounted disconnect switches on exterior of unit.

5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
    b. Single-wall, stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

7. Air Filtration Section:

    a. General Requirements for Air Filtration Section:

        1) Comply with NFPA 90A.
        2) Minimum Arrestance: According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
        3) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

    b. Disposable Panel Filters:

1) Factory-fabricated, viscous-coated, flat-panel type.
2) Thickness: 1 inch.
3) Arrestance according to ASHRAE 52.1: 80.
4) MERV according to ASHRAE 52.2: 5.
5) Media: Interlaced glass fibers sprayed with nonflammable adhesive.
6) Frame: Galvanized steel, with metal grid on outlet side, steel rod grid on inlet side, and hinged; with pull and retaining handles.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Refrigerant Charge: R-410A.
    c. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Drain Hose: For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install compressor-condenser components on field fabricated roof curb or polyethylene mounting base as indicated on drawings.
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Insert startup steps if any.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Electrical equipment coordination and installation.
   2. Sleeves for raceways and cables.
   3. Sleeve seals.
   4. Grout.
   5. Common electrical installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate electrical connections to equipment:
   1. Refer to equipment manufacturer's shop drawings and written instructions. Provide all power and control wiring with associated raceways for complete operation.
   2. Where equipment is furnished with a cord and plug, provide receptacle to match equipment plug.
   3. Verify electrical requirements of equipment on nameplate and installation manual. Ensure that the electrical connections meet the requirements and notify Architect/Engineer of any discrepancies.
   4. Meet with equipment manufacturers representatives to coordinate equipment installation and electrical connections.

C. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

E. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."."

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Metraflex Co.
   d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants.".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.5 ACCESS DOORS

A. Provide access doors to maintain access to junction boxes, cable trays, open wiring systems and other equipment requiring access. Install access doors in locations approved by the Architect. . Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

END OF SECTION 260500

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Technologies Corporation.
3. Senator Wire & Cable Company.
4. Southwire Incorporated.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2 Type XHHW-2.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following
1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; a brand of the EGS Electrical Group.
4. 3M; Electrical Markets Division.
5. Tyco Electronics.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Branch Circuits: Type THHN-2-THWN-2, single conductors in raceway.

B. Multi-Wire Branch Circuits: Install no more than three circuits in a raceway, unless specifically shown otherwise.

C. Neutral Conductors: Provide one neutral conductor for each phase conductor. Shared neutral conductors are not allowed.
   1. Share neutral conductors are allowed only when multi-pole branch breakers are used to disconnect all phase conductors with a common neutral conductor, and shared neutral conductor is one size larger than the phase conductors.

D. Minimum Branch Circuit Conductor Size: Provide the following minimum sizes for distances listed on 20A branch circuits to prevent excessive voltage drop. The circuit length shall be measured along the length of the conductor form the circuit breaker in the panelboard to the last device on the circuit. Increase raceway size to comply with conductor fill requirements of NFPA 70.

   1. Branch Circuit Voltage of 120V:
      a. Circuit lengths less than 70 feet: Provide minimum #12 AWG conductor size.
      b. Circuit lengths between 70 feet and 110 feet: Provide minimum #10 AWG conductor size.
      c. Circuit lengths between 110 feet and 170 feet: Provide minimum #8 AWG conductor size.
      d. Circuit lengths greater than 170 feet: Perform voltage drop calculations and provide conductor size to keep branch circuit voltage drop less than 3% with a 15 amp load.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least **12 inches (300 mm)** of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

B. Section includes grounding and bonding systems and equipment, plus the following special applications:
   1. Underground distribution grounding.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 467 for grounding and bonding materials and equipment.

D. Comply with NFPA 70 for grounding and bonding of electrical systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. Burndy; Part of Hubbell Electrical Systems.
   2. Dossert; AFL Telecommunications LLC.
   3. ERICO International Corporation.
   4. Fushi Copperweld Inc.
   5. Galvan Industries, Inc.; Electrical Products Division, LLC.
   6. Harger Lightning and Grounding.
   7. ILSCO.
   8. O-Z/Gedney; A Brand of the EGS Electrical Group.
   9. Robbins Lightning, Inc.
   10. Siemens Power Transmission & Distribution, Inc.

2.2 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.3 CONDUCTORS

A. Insulated ConductorsCopper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.
1. Bury at least 35 inches (900 mm) below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

3.2 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

C. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
b. Perform tests by fall-of-potential method according to IEEE 81.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Hangers and supports for electrical equipment and systems.
   2. Construction requirements for concrete bases.

B. Related Sections include the following:
   1. Section 260548 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. RMC: Rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Steel slotted support systems.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
   1. Trapeze hangers. Include Product Data for components.

2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

1.8 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Allied Tube & Conduit.
   b. Cooper B-Line, Inc.; a division of Cooper Industries.
   c. ERICO International Corporation.
   d. GS Metals Corp.
   e. Thomas & Betts Corporation.
   f. Unistrut; Tyco International, Ltd.
   g. Wesanco, Inc.
2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Hilti Inc.
      2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.
      4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      1) Cooper B-Line, Inc.; a division of Cooper Industries.
      2) Empire Tool and Manufacturing Co., Inc.
      3) Hilti Inc.
      4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings less than stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 50 percent in future without exceeding specified design load limits.
1. Secure raceways and cables to these supports with two-bolt conduit clamps.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.
1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. GRC: Galvanized rigid steel conduit.

B. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
1. Custom enclosures and cabinets.
2. For handholes and boxes for underground wiring, including the following:
a. Duct entry provisions, including locations and duct sizes.
b. Frame and cover design.
c. Grounding details.
d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
e. Joint details.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

B. Source quality-control test reports.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Allied Tube & Conduit; a Tyco International Ltd. Co.
4. Anamet Electrical, Inc.; Anaconda Metal Hose.
5. Electri-Flex Co.
6. Manhattan/CDT/Cole-Flex.
7. Maverick Tube Corporation.
8. O-Z Gedney; a unit of General Signal.
9. Wheatland Tube Company.

B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. GRC: Comply with ANSI C80.1 and UL 6.

D. IMC: Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit].
1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

F. EMT: Comply with ANSI C80.3 and UL 797.

G. FMC: Comply with UL 1; zinc-coated steel

H. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2. Fittings for EMT:
   a. Material: Steel .
   b. Type: Setscrew or compression.
3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems, Inc.
2. Anamet Electrical, Inc.
3. Arnco Corporation.
4. CANTEX Inc.
5. CertainTeed Corp.
6. Condux International, Inc.
7. ElecSYS, Inc.
8. Electri-Flex Company.
9. Lamson & Sessions; Carlon Electrical Products.
10. Niedax-Kleinhuis USA, Inc.
11. RACO; a Hubbell company.
12. Thomas & Betts Corporation.

B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

D. Fittings for RNC: Comply with NEMA TC 3; match to conduit type and material.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper B-Line, Inc.
2. Hoffman; a Pentair company.
3. Square D; a brand of Schneider Electric.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for indoor dry installations and 3R for outdoor and wet or damp location, unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Retain one or more options in "Wireway Covers" Paragraph below. If retaining more than one type, indicate locations of each type on Drawings.

E. Wireway Covers: Hinged type.

F. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. EGS/Appleton Electric.
3. Erickson Electrical Equipment Company.
4. Hoffman.
5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
6. O-Z/Gedney; a unit of General Signal.
7. RACO; a Hubbell Company.
8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: NEMA OS 1; double-gang, minimum 4-11/16" square boxes with single or double-gang mud ring appropriate for the device and wall plate. Comply with UL 514A.
1. Boxes in concrete and block walls may be single-gang.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:
1. Cast or sheet metal, fully adjustable, rectangular.
2. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Nonmetallic Floor Boxes: Nonadjustable, rectangular.

1. Listing and Labeling: Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions unless otherwise indicated: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**.

L. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 for indoors; Type 3R for outdoor,with continuous-hinge cover with flush latch unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

M. Cabinets:
1. NEMA 250, Type 1 for indoors; Type 3R for outdoor,galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: Rigid galvanized steel conduit.

2. Concealed Conduit, Aboveground: Rigid steel conduit.
3. Underground Conduit: RNC, Type EPC-40-PVC:
   a. Concrete-encased where indicated.
   b. Provide wrapped rigid steel conduit for the following conditions:
      1) Penetrations through foundation walls.
      2) Bends greater than 22 degrees.
      3) Stub ups, or where underground conduits otherwise become exposed.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R
6. Application of Handholes and Boxes for Underground Wiring:

a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Physical Damage: Rigid steel conduit. Raceway locations include the following:
a. Loading dock.
b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
c. Mechanical rooms.
3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
5. Damp or Wet Locations: GRC.
6. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Install surface raceways only where indicated on Drawings.

3.2 INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

C. Complete raceway installation before starting conductor installation.

D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

H. Do not install conduits embedded in elevated slabs.

I. Support conduit within 12 inches (300 mm) of enclosures to which attached.

J. Raceways Embedded in Slabs:
   1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m)intervals.
   2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
   3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
   4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
   5. Change to rigid steel conduit before rising above the floor.

K. Stub-ups to Above Recessed Ceilings:
   1. Use EMT, IMC, or RMC for raceways.
   2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

R. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

S. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

T. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

U. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where an underground service raceway enters a building or structure.
   3. Where otherwise required by NFPA 70.

V. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
   1. Use LFMC in damp or wet locations subject to severe physical damage.

X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Z. Boxes in stud walls: Do not install boxes back to back in stud walls. Allow one stud separation or 24" minimum. Where this is not possible, then provide boxes with UL-listed fire rated and sound rated wrapping.

AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

BB. Locate boxes so that cover or plate will not span different building finishes.

CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

EE. Set metal floor boxes level and flush with finished floor surface.

FF. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Conduit, ducts, and duct accessories for direct-buried duct banks, and in single duct runs.
   2. Handholes and boxes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Duct-bank materials, including separators and miscellaneous components.
   2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
   3. Accessories for manholes, handholes, pull boxes, and other utility structures.
   4. Warning tape.

B. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
   1. Duct entry provisions, including locations and duct sizes.
   2. Cover design.
   3. Grounding details.
   4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For concrete and steel used in precast concrete manholes , pull boxes and handholes, comply with ASTM C 858.

B. Source quality-control test reports.

C. Field quality-control test reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Comply with ANSI C2.

C. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Architect/Engineer and Owner no fewer than two weeks in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Architect's and Owner's written permission.

1.9 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Architect and/or Engineer.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. AFC Cable Systems.
2. ARNCO Corp.
3. Beck Manufacturing.
4. Cantex, Inc.

5. CertainTeed Corp.; Pipe & Plastics Group.
6. Condux International, Inc.
7. DCX-CHOL Enterprises, Inc.; ELECSYS Division.
8. Electri-Flex Company.
9. IPEX Inc.
10. Lamson & Sessions; Carlon Electrical Products.
11. Manhattan/CDT; a division of Cable Design Technologies.

B. Duct Accessories:
1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Christy Concrete Products.
2. Cretex Concrete Products West, Inc.; Riverton Division
3. Elmhurst-Chicago Stone Co.
4. Oldcastle Precast Group.
5. Utility Concrete Products, LLC.
6. Wausau Tile, Inc.

B. Comply with ASTM C 858 for design and manufacturing processes.

C. Ferrous metal hardware shall be hot-dip galvanized in accordance with ASTM A153 (ASTM A153M) and ASTM A123 (ASTM A123M).

D. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
1. Frame and Cover: Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
2. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
3. Cover Legend: Molded lettering, "ELECTRIC" or "TELEPHONE" as required for each service.
4. Configuration: Units shall be designed for flush burial and have closed bottom, unless otherwise indicated.
5. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
   a. Extension shall provide increased depth of 12 inches (300 mm)
   b. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
6. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
   a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.

b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.

7. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   a. Type and size shall match fittings to duct or conduit to be terminated.
   b. Fittings shall align with elevations of approaching ducts and be located near interior corners of handholes to facilitate racking of cable.
8. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
   a.

2.4 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

PART 3 - EXECUTION

3.1 CORROSION PROTECTION

A. Aluminum shall not be installed in contact with earth or concrete.

3.2 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Brach Circuits 600 V and Less: RNC**,** NEMA Type EPC-40-PVC, in direct-buried duct bank, unless otherwise indicated.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Pull Boxes for 600 V and Less
1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf (13 345-N) vertical loading.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 312000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

3.5 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of **12.5 feet (4 m),** both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
   2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to manhole or handhole.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

G. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.

H. Direct-Buried Duct Banks:
   1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
   2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
   3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
   4. Install backfill as specified in Section 312000 "Earth Moving."
   5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
   6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.

7. Depth, 600V and Below: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES

A. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
3. Install handholes with bottom below the frost line.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.

D. Hardware: Install removable hardware, including pulling eyes, cable stanchions, [**and**] cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

E. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches (98 mm) for manholes and 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
   2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
   3. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 260543

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.
5. Silicone sealants.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATION SUBMITTALS

A. COORDINATION
1. Coordinate arrangement, mounting, and support of electrical equipment:
a. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
b. To provide for ease of disconnecting the equipment with minimum interference to other installations.
c. To allow right of way for piping and conduit installed at required slope.
d. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
2. Coordinate electrical connections to equipment:
a. Refer to equipment manufacturer's shop drawings and written instructions. Provide all power and control wiring with associated raceways for complete operation.
b. Where equipment is furnished with a cord and plug, provide receptacle to match equipment plug.
c. Verify electrical requirements of equipment on nameplate and installation manual. Ensure that the electrical connections meet the requirements and notify Architect/Engineer of any discrepancies.
d. Meet with equipment manufacturers representatives to coordinate equipment installation and electrical connections.

3. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
4. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:
1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.

D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.

E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

F. Sleeves for Rectangular Openings:
1. Material: Galvanized sheet steel.
2. Minimum Metal Thickness:
   a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
   b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Advance Products & Systems, Inc.
   b. CALPICO, Inc.
   c. Metraflex Company (The).
   d. Pipeline Seal and Insulator, Inc.
2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 SLEEVE-SEAL FITTINGS

A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Presealed Systems.

2.4 GROUT

A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.

B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.5 SILICONE SEALANTS

A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.

B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Comply with NEMA VE 2 for cable tray and cable penetrations.

C. Cut sleeves to length for mounting flush with both surfaces of walls.

D. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."

b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.

2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.

E. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.

F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.

B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

A. Install sleeve-seal fittings in new walls and slabs as they are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.

C. Secure nailing flanges to concrete forms.

D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 260544

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Isolation pads.
   2. Spring isolators.
   3. Restrained spring isolators.
   4. Channel support systems.
   5. Restraint cables.
   6. Hanger rod stiffeners.
   7. Anchorage bushings and washers.

B. Related Sections include the following:
   1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

A. The IBC: International Building Code.

B. ICC-ES: ICC-Evaluation Service.

C. OSHPD: Office of Statewide Health Planning and Development for the State of California.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:
   1. Site Class as Defined in the IBC: Refer to structural plans and specifications.
   2. Assigned Seismic Use Group or Building Category as Defined in the IBC: Refer to structural plans and specifications.
      a. Component Importance Factor: Refer to structural plans and specifications.
      b. Component Response Modification Factor: Refer to structural plans and specifications.
      c. Component Amplification Factor: Refer to structural plans and specifications.
   3. Design Spectral Response Acceleration at Short Periods (0.2 Second): Refer to structural plans and specifications.
   4. Design Spectral Response Acceleration at 1.0-Second Period: Refer to structural plans and specifications.

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
    b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
    a. Coordinate design calculations with wind-load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
3. Field-fabricated supports.
4. Seismic-Restraint Details:
    a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
    c. Preapproval and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data: For professional engineer.

C. Welding certificates.

D. Field quality-control test reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ace Mountings Co., Inc.
2. Amber/Booth Company, Inc.
3. California Dynamics Corporation.
4. Isolation Technology, Inc.
5. Kinetics Noise Control.
6. Mason Industries.
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation.
9. Vibration Mountings & Controls, Inc.

B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material: Oil- and water-resistant neoprene, rubber, or hermetically sealed compressed fiberglass.

C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
   2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
   3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Amber/Booth Company, Inc.
   2. California Dynamics Corporation.
   3. Cooper B-Line, Inc.; a division of Cooper Industries.
   4. Hilti Inc.
   5. Loos & Co.; Seismic Earthquake Division.
   6. Mason Industries.
   7. TOLCO Incorporated; a brand of NIBCO INC.
   8. Unistrut; Tyco International, Ltd.

C. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
   1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

D. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

E. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

F. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

G. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

I. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

J. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

K. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish: Manufacturer's standard prime-coat finish ready for field painting.

B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
1. Powder coating on springs and housings.
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color-code or otherwise mark vibration isolation and seismic-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment and Hanger Restraints:
   1. Install restrained isolators on electrical equipment.
   2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
   3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.

B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

D. Drilled-in Anchors:
   1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
   2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
   3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
   4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
   5. Set anchors to manufacturer's recommended torque, using a torque wrench.
   6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Perform tests and inspections.

C. Tests and Inspections:
   1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
   2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
   3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
   4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
   5. Test to 90 percent of rated proof load of device.
   6. Measure isolator restraint clearance.
   7. Measure isolator deflection.
   8. Verify snubber minimum clearances.
   9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Warning labels and signs.
5. Instruction signs.
6. Equipment identification labels.
7. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."

C. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Colors for Cables Carrying Circuits at 600 V and Less:
1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

C. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.3 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.

B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- (0.08-mm-) thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.

D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

E. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

F. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

G. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.4 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

D. Write-On Tags: Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
   1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.5 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:
   1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.
   3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Metal-Backed, Butyrate Warning Signs:
   1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
   2. 1/4-inch (6.4-mm) grommets in corners for mounting.

3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.6 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

B. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Minimum letter height shall be 3/8 inch (10 mm). Color-code labels based on the electrical system branch as indicated in the Execution section below.

B. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch (25 mm).

2.8 CABLE TIES

A. Plenum-Rated Cable Ties: Self extinguishing, UV stabilized, one piece, self locking.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 deg F (23 deg C), According to ASTM D 638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.

G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
   1. Outdoors: UV-stabilized nylon.
   2. In Spaces Handling Environmental Air: Plenum rated.

J. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

A. Accessible Raceways, More Than 600 V: Painted Red. Install labels at 30-foot (10-m) maximum intervals.

B. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 10-foot (3-m) maximum intervals.

C. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
   1. Emergency Power.

2. Power.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
   1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
      a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
      b. Colors for 208/120-V Circuits:
         1) Phase A: Black.
         2) Phase B: Red.
         3) Phase C: Blue.
      c. Colors for 480/277-V Circuits:
         1) Phase A: Brown.
         2) Phase B: Orange.
         3) Phase C: Yellow.
      d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

E. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use write-on tags.Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

G. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
   1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
   2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
   3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
   1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

K. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless

otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
   1. Comply with 29 CFR 1910.145.
   2. Identify system voltage with black letters on an orange background.
   3. Apply to exterior of door, cover, or other access.
   4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
      a. Power transfer switches.
      b. Controls with external control power connections.

M. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

N. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

O. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
   1. Labeling Instructions:
      a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
      b. Outdoor Equipment: Engraved, laminated acrylic or melamine label stenciled legend 4 inches (100 mm) high.
      c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
      d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
      e. Color Coding of Labels: Identify branch of electrical system by coloring coding the labels
         1) Equipment Connected to Normal Power: White lettering on black background.
         2) Equipment Connected to Emergency (life-safety) Power: White lettering on red background.
         3) Equipment Connected to Stand-by(optional) Power: Red lettering on white background.
         4) Equipment Connected to UPS Power, "A" system: White lettering on orange background.
         5) Equipment Connected to UPS Power, "B" system: White lettering on blue background.

6) Equipment Connected to UPS Power, non-redundant office system: Orange lettering on white background

f. Identify source bus, voltage and location feeding the equipment, for example:

PANEL 3LBA
120/208V 3-PHASE 4-WIRE
FED FROM 3LDPB
ROOM #1003

2. Equipment to Be Labeled:
   a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
   b. Enclosures and electrical cabinets.
   c. Access doors and panels for concealed electrical items.
   d. Switchboards.
   e. Emergency system boxes and enclosures.
   f. Motor-control centers.
   g. Enclosed switches.
   h. Enclosed circuit breakers.
   i. Enclosed controllers.
   j. Variable-speed controllers.
   k. Push-button stations.
   l. Power transfer equipment.
   m. Contactors.
   n. Remote-controlled switches, dimmer modules, and control devices.
   o. Power-generating units.

END OF SECTION 260553

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Time switches.
   2. Photoelectric switches.
   3. Indoor occupancy sensors.
   4. Lighting contactors.
   5. Emergency shunt relays.

B. Related Requirements:
   1. Section 262726 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Interconnection diagrams showing field-installed wiring.
   2. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Intermatic, Inc.
   2. TORK.

B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
   1. Contact Configuration: SPST, DPST or DPDT.
   2. Contact Rating: 30-A inductive or resistive, 240-V ac.
   3. Programs: Eight channels; each channel shall be individually programmable with 40 on-off operations per week and an annual holiday schedule that overrides the weekly operation on holidays.
   4. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
   5. Astronomic Time: All channels.
   6. Automatic daylight savings time changeover.
   7. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

C. Electromechanical-Dial Time Switches: Comply with UL 917.
   1. Contact Configuration: SPST, DPST, SPDT or DPDT.
   2. Contact Rating: 30-A inductive or resistive, 240-V ac
   3. Circuitry: Allows connection of a photoelectric relay as a substitute for the on-off function of a program.
   4. Astronomic time dial.
   5. Eight-Day Program: Uniquely programmable for each weekday and holidays.
   6. Skip-a-day mode.
   7. Wound-spring reserve carryover mechanism to keep time during power failures, minimum of 16 hours.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Intermatic, Inc.
   2. Lithonia Lighting; Acuity Lighting Group, Inc.
   3. Novitas, Inc.
   4. Square D; Schneider Electric.
   5. TORK.
   6. Touch-Plate, Inc.
   7. Watt Stopper (The).

B. Description: Solid state, with DPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lux), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lithonia Lighting; Acuity Lighting Group, Inc.
2. MicroLite Lighting Control Systems.
3. Novitas, Inc.
4. Paragon Electric Co.; Invensys Climate Controls.
5. Sensorswitch.
6. Watt Stopper (The).

B. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
1. Sensor Output:
   a. On/Off Relay: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   b. Analog Output: 0 - 10VDC, proportional to the amount of monitored light, to direclty control a fluorescent dimming ballast, or connect to a central daylighting control unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
3. Light-Level Monitoring Range: 10 to 1000 fc (108 to 10 800 lx), with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

C. Skylight Photoelectric Sensors: Solid-state, light-level sensor; housed in a threaded, plastic fitting for mounting under skylight, facing up at skylight; with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
1. Sensor Output:
   a. On/Off Relay: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
   b. Analog Output: 0 - 10VDC, proportional to the amount of monitored light, to direclty control a fluorescent dimming ballast, or connect to a central daylighting control unit.
2. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.

3. Light-Level Monitoring Range: 10 to 1000 fc (108 to 10 800 lx), with an adjustment for turn-on and turn-off levels within that range.
4. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with deadband adjustment.
5. Indicator: Two LEDs to indicate the beginning of on-off cycles.

2.4 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Building Automation, Inc.
2. Leviton Mfg. Company Inc.
3. Lithonia Lighting; Acuity Lighting Group, Inc.
4. Novitas, Inc.
5. Sensor Switch, Inc.
6. Watt Stopper.

B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate relay unit power pack.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
5. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
6. Auxiliary Relay: For connection to the building automation system to monitor room occupancy.
7. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.
   b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
   c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
8. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
9. Bypass Switch: Override the "on" function in case of sensor failure.
10. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux); turn lights off when selected lighting level is present.

C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
1. Sensitivity Adjustment: Separate for each sensing technology.

2. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm), and detect a person of average size and weight moving not less than 12 inches (305 mm) in either a horizontal or a vertical manner at an approximate speed of 12 inches/s (305 mm/s).
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.

2.5 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Corporation.
4. GE Industrial Systems; Total Lighting Control.
5. Square D; a brand of Schneider Electric.

B. Description: Electrically operated and mechanically held, combination-type lighting contactors with nonfused disconnect complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250.
4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

C. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
1. Monitoring: On-off status.
2. Control: On-off operation.

2.6 EMERGENCY SHUNT RELAY

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
1. Lighting Control and Design; Acuity Lighting Group, Inc.

B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
1. Coil Rating: 120-277 V.

2.7 CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is 1/2 inch (13 mm).

B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections:
1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Lighting control devices will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

END OF SECTION 260923

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.
   3. Fusible selective coordination branch-circuit panelboards.

1.3 DEFINITIONS

A. SVR: Suppressed voltage rating.

B. SPD: Surge Protection Device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard, switching and overcurrent protective device, surge protection device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
   2. Detail enclosure types and details for types other than NEMA 250, Type 1.
   3. Detail bus configuration, current, and voltage ratings.
   4. Short-circuit current rating of panelboards and overcurrent protective devices.
   5. Include evidence of NRTL listing for series rating of installed devices.
   6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   7. Include wiring diagrams for power, signal, and control wiring.
   8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems." Include the following:
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field Quality-Control Reports:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NEMA PB 1.

E. Comply with NFPA 70.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
   2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
      a. Ambient Temperature: Not exceeding minus 22 deg F (minus 30 deg C) to plus 104 deg F (plus 40 deg C).
      b. Altitude: Not exceeding 6600 feet (2000 m).

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
   1. Ambient temperatures within limits specified.
   2. Altitude not exceeding 6600 feet (2000 m).

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of electric service.
   2. Do not proceed with interruption of electric service without Architect's and Owner's written permission.
   3. Comply with NFPA 70E.

1.11 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate with work of other trades so that piping, ductwork or any equipment foreign to the electrical installation is not located directly above panelboards.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets as indicated.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
      b. Outdoor Locations: NEMA 250, Type 3R.
      c. Kitchen Areas: NEMA 250, Type 4X.
      d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
      e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
   2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
   3. Finishes:
      a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel.
   4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.

C. Incoming Mains Location: Top and bottom.

D. Phase, Neutral, and Ground Buses:
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
   4. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.

E. Conductor Connectors: Suitable for use with conductor material and sizes.
   1. Material: Hard-drawn copper, 98 percent conductivity.
   2. Main and Neutral Lugs: Mechanical type.
   3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
   5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
   6. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

F. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

2.3 DISTRIBUTION PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, power and feeder distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

D. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

F. Branch Overcurrent Protective Devices: Fused switches.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

D. Doors: Hinged front cover; secured with flush latch with tumbler lock; keyed alike.

E. Covers: Hinged front cover (door-in-door) type.

2.5 FUSIBLE SELECTIVE COORDINATION BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann
2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
3. Siemens Energy & Automation, Inc.

B. Panelboard branch circuits shall incorporate overcurrent protection and branch-circuit rated disconnecting means into a single integrated component.

C. Panelboard shall be equipped with a six-space spare fuse holder for storing replacement branch circuit fuses. Spare fuse holder shall be located behind locking panel door.

D. Panelboard overcurrent protective device interrupting ratings shall be fully rated for the maximum available fault current and have a UL Listed interrupting rating of 300kA and CSA Certified interrupting rating of 200kA.

E. Main Disconnect: Quick-make, quick break type.
1. Permanently installed lockout means shall be provided on the main disconnect for lockout tag-out procedures.
2. Ratings up to 400A.

F. Branch Fused Disconnects:
1. Branch circuit switches shall have visible circuit ON/OFF indication with colored and international symbol markings.
2. Branch circuit switches open fuse indication via permanently installed neon indicating light.
3. Device shall be UL and cUL Listed 600Vac, 200kA short-circuit current rating, load-break disconnect with amperage ratings and number of poles as indicated on the panelboard schedule.
4. Fuse and disconnect assembly shall be a finger-safe component with trim installed.
5. Fuse and disconnect shall be mechanically interlocked so as not to allow fuse removal while fuse terminals are energized.
6. Branch circuit switches shall have bolt-on style bus connectors.
7. Branch circuit switches housing shall be clearly marked with device amperage.
8. Permanently installed lockout means shall be provided on the device for lockout tag-out procedures. Permanently installed means for locking device in the ON position shall also be provided where indicated on associated schedules or drawings.

9. Branch circuit switches shall provide fuse ampere rating rejection at the following ampacities to ensure continued circuit protection at the specified circuit rating (1-pole, 2-pole and 3-pole types): 15A, 20A, 30A, 40A, 50A, 60A, 70A, 80A & 100A.

G. Enclosures: Boxes shall be a nominal 20 inches wide and 5-¾ inches deep with wire bending space per the National Electrical Code.

H. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

I. Covers: Hinged front cover (door-in-door) type.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

f. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
g. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
h. Handle Clamp: loose attachments, for holding circuit-breaker handle in on position.

B. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Section 262813 "Fuses."
2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

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

3.2 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Equipment Mounting: Install floor-mounted panelboards on concrete bases, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

E. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.

H. Install filler plates in unused spaces.

I. Stub five 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

K. Comply with NECA 1.

L. Fuse Selection and Installation: Verify connected load(s) and selection of fuse sizes for each disconnect switch prior to selection and installation.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

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A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Isolated-ground receptacles.
4. Snap switches and wall-box dimmers.
5. Pendant cord-connector devices.
6. Cord and plug sets.
7. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.6 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Service/Power Poles: One for every 10, but no fewer thanone.
   2. Poke-Through, Fire-Rated Closure Plugs: One for every ten floor service outlets installed, but no fewer than two**.**
   3. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles and in the Wiring Device Schedule:
   1. Cooper Wiring Devices; Division of Cooper Industries, Inc. (Cooper).
   2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   3. Leviton Mfg. Company Inc. (Leviton).
   4. Pass & Seymour/Legrand (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

B. Products: Subject to compliance with requirements, provide products from the manufacturers listed in the Wiring Device Schedule.Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement SD, and FS W-C-596.

C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.

2.4 Products: Subject to compliance with requirements, provide products from the manufacturers listed in the Wiring Device Schedule.

A. GFCI RECEPTACLES
   1. General Description:
   2. Straight blade, non-feed-through type.
   3. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.

4. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection. UL listed for weather-resistant with "WR" listing marked visibly on face.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Products: Subject to compliance with requirements, provide products from the manufacturers listed in the Wiring Device Schedule.

2.5 PENDANT CORD-CONNECTOR DEVICES

A. Description:
1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.6 CORD AND PLUG SETS

A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.7 Toggle SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide products from the manufacturers listed in the Wiring Device Schedule.

C. Key-Operated Switches, 120/277 V, 20 A:
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 2221L.
b. Hubbell; HBL1221L.
c. Leviton; 1221-2L.
d. Pass & Seymour; PS20AC1-L.
2. Description: Single pole, with factory-supplied key in lieu of switch handle.

D. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 1995.
b. Hubbell; HBL1557.

c. Leviton; 1257.
d. Pass & Seymour; 1251.

E. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Cooper; 1995L.
b. Hubbell; HBL1557L.
c. Leviton; 1257L.
d. Pass & Seymour; 1251L

2.8 WALL-BOX DIMMERS

A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.

B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.

C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
1. Minimum rating: 1500 W.

D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Provide from full range of finished metal plates, as selected by the Architect.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

2.10 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartments: Barrier separates power from voice and data communication cabling.

C. Service Plate: Rectangular, Round, or as indicated; die-cast aluminum or solid brass with satin finish, as selected by Architect

D. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.

E. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable. Coordinate with voice/data cabling installer.

2.11 POKE-THROUGH ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products from the manufacturers listed in the wiring device schedule.

B. Description:
1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Service-Outlet Assembly: Flush type with four simplex receptacles and space for four RJ-45 jacks complying with requirements in Section 271500 "Communications Horizontal Cabling."
4. Size: Selected to fit nominal 3-inch (75-mm) cored holes in floor and matched to floor thickness.
5. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
6. Closure Plug: Arranged to close unused 3-inch (75-mm) cored openings and reestablish fire rating of floor.
7. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables.

2.12 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hubbell Incorporated; Wiring Device-Kellems.
2. Wiremold/Legrand.

B. Description:
1. Two-piece surface metal raceway, with factory-wired multioutlet harness.
2. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Multioutlet Harness:
1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
2. Receptacle Spacing: Refer to plans.
3. Wiring: No. 12 AWG solid, Type THHN copper, two circuit, connecting alternating receptacles.

2.13 FINISHES

A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

3. Isolated-Ground Receptacles: As specified above, with orange triangle on face.

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.

9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:
1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar

problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Wiring device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers and motor-control centers.
   2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
   1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
      a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
      b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
   2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
   3. Current-limitation curves for fuses with current-limiting characteristics.
   4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
   5. Coordination charts and tables and related data.
   6. Fuse sizes for elevator feeders and elevator disconnect switches.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Ambient temperature adjustment information.
   2. Current-limitation curves for fuses with current-limiting characteristics.
   3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
   4. Coordination charts and tables and related data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.6 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

1.7 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.8 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
2. Edison Fuse, Inc.
3. Ferraz Shawmut, Inc.
4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.

4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

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

3.2 FUSE APPLICATIONS

A. Cartridge Fuses:
1. Feeders: Class J, time delay.
2. Motor Branch Circuits: Class RK5, time delay.
3. Other Branch Circuits: Class J, time delay.
4. Control Circuits: Class CC, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Fuse Selection and Installation: Verify connected load(s) and selection of fuse sizes for each disconnect switch prior to selection and installation.

C. Install spare-fuse cabinet(s) indoors, in vicinity of main electrical disconnect.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Molded-case switches.
5. Enclosures.
6. Elevator Shunt-Trip Fused Disconnects

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of NRTL listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
   1. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

C. Manufacturer's field service report.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
   2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Comply with NFPA 70.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
   2. Altitude: Not exceeding 6600 feet (2010 m).

1.10 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position. Voltage rating shall exceed circuit voltage.

C. Accessories:
   1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
   2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
   3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
   4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
   5. Hookstick Handle: Allows use of a hookstick to operate the handle.
   6. Lugs: Mechanical type, suitable for number, size, and conductor material.
   7. Service-Rated Switches: Labeled for use as service equipment.

2.2 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
   2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
   3. Siemens Energy & Automation, Inc.
   4. Square D; a brand of Schneider Electric.

B. Type HD, Heavy Duty, Single Throw, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position. Voltage rating shall exceed circuit voltage.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
2. Long- and short-time pickup levels.
3. Long- and short-time time adjustments.
4. Ground-fault pickup level, time delay, and I^2t response.

F. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

G. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

H. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.

2.4 MOLDED-CASE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

C. Features and Accessories:
1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
8. Alarm Switch: One NO contact that operates only when switch has tripped.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

2.6 ELEVATOR SHUNT-TRIP FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Bussmann, Inc. - Power Module PS

B. Provide shunt-trip fused disconnect switch with all necessary relay(s), control transformer and other options, as shown on drawings and listed below:
   1. Ampere rating of the switch shall be based upon the elevator manufacturer requirements.
   2. Short-circuit current rating of 200,000A.
   3. Interlocks to prevent the opening of the cover when the switch is in the ON position. Interlock shall be defeatable for testing purposes.
   4. Handle lockable in OFF position.
   5. 100VA/120V control power transformer with primary and secondary fuses.
   6. Isolation relay (3PDT, 10amp, 120V). A normally open dry contact shall be provided by the Fire Alarm Safety System to energize the isolation relay and activate the shunt trip solenoid (140VA inrush at 120V). (Note: if 24V DC coil is selected, a separate 24V DC source and contact must be provided by the Fire Alarm Safety System.)
   7. Provide additional options as indicated below:
      a. Key to Test Switch
      b. “On” Pilot Light (Green, Red or White)
      c. Isolated Full Capacity Neutral Lug
      d. 1P NC Mechanical Interlock (required for hydraulic elevators with automatic recall).
      e. Fire Alarm Voltage Monitoring Relay (Comply with NFPA 72)
      f. NEMA 1 Enclosure.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in fusible devices. Verify connected load(s) and selection of fuse sizes for each disconnect switch prior to selection and installation.

E. Comply with NECA 1.

3.3 IDENTIFICATION

A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 262816

SECTION 262913 - ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes the following enclosed controllers rated 600 V and less:
   1. Full-voltage manual.
   2. Full-voltage magnetic.
   3. Multispeed.

B. Related Section:
   1. Section 262923 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

1.3 DEFINITIONS

A. CPT: Control power transformer.

B. MCCB: Molded-case circuit breaker.

C. MCP: Motor circuit protector.

D. N.C.: Normally closed.

E. N.O.: Normally open.

F. OCPD: Overcurrent protective device.

G. SCR: Silicon-controlled rectifier.

1.4 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.5 ACTION SUBMITTALS

A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.

B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
   1. Show tabulations of the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Nameplate legends.
      d. Short-circuit current rating of integrated unit.
      e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
      f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
   3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
   1. Routine maintenance requirements for enclosed controllers and installed components.
   2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
   3. Manufacturer's written instructions for setting field-adjustable overload relays.
   4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

1.9 DELIVERY, STORAGE, AND HANDLING

A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

B. If stored in areas subject to weather, cover enclosed controllers to protect them from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside controllers; install temporary electric heating, with at least 250 W per controller.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
1. Ambient Temperature: Not less than minus 22 deg F (minus 30 deg C) and not exceeding 104 deg F (40 deg C).
2. Altitude: Not exceeding 6600 feet (2010 m).

1.11 COORDINATION

A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 FULL-VOLTAGE CONTROLLERS

A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.

A. Motor-Starting Switches: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Siemens Energy & Automation, Inc.
d. Square D; a brand of Schneider Electric.
2. Configuration: Nonreversing.

3. Flush or surface mounting.
4. Red pilot light.

B. Fractional Horsepower Manual Controllers: "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
      c. Siemens Energy & Automation, Inc.
      d. Square D; a brand of Schneider Electric.
   2. Configuration: Nonreversing.
   3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
   4. Surface mounting.
   5. Red pilot light.

C. Magnetic Controllers: Full voltage, across the line, electrically held.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
      c. Siemens Energy & Automation, Inc.
      d. Square D; a brand of Schneider Electric.
   2. Configuration: Nonreversing.
   3. Contactor Coils: Pressure-encapsulated type.
      a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
   4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
   5. Control Circuits: 24 or 120-V ac, as required by the control circuit; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
      a. CPT Spare Capacity: 100 VA.
   6. Solid-State Overload Relay:
      a. Switch or dial selectable for motor running overload protection.
      b. Sensors in each phase.
      c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
      d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
      e. Analog communication module.
   7. N.C./N.O., isolated overload alarm contact.
   8. External overload reset push button.

D. Combination Magnetic Controller: Factory-assembled combination of magnetic controller, OCPD, and disconnecting means.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.

b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
c. Siemens Energy & Automation, Inc.
d. Square D; a brand of Schneider Electric.

2. Fusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
3. Nonfusible Disconnecting Means:
   a. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary Contacts: N.O./N.C., arranged to activate before switch blades open.
4. MCP Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
   b. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   c. Auxiliary contacts "a" and "b" arranged to activate with MCP handle.
   d. N.C./N.O. alarm contact that operates only when MCP has tripped.
   e. Current-limiting module to increase controller short-circuit current (withstand) rating to 100 kA.
5. MCCB Disconnecting Means:
   a. UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
   b. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   c. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
   d. Auxiliary contacts "a" and "b" arranged to activate with MCCB handle.
   e. N.C./N.O. alarm contact that operates only when MCCB has tripped.

2.2 MULTISPEED MAGNETIC CONTROLLERS

A. General Requirements for Multispeed Magnetic Controllers: Comply with NEMA ICS 2, general purpose, Class A.

B. Multispeed Magnetic Controllers: Two speed, full voltage, across the line, electrically held.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
      b. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
      c. Siemens Energy & Automation, Inc.
      d. Square D; a brand of Schneider Electric.
   2. Configuration: Nonreversing; consequent pole or two winding types as required by the motor being controlled.

3. Contactor Coils: Pressure-encapsulated type.
    a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
4. Power Contacts: Totally enclosed, double break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: 24 or 120-V ac, as required by the control circuit; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
    a. CPT Spare Capacity: 100 VA.
6. Compelling relays shall ensure that motor will start only at low speed.
7. Accelerating timer relays shall ensure properly timed acceleration through speeds lower than that selected.
8. Decelerating timer relays shall ensure automatically timed deceleration through each speed.
9. Antiplugging timer relays shall ensure a time delay when transferring from FORWARD to REVERSE and back.
10. Solid-State Overload Relay:
    a. Switch or dial selectable for motor running overload protection.
    b. Sensors in each phase.
    c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    d. Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
11. N.C./N.O., isolated overload alarm contact.
12. External overload reset push button.

2.3 ENCLOSURES

A. Enclosed Controllers: NEMA ICS 6, to comply with environmental conditions at installed location.
    1. Dry and Clean Indoor Locations: Type 1.
    2. Outdoor Locations: Type 3R.
    3. Kitchen and Wash-Down Areas: Type 4X, stainless steel.
    4. Other Wet or Damp Indoor Locations: Type 4.
    5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.

2.4 ACCESSORIES

A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
    1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oiltight type.
        a. Push Buttons: Covered, lockable types; maintained or momentary as indicated.
        b. Pilot Lights: LED types; colors as indicated; push to test.
        c. Selector Switches: Rotary type.

B. N.C./N.O. auxiliary contact(s).

C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.

D. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

E. Cover gaskets for Type 1 enclosures.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."

B. Floor-Mounted Controllers: Install enclosed controllers on 4-inch (100-mm) nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Seismic Bracing: Comply with requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in each fusible-switch enclosed controller.

F. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

G. Install heaters in thermal overload relays. Select heaters based on actual nameplate full-load amperes after motors have been installed.

H. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

I. Install power factor correction capacitors. Connect to the line side of overload relays. If connected to the load side of overload relays, adjust overload heater sizes to accommodate the reduced motor full-load currents.

J. Comply with NECA 1.

3.3 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved nameplate.
   3. Label each enclosure-mounted control and pilot device.

3.4 CONTROL WIRING INSTALLATION

A. Install wiring between enclosed controllers and remote devices and facility's central control system. Comply with requirements in Division 26 Section "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control selection devices where applicable.
   1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
   2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.
   1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
   2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
   3. Test continuity of each circuit.

4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Architect and Owner before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

D. Enclosed controllers will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.

C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Architect and Owner before increasing settings.

D. Set field-adjustable switches and program microprocessors for required start and stop sequences in reduced-voltage solid-state controllers.

E. Set field-adjustable circuit-breaker trip ranges.

3.7 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until enclosed controllers are ready to be energized and placed into service.

B. Replace controllers whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain enclosed controllers, and to use and reprogram microprocessor-based, reduced-voltage solid-state controllers.

END OF SECTION 262913

SECTION 265100 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Interior lighting fixtures, lamps, and ballasts.
   2. Emergency lighting units.
   3. Exit signs.
   4. Lighting fixture supports.

B. Related Sections:
   1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2.
   3. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

A. BF: Ballast factor.

B. CCT: Correlated color temperature.

C. CRI: Color-rendering index.

D. HID: High-intensity discharge.

E. LER: Luminaire efficacy rating.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of lighting fixture including dimensions.
   2. Emergency lighting units including battery and charger.
   3. Ballast, including BF.
   4. Energy-efficiency data.
   5. Air and Thermal Performance Data: For air-handling lighting fixtures. Furnish data required in "Action Submittals" Article in Section 233713 "Diffusers, Registers, and Grilles."

6. Sound Performance Data: For air-handling lighting fixtures. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."
7. Life, output (lumens, CCT, and CRI), and energy-efficiency data for lamps.
8. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing & Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the lighting fixture as applied in this Project.
    a. Testing Agency Certified Data: For indicated fixtures, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining fixtures shall be certified by manufacturer.
    b. Manufacturer Certified Data: Photometric data shall be certified by a manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom lighting fixtures. Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Seismic Qualification Certificates: For lighting fixtures, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Samples: For each lighting fixture indicated in the Interior Lighting Fixture Schedule. Each Sample shall include the following:
1. Lamps and ballasts, installed.
2. Cords and plugs.
3. Pendant support system.

E. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of ballast for bi-level and dimmer-controlled fixtures, from manufacturer.

B. Field quality-control reports.

C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.
   1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
   2. Plastic Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
   3. Fluorescent-fixture-mounted, emergency battery pack: One for every 20 emergency lighting unit.
   4. Ballasts: One for every 100 of each type and rating installed. Furnish at least one of each type.
   5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. FM Global Compliance: Lighting fixtures for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

1.9 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.10 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.
   3. Acrylic Lenses, Anti-Yellowing: 5 years from date of Substantial Completion if acrylic lenses have any noticeable sign of yellowing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated.

2.2 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

A. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

B. Incandescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5A.

C. Fluorescent Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.

D. HID Fixtures: Comply with UL 1598. Where LER is specified, test according to NEMA LE 5B.

E. Metal Parts: Free of burrs and sharp corners and edges.

F. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

H. Diffusers and Globes:
1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   a. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
   b. UV stabilized.
2. Glass: Annealed crystal glass unless otherwise indicated.

I. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp and ballast characteristics:
   a. "USE ONLY" and include specific lamp type.
   b. Lamp diameter code (T-4, T-5, T-8, T-12, etc.), tube configuration (twin, quad, triple, etc.), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
   c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
   d. Start type (preheat, rapid start, instant start, etc.) for fluorescent and compact fluorescent luminaires.
   e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
   f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR LINEAR FLUORESCENT LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Transformer
2. GE Lighting
3. Lightolier Controls (for dimming ballasts only)
4. Lutron (for dimming ballasts only)
5. Osram Sylvania
6. Universal Lighting Technology

A. General Requirements for Electronic Ballasts:
1. Program-Start Ballasts. Comply with UL 935 and with ANSI C82.11.
2. Designed for type and quantity of lamps served.
3. Ballasts shall be designed for full light output unless another BF, dimmer, or bi-level control is indicated.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 10 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Operating Frequency: 42 kHz or higher.
8. Lamp Current Crest Factor: 1.7 or less.
9. BF: 0.88 for 4' T8 lamps; 0.88 for all other lamps.
10. Power Factor: 0.98 or higher.
11. Parallel Lamp Circuits: Multiple lamp ballasts shall comply with ANSI C82.11 and shall be connected to maintain full light output on surviving lamps if one or more lamps fail.

B. Luminaires controlled by occupancy sensors shall have programmed-start ballasts.

C. Electronic Programmed-Start Ballasts for T8, T5 and T5HO Lamps: Comply with ANSI C82.11 and the following:
1. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
2. Automatic lamp starting after lamp replacement.

D. Electromagnetic Ballasts: Comply with ANSI C82.1; energy saving, high-power factor, Class P, and having automatic-reset thermal protection.
1. Ballast Manufacturer Certification: Indicated by label.

E. Single Ballasts for Multiple Lighting Fixtures: Factory wired with ballast arrangements and bundled extension wiring to suit final installation conditions without modification or rewiring in the field.

F. Ballasts for Low-Temperature Environments:
1. Temperatures 0 Deg F (Minus 17 Deg C) and Higher: Electronic or electromagnetic type rated for 0 deg F (minus 17 deg C) starting and operating temperature with indicated lamp types.
2. Temperatures Minus 20 Deg F (Minus 29 Deg C) and Higher: Electromagnetic type designed for use with indicated lamp types.

G. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
1. Dimming Range: 100 to 5 percent of rated lamp lumens.
2. Ballast Input Watts: Can be reduced to 20 percent of normal.

3. Compatibility: Certified by manufacturer for use with specific dimming control system and lamp type indicated.
4. Control: Coordinate wiring from ballast to control device to ensure that the ballast, controller, and connecting wiring are compatible.

H. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic type.
1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

I. Ballasts for Tri-Level Controlled Lighting Fixtures: Electronic type.
1. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   a. High-Level Operation: 100 percent of rated lamp lumens.
   b. Low-Level Operation: 30 and 60 percent of rated lamp lumens.
2. Ballast shall provide equal current to each lamp in each operating mode.
3. Compatibility: Certified by manufacturer for use with specific tri-level control system and lamp type indicated.

2.4 BALLASTS FOR COMPACT FLUORESCENT LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Advance Transformer
2. GE Lighting
3. Lightolier Controls (for dimming ballasts only)
4. Lutron (for dimming ballasts only)
5. Osram Sylvania
6. Universal Lighting Technology

B. Description: Electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated:
1. Lamp end-of-life detection and shutdown circuit.
2. Automatic lamp starting after lamp replacement.
3. Sound Rating: Class A.
4. Total Harmonic Distortion Rating: Less than 20 percent.
5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
6. Operating Frequency: 20 kHz or higher.
7. Lamp Current Crest Factor: 1.7 or less.
8. BF: 0.95 or higher unless otherwise indicated.
1. Power Factor: 0.98 or higher.
2. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.5 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
   1. Emergency Connection: Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
   2. Nightlight Connection: Operate one fluorescent lamp continuously.
   3. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   4. Battery: Sealed, maintenance-free, nickel-cadmium type.
   5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   6. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture. Comply with UL 924.
   1. Emergency Connection: Operate one fluorescent lamp continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
   2. Nightlight Connection: Operate one fluorescent lamp in a remote fixture continuously.
   3. Battery: Sealed, maintenance-free, nickel-cadmium type.
   4. Charger: Fully automatic, solid-state, constant-current type.
   5. Housing: NEMA 250, Type 1 enclosure.
   6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.6 BALLASTS FOR HID LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Transformer
   2. GE Lighting

3. Osram Sylvania
4. Universal Lighting Technology

B. Electromagnetic Ballast for Metal-Halide Lamps: Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
3. Rated Ambient Operating Temperature: 104 deg F (40 deg C).
4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

C. Electronic Ballast for Metal-Halide Lamps: Include the following features unless otherwise indicated:
1. Minimum Starting Temperature: Minus 20 deg F (Minus 29 deg C) for single-lamp ballasts.
2. Rated Ambient Operating Temperature: 130 deg F (54 deg C).
3. Lamp end-of-life detection and shutdown circuit.
4. Sound Rating: Class A.
5. Total Harmonic Distortion Rating: Less than 20 percent.
6. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
7. Lamp Current Crest Factor: 1.5 or less.
8. Power Factor: 0.90 or higher.
9. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
10. Protection: Class P thermal cutout.

2.7 EXIT SIGNS

A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
   a. Battery: Sealed, maintenance-free, nickel-cadmium type.
   b. Charger: Fully automatic, solid-state type with sealed transfer relay.
   c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.

g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.8 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
   1. Battery: Sealed, maintenance-free, lead-acid type.
   2. Charger: Fully automatic, solid-state type with sealed transfer relay.
   3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   6. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures.
   7. Integral Time-Delay Relay: Holds unit on for fixed interval of 15 minutes when power is restored after an outage.
   8. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   9. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.9 FLUORESCENT LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. GE Lighting
   2. Osram Sylvania
   3. Philips Lighting Company

B. T8 rapid-start lamps, rated 32 W maximum, nominal length of 48 inches (1220 mm), 3100 initial lumens (minimum), CRI 85 (minimum), color temperature as indicated on Lighting Fixture Schedule, and average rated life 30,000 hours unless otherwise indicated.

C. T8 rapid-start lamps, rated 17 W maximum, nominal length of 24 inches (610 mm), 1300 initial lumens (minimum), CRI 75 (minimum), color temperature as indicated on Lighting Fixture Schedule, and average rated life of 20,000 hours unless otherwise indicated.

D. T5 rapid-start lamps, rated 28 W maximum, nominal length of 45.2 inches (1150 mm), 2900 initial lumens (minimum), CRI 85 (minimum), color temperature as indicated on Lighting Fixture Schedule, and average rated life of 20,000 hours unless otherwise indicated.

E. T5HO rapid-start, high-output lamps, rated 54 W maximum, nominal length of 45.2 inches (1150 mm), 5000 initial lumens (minimum), CRI 85 (minimum), color temperature indicated on Lighting Fixture Schedule, and average rated life of 20,000 hours unless otherwise indicated.

F. Compact Fluorescent Lamps: 4-Pin, CRI 80 (minimum), color temperature indicated on Lighting Fixture Schedule, average rated life of 10,000 hours at three hours operation per start, and suitable for use with dimming ballasts unless otherwise indicated.
1. 13 W: T4, double or triple tube, rated 900 initial lumens (minimum).
2. 18 W: T4, double or triple tube, rated 1200 initial lumens (minimum).
3. 26 W: T4, double or triple tube, rated 1800 initial lumens (minimum).
4. 32 W: T4, triple tube, rated 2400 initial lumens (minimum).
5. 42 W: T4, triple tube, rated 3200 initial lumens (minimum).
6. 57 W: T4, triple tube, rated 4300 initial lumens (minimum).
7. 70 W: T4, triple tube, rated 5200 initial lumens (minimum).

G. Low Mercury Lamps: All fluorescent lamps shall be TCLP compliant.]

2.10 HID LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. GE Lighting
2. Osram Sylvania
3. Philips Lighting Company
4. Universal Lighting Technology

B. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature as indicated on Lighting Fixture Schedule, and average rated life of 24,000 hours, minimum.
1. Dual-Arc Tube Lamps: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.

C. Metal-Halide Lamps: ANSI C78.43, with minimum CRI 75, and color temperature as indicated on Lighting Fixture Schedule.

D. Pulse-Start, Metal-Halide Lamps: Minimum CRI 75, and color temperature as indicated on Lighting Fixture Schedule.

E. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature as indicated on Lighting Fixture Schedule.

2.11 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch (13-mm) steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).

E. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.

F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting fixtures:
1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
2. Install lamps in each luminaire.

B. Temporary Lighting: If it is necessary, and approved by Architect, to use permanent luminaires for temporary lighting, install and energize the minimum number of luminaires necessary. When construction is sufficiently complete, remove the temporary luminaires, disassemble, clean thoroughly, install new lamps, and reinstall.

C. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.

D. Lay-in Ceiling Lighting Fixtures Supports: Use grid as a support element.
1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each fixture. Locate not more than 6 inches (150 mm) from at least two diagonal corners of lighting fixture and attach to building structure.
2. Support Clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application.
3. Fixtures of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
4. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

E. Suspended Lighting Fixture Support:
1. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
4. Do not use grid as support for pendant luminaires. Connect support wires or rods to building structure.

F. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 IDENTIFICATION

A. Install labels with panel and circuit numbers on concealed junction and outlet boxes. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.4 STARTUP SERVICE

A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
   1. Adjust aimable luminaires in the presence of Architect.

END OF SECTION 265100

SECTION 265600 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Exterior luminaires with lamps and ballasts.
   2. Poles and accessories.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color-rendering index.

C. HID: High-intensity discharge.

D. LER: Luminaire efficacy rating.

E. Luminaire: Complete lighting fixture, including ballast housing if provided.

F. Pole: Luminaire support structure, including tower used for large area illumination.

G. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, and supporting structure, applied as stated in AASHTO LTS-4-M.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4-M.

C. Ice Load: Load of 3 lbf/sq. ft. (145 Pa), applied as stated in AASHTO LTS-4-M Ice Load Map.

D. Wind Load: Pressure of wind on pole and luminaire and banners and banner arms, calculatedand applied as stated in AASHTO LTS-4-M.
   1. Basic wind speed for calculating wind load for poles 50 feet (15 m) high or less is 100 mph (45 m/s) with a 1.3 gust factor, and minimum design life of 30 years.

1.5 ACTION SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
   1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.

2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    a. Manufacturer Certified Data: Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, CCT, CRI, lumens, and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.
11. Manufactured pole foundations.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
3. Design calculations, certified by a qualified professional engineer, indicating strength of soil conditions on which they are based.
4. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

B. Qualification Data: For qualified agencies providing photometric data for lighting fixtures.

C. Field quality-control reports.

D. Warranty: Sample of special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: One for every 10 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: One for every 20 of each type and rating installed. Furnish at least one of each type.

3. Ballasts: One for every 10 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.9 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with IEEE C2, "National Electrical Safety Code."

C. Comply with NFPA 70.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
4. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products indicated.

2.2 GENERAL REQUIREMENTS FOR LUMINAIRES

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
1. LER Tests Fluorescent Fixtures: Where LER is specified, test according to NEMA LE 5 and NEMA LE 5A as applicable.
2. LER Tests HID Fixtures: Where LER is specified, test according to NEMA LE 5B.

B. Lateral Light Distribution Patterns: Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

M. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
   2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected by Architect from manufacturer's full range.

N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
      a. Color: As selected by Architect from manufacturer's full range.

O. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and ballasts. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
   1. Label shall include the following lamp and ballast characteristics:
      a. "USES ONLY" and include specific lamp type.
      b. Lamp diameter code (T-4, T-5, T-8, T-12), tube configuration (twin, quad, triple), base type, and nominal wattage for fluorescent and compact fluorescent luminaires.
      c. Lamp type, wattage, bulb type (ED17, BD56, etc.) and coating (clear or coated) for HID luminaires.
      d. Start type (preheat, rapid start, instant start) for fluorescent and compact fluorescent luminaires.
      e. ANSI ballast type (M98, M57, etc.) for HID luminaires.
      f. CCT and CRI for all luminaires.

2.3 BALLASTS FOR HID LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Advance Transformer
   2. GE Lighting
   3. Osram Sylvania
   4. Universal Lighting Technology

B. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features unless otherwise indicated:
   1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
   2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
   3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
   4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.

2.4 HID LAMPS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. GE Lighting
   2. Osram Sylvania

3. Philips Lighting Company
4. Universal Lighting Technology

B. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and CCT color as indicated on Lighting Fixture Schedule.

C. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and CCT color temperature as indicated on Lighting Fixture Schedule.

2.5 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Structural Characteristics: Comply with AASHTO LTS-4-M.
1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches (65 by 130 mm), with cover secured by stainless-steel captive screws.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Section 033000 "Cast-in-Place Concrete."

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4-M.

2.6 STEEL POLES

A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); one-piece construction up to 40 feet (12 m) in height with access handhole in pole wall.
1. Shape: As indicated.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
3. Indicate on Drawings the span and rise of mast arms in "Steel Mast Arms" Paragraph below Delete paragraph if mast arms are adequately described in the Exterior Lighting Device Schedule or in details on Drawings.

B. Steel Mast Arms: configurations and types indicated, continuously welded to pole attachment plate. Material and finish same as pole.

C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
   1. Adapter fitting welded to pole, allowing the bracket to be bolted to the pole mounted adapter, then bolted together with stainless-steel bolts.
   2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
   3. Match pole material and finish.

D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

E. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

F. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

G. Retain "Galvanized Finish" Paragraph above for plain galvanized finish; retain "Factory-Painted Finish" Paragraph below for factory-painted finish.

H. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or with SSPC-SP 8, "Pickling."
   2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
   3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
      a. Color: As selected by Architect from manufacturer's full range.

2.7 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429/B 429M, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
   1. Shape: as indicated.
   2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Section 260526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
2. Finish: Same as pole and luminaire.

F. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
a. Color: As selected by Architect from manufacturer's full range.

2.8 POLE ACCESSORIES
1. Coordinate two "base" paragraphs below with "Breakaway Supports" Paragraph in "General Requirements for Poles and Support Components" Article.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

C. Accessories in paragraph below are usually selected for decorative poles only; verify availability for other types of poles.

D. Decorative accessories, supplied by decorative pole manufacturer, include the following:
1. Banner Arms.
Flag Holders.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.
1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.2 POLE INSTALLATION

A. Alignment: Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
   1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
   2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).
   3. Trees: 15 feet (5 m) from tree trunk.

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 033000 "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
   1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
   2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
   3. Install base covers unless otherwise indicated.
   4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 2 inches (100 mm) above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 GROUNDING

A. Ground metal poles and support structures according to Section 260526 "Grounding and Bonding for Electrical Systems."
   1. Install grounding electrode for each pole unless otherwise indicated.
   2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.6 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
   1. Verify operation of photoelectric controls.
      a. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

C. END OF SECTION 265600

SECTION 321540 – CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Part I – General Provisions specification sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Decomposed stone surface.
2. Edge restraints.

B. Related Requirements:

1. Section 312000 "Earth Moving" for excavation and compacted subgrade.
2. Section 329113 “Soil Preparation” for planting soil subbase.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 SUBMITTALS

A. Product Data: For each of the following:

1. Edge restraints.

B. Samples:

1. Decomposed stone surface.
2. Edge restraints.

1.5 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion or as directed by the Owner’s Representative and Landscape Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

PART 2 - PRODUCTS

2.1 DECOMPOSED STONE SURFACE

A. Crushed Aggregate/Rock: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 9.

1. Color: Tan.

2.2 ACCESSORIES

A. Steel Edge Restraint: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Basis of Design Product: Steel landscape edging, as manufactured by Pro-Steel, Fort Worth, TX, 817-572-4959 or approved equal.
2. Edging Size: 3/16 inch thick by 6 inches deep, 10 Gauge.
3. Stakes: Tapered steel, a minimum of 12 inches long.
4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: Manufacturer's standard powder coat paint, color - black.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subgrade according to requirements in Section 312000 "Earth Moving" to identify soft pockets and areas of excess yielding. Proceed with crushed stone surfacing installation only after deficient subgrades have been corrected and are ready to receive base course.

3.2 CRUSHED STONE SURFACING INSTALLATION

A. Compact soil subgrade according to requirements in Section 312000 "Earth Moving". Do not proceed if subgrade is deficient or not approved by the Owner’s Representative. Contractor is responsible for correcting deficiencies at no additional cost to the Owner.

B. Place aggregate base according to requirements in Section 312000 "Earth Moving".

C. Place planting soil subbase according to requirements in Section 329113 “Soil Preparation”.

D. Install edge restraints as indicated on Drawings and as directed by Owner's Representative and Landscape Architect.

1. Install edge restraints to comply with manufacturer's written instructions. Install stakes at intervals required to hold edge restraints in place during and after crushed stone surfacing installation.
2. For metal edge restraints with top edge exposed, drive stakes at least 1 inch below finish surface.

E. Place crushed stone surfacing course and screed to a thickness of 6 inches, taking care that moisture content remains constant and density is loose and constant until lightly compacted. Crushed stone surfacing shall not exceed 4" over rootballs in tree planting.

F. Lines and Levels: Install crusher fines course true to grade, properly coinciding with adjacent work and elevations with a maximum 2% cross slope.

1. Do not create low points for water to pond.
2. All surfaces shall be flush and meet smoothly and evenly.

H. Provide a finished surface uniform in texture and appearance.

3.3 FIELD QUALITY CONTROL

A. Remove work that does not meet compaction requirements or as directed by the Owner's Representative and Landscape Architect. Replace and retest as required and at no additional cost to the Owner.

3.4 MAINTENANCE AND PROTECTION

A. Protect partially completed installation against damage by construction traffic.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Decomposed Stone Surface: Measurement will be made to the nearest cubic yard for installation of the decomposed stone surfacing. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, installation and compaction of the decomposed stone surfacing as defined herein.

B. Edge Restraints: Measurement will be made to the nearest linear foot for installation of the edge restraints along the crushed stone surfacing. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing and installation as defined herein.

END OF SECTION 321540

SECTION 323116 - WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Site fence.
2. Pedestrian gates, single and double swing.
3. Vehicular gates, horizontal-slide and swing.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for post concrete footing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for wire mesh.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Site Fence

1. Basis of Design Product: Provide WireWorks Plus fence system as manufactured by Ameristar Fence Products, Inc. Tulsa, OK, 888-333-3422, or approved equal.

a. Posts: Steel, shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft^2, Coating Designation G-60. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

b. Wire Mesh Panels: Steel, shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192 inch) wires shall be spaced at 2 inches; horizontal 6ga. (0.192 inch) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641.

c. Finish: Post and panels shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

d. Color: Bronze.

e. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.

Table 1 – Minimum Sizes for WireWorks Plus Posts

Fence Posts	**Panel Height**	
2" Sq. x 16 Ga.	Up to 6' Height	
2.5" Sq. x 16 Ga.	8' Height	
Gate Leaf	**Gate Height**	
	Up to & Including 6'	**Over 6' Up to & Including 8'**

Up to 4’	2-1/2” x 12Ga.	3” x 12 Ga.
4’1” to 6’	3” x 12Ga.	3” x 12 Ga.
6’1” to 10’	4” x 11 Ga.	6” x 3/16”
10’1” to 16’	6” x 3/16”	6” x 3/16”

Table 2 – Coating Performance Requirements

Quality Characteris-tics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8” coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625” ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.3 PEDESTRIAN SWING GATES

A. Pedestrian Gate Type 1 and 2

1. Basis of Design Product: Provide WireWorks Plus fence system swing gate as manufactured by Ameristar Fence Products, Inc. Tulsa, OK, 888-333-3422, or approved equal.

   a. Posts: Steel, shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft^2, Coating Designation G-60. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

   b. Wire Mesh Panels: Steel, shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192 inch) wires shall be spaced at 2 inches; horizontal 6ga. (0.192 inch) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641.

   c. Swing Gate: Steel, fabricated using 2 inch by 12ga. square rails and gate ends. All rail and gate end intersections shall be joined by welding. Steel gussets (1/4-inch by 2 inch) shall be welded at each rail to gate end intersection and rail to intermediate intersections (4 gussets per gate bay). Gusset shall be punched to accept gate trussing cable and turnbuckle.

   d. Finish: Post and panels shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.

e. Color: Bronze.
f. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.
g. Hardware: Manufacturer's standard latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
h. Hinges: Manufacturer's standard spring hinges, BHMA A156.17, Grade 1, suitable for exterior and intended use. Material - malleable iron, galvanized and painted to match gate.
i. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter minimum, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions. Finish to match gates.
j. Gate configuration: As indicated.

2.4 VEHICULAR SWING GATES

A. Vehicular Gate Type 2

1. Basis of Design Product: Provide WireWorks Plus fence system swing gate as manufactured by Ameristar Fence Products, Inc. Tulsa, OK, 888-333-3422, or approved equal.

a. Posts: Steel, shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft^2, Coating Designation G-60. Fence posts and gate posts shall meet the minimum size requirements of Table 1.
b. Wire Mesh Panels: Steel, shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192 inch) wires shall be spaced at 2 inches; horizontal 6ga. (0.192 inch) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641.
c. Swing Gate: Steel, fabricated using 2 inch by 12ga. square rails and gate ends. Provide 2 inch square by 12 ga. Intermediate upright as required. All rail, upright and gate end intersections shall be joined by welding. Steel gussets (1/4-inch by 2 inch) shall be welded at each rail to gate end intersection and rail to intermediate intersections (4 gussets per gate bay). Gusset shall be punched to accept gate trussing cable and turnbuckle.
d. Finish: Post and panels shall be subjected to an inline electro-deposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2.
e. Color: Bronze.

f. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.
g. Hardware: Manufacturer's standard latches permitting operation from both sides of gate, hinges, and keepers for each gate leaf more than 5 feet wide. Provide center gate stops and cane bolts for pairs of gates. Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.
h. Hinges: Manufacturer's standard spring hinges, BHMA A156.17, Grade 1, suitable for exterior and intended use. Material - malleable iron, galvanized and painted to match gate.
i. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch-diameter minimum, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions. Finish to match gates.
j. Gate configuration: Double leaf.

B. Vehicular Gate Type 3

1. Fabricate as indicated on Drawings.
2. Materials:

a. Plates, Shapes, and bars: ASTM A 36/A 36M
b. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
c. Iron Castings: Either gray or malleable iron unless otherwise indicated.

1) Gray Iron: ASTM A 48/A 48M, Class 30.
2) Malleable Iron: ASTM A 47/A 47M.

3. Finish:

a. Galvanizing: Hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
b. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
c. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

1) Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

d. Color – Bronze (to match other gates).

4. Hardware: Custom galvanized and painted steel latch/lock assembly as specified by the City of Grand Junction.
5. Hinges: Heavy-duty BHMA A156.1, grade 1, suitable for exterior use.

a. Function: 39 – Full surface, triple weight, anti-friction bearing.
b. Material: Wrought steel, forged steel, cast steel or malleable iron; galvanized.

2.5 VEHICULAR HORIZONTAL-SLIDE GATES

A. Vehicular Gate Type 1

1. Basis of Design Product: Provide custom Transport II cantilever gate system with WireWorks Plus Wire Mesh Panels as manufactured by Ameristar Fence Products, Inc. Tulsa, OK, 888-333-3422, or approved equal.

a. Posts: Steel, shall be galvanized prior to forming in accordance with the requirements of ASTM A653/A653M, with minimum yield strength of 45,000 psi. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.60 oz/ft^2, Coating Designation G-60. Fence posts and gate posts shall meet the minimum size requirements of Table 1.

b. Wire Mesh Panels: Steel, shall be welded by resistance welding per ASTM A185 using 6 gauge (0.192 inch) pre-galvanized steel wire, welded at each crossing to form rectangles. Vertical 6ga. (0.192 inch) wires shall be spaced at 2 inches; horizontal 6ga. (0.192 inch) wires shall be spaced at 6 inches. The cold rolled wire shall have a tensile strength of at least 70,000 PSI and 74,000 PSI weld shear strength. Wire strand shall be galvanized before welded (GBW), .050 ounces per square foot zinc coating conforming to the ASTM A641.

c. Cantilever Gate Frame: ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort® Fast-Trak™ rails shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with minimum yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.

d. Diagonal Bracing and Uprights: 2 inch square by ¼-inch aluminum. The design of the top and bottom enclosed track shall conform to the manufacturers 5 inch by 2 inch Fast-Trak system.

e. Internal Roller Truck Assembly: Self-aligning swivel ball-and-socket type running on four bearing wheels. Internal roller truck assembly shall be affixed to the hanger bracket by means of a 5/8-inch diameter industrial-grade rod end/center bolt, with a minimum static load rating of 10,000 pounds. Attachment of the center bolt to the truck body shall be by means of a swivel joint to ensure equivalent and consistent loading on all bearing wheels and internal track surfaces throughout the travel of the gate.

f. Finish: Manufactured components shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a “no-mar” TGIC polyester powder coat finish with a minimum thickness of 2 mils. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1.

g. Color: Bronze.

h. Gate configuration: Single leaf.

i. Hardware: Latches permitting operation from both sides of gate, fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of gate.

Table 1 – Coating Performance Requirements		
Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60˚ Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.6 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that fence height exceeds 4 feet.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    a. Concealed Concrete: As indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

    a. Gates and Other Fence Openings: Ground fence on each side of opening.

        1) Bond metal gates to gate posts.
        2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

PART 1 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Site Fence: Measurement will be made to the nearest linear foot for installation of the site fence. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

B. Pedestrian Gate Type 1: Measurement will be made per each for installation of the pedestrian gate type 1 (double leaf swing). Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

C. Pedestrian Gate Type 2: Measurement will be made per each for installation of the pedestrian gate type 2 (single leaf swing). Payment will be made at the contract unit price and shall

include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

D. Vehicular Gate Type 1: Measurement will be made per each for installation of the vehicular gate type 1 (horizontal slide). Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

E. Vehicular Gate Type 2: Measurement will be made per each for installation of the vehicular gate type 2 (double leaf swing). Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

F. Vehicular Gate Type 3: Measurement will be made per each for installation of the vehicular gate type 3 (single leaf swing). Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

END OF SECTION 323116

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Dumpster enclosure.
2. Dumpster enclosure gate.

B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for post concrete footing.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Samples: For each enclosure material and for each color specified.

1. Provide Samples 12 inches in length for linear materials.
2. Provide Samples 12 inches square for sheet or plate materials.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DUMPSTER ENCLOSURE

A. Fabricate as indicated on Drawings and herein.

1. Posts: Square steel tubing as indicated, 1/8-inch minimum wall thickness.
2. Post Caps: Formed from steel sheet and hot-dip galvanized after forming, 10 Gauge minimum.
3. Frame: Galvanized and painted steel channels 2 by 2 inch, 1/8-inch minimum wall thickness.
4. Corrugated Metal Panel: Galvanized and painted steel sheet, 12 Gauge minimum, match Architecture.
5. Bracing and Miscellaneous Supports: Galvanized and painted steel plates, size as required, 2 inch by 2 inch minimum, 1/8-inch minimum wall thickness.

B. Materials:

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
2. Plates, Shapes, and bars: ASTM A 36/A 36M.
3. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
4. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.
5. Iron Castings: Either gray or malleable iron unless otherwise indicated.

    a. Gray Iron: ASTM A 48/A 48M, Class 30.
    b. Malleable Iron: ASTM A 47/A 47M.

6. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
7. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

C. Finish:

1. Galvanizing: Hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
2. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
3. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

    a. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

D. Color – Bronze (to match other fences).

2.3 DUMPSTER ENCLOSURE GATE

A. Fabricate as indicated on Drawings and herein.

1. Frame: Galvanized and painted steel channels 2 by 2 inch, 1/8-inch minimum wall thickness.
2. Corrugated Metal Panel: Galvanized and painted steel sheet, 12 Gauge minimum, match Architecture.
3. Bracing and Miscellaneous Supports: Galvanized and painted steel plates, size as required, 2 inch by 2 inch minimum, 1/8-inch minimum wall thickness.

B. Materials:

1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
2. Plates, Shapes, and bars: ASTM A 36/A 36M
3. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
4. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 50, with G90 coating.
5. Iron Castings: Either gray or malleable iron unless otherwise indicated.

    a. Gray Iron: ASTM A 48/A 48M, Class 30.
    b. Malleable Iron: ASTM A 47/A 47M.

6. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).
7. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

C. Finish:

1. Galvanizing: Hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.
2. Epoxy Primer for Galvanized Steel: Epoxy primer recommended in writing by topcoat manufacturer.
3. Polyurethane Intermediate Coat and Topcoat: Complying with MPI #72 and compatible with undercoat.

    a. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

D. Color – Bronze (to match other gates).

E. Hardware: Manufacturer’s standard galvanized and painted steel slide bolt assembly as indicated.

F. Hinges: Heavy-duty BHMA A156.1, grade 1, suitable for exterior use.

1. Function: 39 – Full surface, triple weight, anti-friction bearing.
2. Material: Wrought steel, forged steel, cast steel or malleable iron; galvanized.

G. Cane Bolts: Provide for inactive leaf of pairs of gates. Fabricated from 1/2-inch- diameter minimum, round steel bars, hot-dip galvanized after fabrication. Finish to match gates. Provide galvanized-steel pipe strikes to receive cane bolts in both open and closed positions. Finish to match gates.

H. Gate configuration: Double leaf.

2.4 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, clearly identify on Shop Drawings and use Phillips flat-head (countersunk) fasteners unless otherwise indicated or directed. Locate joints where least conspicuous.

G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.5 FINISHES, GENERAL

A. Finish metal fabrications after assembly.

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

2.6 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.

C. Shop prime iron and steel items unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

D. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.7 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Grounding Connectors and Grounding Rods: Comply with UL 467.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Owner's Representative.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of enclosure and gates for review and approval by Owner's Representative prior to installation. Indicate locations of utilities and underground structures that may affect the work.

3.3 DUMPSTER ENCLOSURE INSTALLATION

A. Install enclosure according to fabricator's recommendations.

B. Install enclosure by setting posts as indicated and fastening infill panels to posts. Peen threads of bolts after assembly to prevent removal.

C. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches plus 3 inches for each foot or fraction of a foot that enclosure height exceeds 4 feet.

D. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

    1. Concealed Concrete: Top 2 inches minimum below grade and as indicated on Drawings to allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches of specified excavation depth, but not closer than 3 inches to bottom of concrete.
4. Space posts as indicated on Drawings.

3.4 DUMPSTER ENCLOSURE GATE INSTALLATION

A. Install gates according to fabricator's recommendations, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Enclosure Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Enclosures within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

1. Gates and Other Enclosure Openings: Ground enclosure on each side of opening.

a. Bond metal gates to gate posts.
b. Bond across openings, with and without gates, except at openings indicated as intentional enclosure discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground enclosure at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to enclosure with No. 6 AWG conductor. Connect conductor to each enclosure component at grounding location.

D. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

E. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

F. Bonding to Lightning-Protection System: If enclosure terminates at lightning-protected building or structure, ground the enclosure and bond the enclosure grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.7 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

PART 1 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Dumpster Enclosure: Measurement will be made to the nearest linear foot for installation of the dumpster enclosure. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

B. Dumpster Enclosure Gates: Measurement will be made per each for installation of the dumpster enclosure gates (double leaf swing). Payment will be made at the contract unit price and shall include all costs associated with the satisfactory fabrication, furnishing and installation as defined herein.

END OF SECTION 323119

SECTION 328400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Piping.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Drip irrigation specialties.
13. Controllers.
14. Boxes for automatic control valves.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 200 PSI
2. Circuit Piping: 160 PSI.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories.

B. Wiring Diagrams: For power, signal, and control wiring.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Zoning Chart: Show each irrigation zone and its control valve.

C. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers, controllers, and automatic control valves to include in operation and maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Rotor Sprinklers: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than five units.
2. Spray Sprinklers: Equal to 10 percent of amount installed for each type and size indicated, but no fewer than ten units.
3. Bubblers: Equal to ten percent of amount installed for each type indicated, but no fewer than 15 units.
4. Emitters: Equal to 10 percent of amount installed for each type indicated, but no fewer than 10 units.
5. Drip-Tube System Tubing: Equal to ten percent of total length installed for each type and size indicated, but not **less than 100 feet (30 m)**

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include a certified landscape technician in accordance with the Associated Landscape Contractors of Colorado

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.11 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Owner no fewer than five days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Ductile-Iron Pipe with Mechanical Joints: AWWA C151, with mechanical-joint bell and spigot ends.

1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

C. Ductile-Iron Pipe with Push-on Joint: AWWA C151, with push-on-joint bell and spigot ends.

1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.

a. Gaskets: AWWA C111, rubber.

D. Soft Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B), water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

E. PVC Pipe: ASTM D 1785, PVC 1120 compound, Schedules 40 and 80.

1. PVC Socket Fittings: ASTM D 2466, Schedules 40 and 80.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 80.
3. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket ends.

F. PVC Pipe, Pressure Rated: ASTM D 2241, PVC 1120 compound, SDR 21 and SDR 26.

1. PVC Socket Fittings: ASTM D 2467, Schedule 80.
2. PVC Socket Unions: Construction similar to MSS SP-107, except both headpiece and tailpiece shall be PVC with socket or threaded ends.

2.2 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick unless otherwise indicated; full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM A 674 or AWWA C105.

B. Form: Sheet or tube .

C. Material: minimum thickness or high-density, cross-laminated PE film of 0.004-inch (0.10-mm) minimum thickness.

D. Color: Black

2.4 MANUAL VALVES

A. Curb Valves:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   a. Reference City of Grand Junction Water Department requirements

2. Description:

   a. Reference City of Grand Junction Water Department requirements

   b. Standard: AWWA C800.
   c. NPS 1 (DN 25) and Smaller Pressure Rating: 150 psig (1035 kPa).
   d. NPS 1-1/4 to NPS 2 (DN 32 to DN 50) Pressure Rating: 150 psig (1035 kPa).
   e. Body Material: Brass or bronze with ball or ground-key plug.
   f. End Connections: Matching piping.
   g. Stem: With wide-tee head.

B. Curb-Valve Casing:

1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch (75-mm) diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar

C. Shutoff Rods for Curb-Valve Casings: Furnish two steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Bronze Ball Valves:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   a. Hammond Valve
   b. Milwaukee Valve Company
   c. NIBCO INC
   d. Watts Regulator Co.

2. Description:

   a. Standard: MSS SP-110.
   b. SWP Rating: 150 psig (1035 kPa).
   c. CWP Rating: 600 psig (4140 kPa).
   d. Body Design: Two piece.
   e. Body Material: Bronze.
   f. Ends: Threaded or solder joint if indicated.
   g. Seats: PTFE or TFE.
   h. Stem: Bronze.

i. Ball: Chrome-plated brass.
j. Port: Full.

E. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements. Provide products by on of the following:
   a. Hammond Valve
   b. Milwaukee Valve Company
   c. NIBCO INC
   d. Watts Regulator Co.

2. Description:

   a. Standard: MSS SP-80, Type 2.
   b. Class: 125.
   c. CWP Rating: 200 psig (1380 kPa).
   d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
   e. Ends: Threaded or solder joint.
   f. Stem: Bronze, nonrising.
   g. Disc: Solid wedge; bronze.
   h. Packing: Asbestos free.
   i. Handwheel: Malleable iron, bronze, or aluminum.

F. Iron Gate Valves, Resilient Seated:

1. Manufacturers: Subject to compliance with requirements. Provide products by on of the following:
   a. Kennedy Valve
   b. Mueller Company
   c. NIBCO INC

2. Description:

   a. Standard: AWWA C509.
   b. Pressure Rating: 200 psig (1380 kPa) minimum.
   c. Body Material: Ductile or gray iron with bronze trim.
   d. End Connections: Mechanical joint or push-on joint.
   e. Interior Coating: Comply with AWWA C550.
   f. Body Design: Nonrising stem.
   g. Operator: Stem nut.
   h. Disc: Solid wedge with resilient coating.

G. Iron Gate Valve Casings:

1. Standard: AWWA M44 for cast-iron valve casings.
2. Top Section: Adjustable extension of length required for depth of burial of valve.
3. Barrel: Approximately 5-inch (125-mm) diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar

H. Operating Wrenches for Iron Gate Valve Casings: Furnish two steel, tee-handle operating wrenches with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut for Project.

2.5 AUTOMATIC CONTROL VALVES

1. Manufacturers: Subject to compliance with requirements. Provide products by on of the following:
   a. Rain Bird Corporation

2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid. The valve station identification shall be attached to the valve wiring and the valve box with a Universal Medium Calf Tag with dual colored tag from Ritchey Tags, and have the zone # and decoder address etched into the tag, and the tag affixed to the wiring by a zip tie or wire, and affixed to the control box by a self-tapping screw.

2.6 MISCELLANEOUS PIPING SPECIALTIES

A. Pressure Gages: ASME B40.1. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.

B. Flow Sensor: Rain Bird Flow Sensor with Pulse Transmitter.
   1. Insertion type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part.
   2. The electronics housing shall have two, ethylenepropylene O-Rings and shall be easily removed from the meter body.
   3. The sensor electronics will be potted in an epoxy compound designed for prolongs immersion. Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1,2 meters) long. Insulation shall be direct burial "UF" type colored red for the positive lead and black for the negative lead.
   4. The sensor shall be capable of operating in line pressure up to 100 psi (6.9 bars) and liquid temperatures up to 140° F (60° C), and operating in flows of 1⁄2 foot (0,15 meters) per second to 30 feet (9,2 meters) per second with linearity of ±1% and repeatability of ±1%.
   5. The meter body shall be fabricated from Schedule 80 PVC Tees, available in 1 1⁄2", 2", 3", and 4" (40mm, 50mm, 75mm, and 110mm) with socket end connections.

C. Flow Sensor Pulse Output Transmitter: Rain Bird Transmitter PT322.
   1. The Pulse Output Transmitter shall receive signals for any Rain Bird flow sensor and produce a dry contract closure in units of measure that can be defined by the user.
   2. Calibration shall be achieved by connecting to a computer with Rain Bird PT322SW software.
   3. Model PT322 transmitter shall operate on 12-30 VDC/VAC power (using PTPWRSUPP Power Supply.) Models shall be provided in epoxy filled enclosures.

2.7 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   a. Rain Bird Corporation

2. Description:

   a. Body Material: ABS.
   b. Nozzle: ABS.
   c. Retraction Spring: Stainless steel.
   d. Internal Parts: Corrosion resistant.

3. Capacities and Characteristics:

   a. Flow: SEE PLANS
   b. Pop-up Height: SEE PLANS.
   c. Arc: SEE PLANS.
   d. Radius: SEE PLANS
   e. Inlet: SEE PLANS

C. Plastic, Pop-up Spray Sprinklers:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   a. Rain Bird Corporation

2. Description:

   a. Body Material: ABS.
   b. Nozzle: ABS.
   c. Retraction Spring: Stainless steel.
   d. Internal Parts: Corrosion resistant.
   e. Pattern: Fixed, with flow adjustment.

3. Capacities and Characteristics:

   a. Nozzle: SEE PLANS
   b. Flow: SEE PLANS
   c. Pop-up Height: SEE PLANS.
   d. Arc: [SEE PLANS.
   e. Radius: SEE PLANS.
   f. Inlet: SEE PLANS

D. Plastic Shrub Sprinklers:

1. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   a. Rain Bird Corporation

2. Description:

   a. 1300 and/or 1400 series bubblers

   b. Body Material: ABS or other plastic.
   c. Pattern: Fixed, with flow adjustment.

3. Capacities and Characteristics:

   a. Configuration: SEE PLANS
   b. Flow: SEE PLANS.
   c. Arc: SEE PLANS.
   d. Radius: SEE PLANS.
   e. Mounting Height: SEE PLANS.
   f. Inlet: SEE PLANS

2.8 SWING JOINTS

A. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   1. Rain Bird Corporation
   2. Lasco Fittings, Inc.
   3. Spears Manufacturing.

B. Description: Factory-fabricated, pressure rated to 315 PSI at 73 degrees F when tested in accordance with ASTM D3139. Rigid PVC construction, ASTM D1784, NTP threads per ASTM D2464 and ASTM D2466. Each orating joint shall be sealed with a Buna rubber O-ring installed in pre compressed sealing groove free of parting lines to prevent leakage.

2.9 QUICK COUPLERS

A. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   1. Rain Bird Corporation

B. Description: Factory-fabricated, bronze or brass, two-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, 3/4-11.5NH threads for garden hose on outlet; and operating key.

   1. Locking-Top Option: Vandal-resistant locking feature. Include two matching key(s).

2.10 Air Release Valves/Air Vents

A. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:

1. Netafim
2. Amiad

B. Description: Valve will be manufactured with UV stabilized, durable, weather resistant and non-corrosive engineered plastics of Nylon or Polypropylene body, and brass base as necessary to meet pressure requirements.
   1. The air release/vacuum relief valve shall have a maximum working pressure greater than or equal to the 1.5 times the operating pressure of the mainline, and a minimum of 150 psi rated at standard temperature of 73 degrees F and have a MPT inlet, sized per the plans and details.
   2. Valve shall incorporate a valve that ensures vent closure as water fills the system, remains open when air pressure differential reaches up to at least 10 psi with a slam resistant design that allows only water to close the valve, which will operate as a dual acting air release and vacuum relief.
   3. Incorporates a rolling seal feature allows gradual opening, closing and self-cleaning.
   4. Valve shall achieve minimum positive sealing at a pressure of 2 psi water with a clear open diameter orifice of 0.0186 square inch small orifice and an 1.25 square inch large orifice for the 2" version and 0.0233 square inch orifice for the 1" version..
   5. Valve will have a removable top for easy seal maintenance. Retain subparagraph below if required.

2.11 CONTROLLERS

A. Manufacturers: Subject to compliance with requirements. Provide products by one of the following:
   1. Rain Bird Corporation

B. Description:

   1. Controller Stations for Automatic Control Valves: Each station is variable from approximately 2-700 minutes. Include switch for manual or automatic operation of each station. The controller shall have a minimum of 40 stations.

   2. Maxicom^2 Site Satellite irrigation central control compatible controller, with an integrated radio to communicate with the existing Maxicom system, and have repeater radios installed as necessary. Controller shall have the ability to operate under central control or local manual control.
   3. Exterior Control Enclosures: NEMA 250, Type 4, weatherproof, with locking cover and two matching keys; include provision for grounding.

      a. Body Material: Stainless-steel sheet metal.
      b. Mounting: Freestanding type for concrete base

   4. Control Transformer: 24-V secondary, with primary fuse.
   5. Timing Device: Adjustable, 24-hour, 365-day clock, with automatic operations to skip operation any day in timer period, to operate every other day, or to operate two or more times daily.

      a. The controller shall be capable of being operated manually at any time. A manual single station, a group of stations, or a program can be selected to run for the

programmed time without affecting the normal program. This controller shall be capable of running a variable system test program without affecting the normal program.

b. Manual or Semiautomatic Operation: Allows this mode without disturbing preset automatic operation.
c. Nickel-Cadmium Battery and Trickle Charger: Automatically powers timing device during power outages.
d. Surge Protection: Metal-oxide-varistor type on each station and primary power.
e. Compatible with central control communicating by radio modem

6. Wiring: UL 493, Type UF multiconductor, with solid-copper conductors; insulated cable; suitable for direct burial.

a. Feeder-Circuit Cables: No. 12 AWG minimum, between building and controllers.
b. Low-Voltage, Branch-Circuit Cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.
c. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

7. Concrete Base: Reinforced precast concrete not less than 36 by 24 by 6 inches (900 by 600 by 100 mm) thick, and 6 inches (150 mm) greater in each direction than overall dimensions of controller. Include opening for wiring.

2.12 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.
b. Carson Industries LLC

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.
a. Size: As required for valves and service.
b. Shape: Rectangular.
c. Sidewall Material: PE.
d. Cover Material: PE.
1) Lettering: "VALVE BOX."

B. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

2.13 WIRE CONNECTORS – LOW VOLTAGE

A. Manufacturers:

1. 3-M – DBRY
2. Spears Manufacturing Company – DS400.

B. Description: Dri-splice wire connector with dielectric silicone sealant.

1. Plug and body: polyethylene.
2. Crimp and sleeve: UL and CSA listed for 18-10 AWG solid or stranded copper.

2.14 LOW VOLTAGE WIRE

A. Control wiring shall be either direct burial or installed in conduit.

1. Direct Burial:

a. Conductor construction is soft drawn bare copper meeting the requirements of ASTM Specification B-3. No. 14 AWG minimum. The insulation is a linear low density, high molecular weight polyethylene for systems applications of up to 600 volts.
b. Application: Suitable for use as power and control wire for irrigation systems.
c. Conductor: Soft drawn bare copper (ASTM Specs. B-3 and B-8), Solid (No. 14 AWG minimum).
d. Insulation: Polyethylene (PE)
e. Temperature: 75°C
f. Voltage: 600 volts
g. Conductor size: No. 14 AWG minimum; insulation thickness: 0.045
h. Material must be able to pass the following tests without showing signs of degradation:
1) Cold Bend—The insulation shall not show any cracks when sample is bent around a 3X mandrel after being subjected to -25°C for four (4) hours.
2) Electrical—AC test voltage, 60 seconds at 7500 volts.
3) Mechanical Water Absorption—Insulation shall not absorb more than 25 mg mass of water per square inch.
4) Sunlight Resistance Test—Samples conditioned for 300 hours of carbon-arc or xenon-arc exposure.

2. Conduit Wire – THWN Wire:

a. Conductor construction is soft drawn bare copper meeting ASTM Specifications B-3 and B-787, No. 14 AWG minimum.
b. The insulation is a high quality polyvinylchloride (PVC) with a nylon jacket for systems applications of up to 600 volts and conductor temperatures up to 75°C.
c. Application: Suitable for use as power wire for irrigation systems, when buried in conduit.
d. Conductor: Soft drawn bare copper meeting applicable ASTM Specifications.
e. Solid (No. 14 AWG minimum).
f. Insulation: Polyvinylchloride (PVC)
g. Jacket: Nylon
h. Temperature: 90°C
i. Voltage: 600 volts

B. Feeder-circuit cables: No. 14 AWG minimum, between building and controllers.

C. Communication cable shall be 18 AWG with a minimum of 3-pairs (or 6-pairs or 12-pairs, etc.). The cable construction shall be:

1. Type PE-89, for direct burial. Ground communication cable at intervals and details according to manufacturer instructions.

D. Wire splicing:

1. Wire splicing shall be avoided if possible.
2. Splicing materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.
3. Splices shall incorporate the following items:

a. A solid mechanical connection of the copper conductors.
b. Electrical insulation of the mechanical connection.
c. A means to waterproof the insulated connection.
d. "Strain Relief" to prevent the connection from coming apart.

E. Wire conduit:

1. Conduit size and location shall be according to the electrical engineering plans by others.
2. Communication cable and branch circuit cables shall be in separate conduits.

F. Grounding:

1. Ground all wire systems in accordance with the latest version of the American Society of Irrigation Consultants Guideline 100 for Earth Grounding Electronic Equipment in Irrigation Systems.
2. Each decoder wire path shall be grounded using a Rain Bird MSP-1 surge protector.
3. All Decoders shall be grounded to a 5-ohm or less earth ground.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, backfilling, and concrete shall be installed in accordance with all other Divisions in the specifications regarding earthwork and concrete.

B. Install warning tape directly above pressure piping for main lines 12 inches below finished grades, except 6 inches (150 mm) below subgrade under pavement and slabs.

C. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 24 inches below finished grade.
2. Circuit Piping: 12 inches.
3. Sleeves: Reference Plans & Details.

D. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/8 to 1 inches to 12 inches below grade. Cover gravel or crushed stone with sheet of nonwoven 6 oz geotextile and backfill remainder with excavated material.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves and away from air vents.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections. DO NOT DEFLECT PIPE BEYOND MANUFACTURED RECOMMEND MAXIMUM BEND RADIUS

F. Install unions adjacent to valves and to final connections to other components.

G. Install underground thermoplastic piping according to ASTM D 2774.

H. Install expansion loops in control-valve boxes for plastic piping.

I. Lay piping on solid subbase, uniformly sloped without humps or depressions.

J. Install PVC piping in dry weather when temperature is above 40 deg F (5 deg C). Allow joints to cure at least 24 hours at temperatures above 40 deg F (5 deg C) before testing.

K. Install piping in sleeves under all hardscape surfaces, parking lots, roadways, and sidewalks.

L. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

F. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

G. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

H. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 WIRE INSTALLATION

A. Low voltage, branch-circuit cables: No. 14 AWG minimum, between controllers and automatic control valves; color-coded different from feeder-circuit-cable jacket color; with jackets of different colors for multiple-cable installation in same trench.

B. Each controller shall have a unique communication wire cable. Each valve shall have a unique individual wire from the controller to the valve and a common wire.

C. Each unique control wire and decoder shall be labeled with an indelible marking that identifies it at the valve, the controller, and junction boxes at a minimum.

D. An additional common and spare valve wire shall be installed to the terminus of each pipe branch, and shall be continuous from the most distal point to the controller.

E. Any laterals to valves shall have extra common wire and two extra zone wires shall be installed per valve.

3.6 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with finish grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Air Release Valves: Install in underground piping in boxes similar control valves.

G. Drain Valves: Install in underground piping in boxes similar control valves.

H. Air Release Valves/Air Vents: Install in underground piping in boxes similar control valves.

3.7 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries unless otherwise indicated.

D. All sprinkler heads and application devices shall be installed such to avoid damage by snow removal equipment and snow storage. All sprinklers adjacent hardscape shall be installed adequately below the adjacent hardscape surface to avoid damage or impact with snow removal equipment

3.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install interior controllers on inside wall, and exterior wall mount controllers on exterior wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Coordinate mounting location with electrician
4. Coordinate mounting location with Owner & Architect

B. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Coordinate mounting location with Owner & Landscape Architect
4. Coordinate mounting location with electrician

C. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.
   1. Cable under hardscape areas shall be in a sleeve

3.9 CONNECTIONS

A. Comply with local, state, and all other requirements for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Reference Civil Drawings for connection to water meter and service lines, coordinate with water service contractor.

C. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

D. Connect wiring between controllers and automatic control valves.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, controller and automatic valve equipment installations, including connections.

B. Perform tests and inspections.

   1. Manufacturer's Field Service or Certified Back Flow Preventer Technician: Engage a factory-authorized service representative or Certified Back Flow Preventer Technician to inspect components of backflow and connection to potable water source, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
   2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
   3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.11 STARTUP SERVICE

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents and are functioning to allow automated irrigation.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.12 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.13 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.14 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

B. Operate all zones and system for a minimum of a one week period without interruption or adjustment to prove system operates as designed, applying full peak demand water requirement, operate as intended, and operate without unnecessary management or adjustment. The Central Control system shall also be logging data, observing, and integrating adjustment control during this period, or a subsequent weeklong period. Coordinate this item with Parks & Recreation staff to assure the Central Control and Satellite controller are communicating and operating correctly both independently and under central control.

C. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers and confirm proper communication with central control.

3.15 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Underground irrigation main piping, NPS 4 (DN 100) and smaller, shall be the following:
1. Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.
2. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

D. Underground irrigation main piping, NPS 5 (DN 125) and larger, shall be the following:
1. Schedule 40 PVC pipe and socket fittings; and solvent-cemented joints.
2. SDR 21, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

E. Circuit piping, NPS 2 (DN 50) and smaller, shall be the following:
1. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.

2. SDR 21, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

F. Underground Branches and Offsets at Sprinklers and Devices: Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.
2. Swing pipe in lengths no greater than 5 feet on flows less than 5 gpm.

3.16 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. NPS 2 (DN 50) and Smaller: Bronze gate valve.
2. NPS 3 (DN 80) and Larger: Iron gate valve, resilient seated; iron gate valve casing; and operating wrenches.

B. Drain Valves:

1. NPS 1/2 and NPS 3/4 (DN 15 and DN 20): Brass or bronze ball valve.
2. NPS 1 to NPS 2 (DN 25 to DN 50): Bronze gate valve.

END OF SECTION 328400

SECTION 329113 - SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes planting soils.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
3. Section 329300 "Plants" for placing planting soil for plantings.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product furnished, including soil amendments.

1. Include test data substantiating that products comply with requirements.
2. Material Certificates: For each type of imported soil before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each planting soil type (and any soil amendment if requested by Owner’s Representative and Landscape Architect), 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

A. Provide soil samples to Testing Agency for each type of planting soil specified according to requirements of the testing agency.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm and sodium absorption ratio.
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for each required depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for each required depth of soil.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Regional Materials: Imported soil, manufactured planting soil and soil amendments and fertilizers shall be manufactured within 500 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

2.2 PLANTING SOILS

A. Planting-Soil Type 1: Imported, manufactured soil consisting of manufacturer's basic topsoil, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil for lawn/sodded turf and tree planting.

1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7, electro-conductivity range of 0 to 4 millimhos/cm, and minimum of 4 percent (maximum of 25 percent) organic-matter content with a limit of decaying matter to 2 percent of total volume, friable, and with sufficient structure to give good tilth and aeration.
2. Unacceptable Properties: Manufactured soil shall not contain the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 5 percent by dry weight of the manufactured soil.
c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 1-1/2 inches in any dimension.

3. Blend manufacturer's basic soil with soil amendments and fertilizers in the following quantities to produce planting soil:

    a. In accordance with recommendations set forth by soils-testing laboratory soils analysis to produce planting soil.

B. Planting-Soil Type 2: Imported, naturally formed soil from off-site sources and consisting of sandy loam, loam, silt loam, loamy sand or sand soil according to USDA textures; and modified to produce viable planting soil for native grass seed mix.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimal organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
3. Unacceptable Properties: Clean soil of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

4. Amended Soil Composition: Blend imported, unamended soil with soil amendments and fertilizers in the following quantities to produce planting soil:

    a. In accordance with recommendations set forth by soils-testing laboratory soils analysis to produce planting soil.

C. Planting-Soil Type 3: Imported, naturally formed soil from off-site sources and consisting of sandy loam, loam, silt loam, loamy sand or sand soil according to USDA textures.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Unacceptable Properties: Clean soil of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar,

roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
3. Form: Provide lime in form of ground calcitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

A. Sand: Fine concrete sand, ASTM C-33 Fine Aggregate, with a Fines Modulus Index of 2.3 and 3.1.

1. Sands shall be clean, sharp, natural sands free of limestone, shale and slate particles. Sand pH shall be lower than 7.5.
2. Provide the following particle size distribution:

Sieve:	**Percent Passing:**
3/8” (9.5mm)	100
No. 4 (4.75mm)	95-100
No. 8 (2.36mm)	80-100
No. 16 (1.18mm)	50-85
No. 30 (.60mm)	25-60
No. 50 (.30mm)	5-30
No. 100 (.15mm)	0-10

2.4 ORGANIC SOIL AMENDMENTS

A. Compost shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter. Compost shall be composed of but not limited to animal manures and bedding, hard and soft tree waste, coffee waste, and cotton waste. The product must not contain substances toxic to plants, or over 5% sand, silt, clay or rock material by dry weight. The product shall possess no objectionable odors. The product must meet all applicable USEPA CFR, Title 40, Part 503 Standards for Class A biosolids. The moisture level shall be such that no visible water or dust is produced when handling the material.

1. Compost shall be dark brown in color, approximately the color of dark chocolate candy (70% chocolate). Black compost and compost the color of milk chocolate shall be rejected.
2. Compost shall have a strong aerobic (sweet) odor. Compost lacking a strong aerobic odor or which has an anaerobic (sour) odor shall be rejected.
3. Testing: The results of the Compost analysis shall be provided by the Compost Supplier and approved by the Owner prior to delivery of the Compost.

Compost shall meet the requirements of the US Composting Council Seal of Testing Assurance (STA) program - *www.compostingcouncil.org* - and the following requirements:

The compost shall be the result of the biological degradation and transformation of plant- derived materials under conditions designed to promote aerobic decomposition. The material shall be well composted and free of viable weed seeds. The compost shall have no visible free water and produce no dust when handled. It shall meet the following criteria:

- 100 percent of the material must pass through a 3/4-inch screen.
- The pH of the material shall be between 6 and 8.
- Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1.0 percent by weight.
- The organic matter content shall be between 35 and 65 percent.
- Soluble salt content shall be less than 6.0 mmhos/cm.
- Germination (an indicator of maturity) shall be greater than 80%.
- Stability shall be between classes 5-7.
- Carbon/nitrogen ratio shall be less than 25:1.
- Trace metals test result = “pass.

- Chemical contaminants shall meet or exceed US EPA Class A standard, 40 CFR§ 503.13, Tables 1 and 3 levels.

Compost testing methodologies and sampling procedures shall be as provided in Test methods for the Examination of Composting and Compost (TMECC), as published by the US Composting Council.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of [**20**] [**33**] [**50**] percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PLACING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply planting soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Do not till subgrade unless directed otherwise by Owner's Representative.

C. Application: Spread planting soil to total depth indicated on Drawings, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft. of in-place soil or part thereof.

C. Soil will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.4 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owner's Representative and Landscape Architect and replace contaminated planting soil with new planting soil.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

3.6 PLANTING SOIL SCHEDULE

A. Lawn/Sod Areas: Planting Soil Type 1, thickness as indicated on Drawings.

B. Tree Planting and Backfill: Planting Soil Type 1, thickness as indicated on Drawings.

C. Native Grass Seed Mix Areas: Planting Soil Type 2, thickness as indicated on Drawings.

D. Under Decomposed Stone Surfacing: Planting Soil Type 3, thickness as indicated on Drawings.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Planting Soil Type 1: Measurement will be made to the nearest cubic yard for installation of planting soil type 1. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, testing and amending, installation and compaction of planting soil type 1 as defined herein.

B. Planting Soil Type 2: Measurement will be made to the nearest cubic yard for installation of planting soil type 2. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, testing and amending, installation and compaction of planting soil type 2 as defined herein.

C. Planting Soil Type 3: Measurement will be made to the nearest cubic yard for installation of planting soil type 3. Payment will be made at the contract unit price and shall include all costs

associated with the satisfactory furnishing, installation and compaction of planting soil type 3 as defined herein.

END OF SECTION 329113

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Native Grass Seed Mix Seeding/Hydroseeding.
2. Sodding.

B. Related Requirements:

1. Section 328400 “Planting Irrigation” for irrigation system.
2. Section 329113 "Soil Preparation" for preparation and placing planting soil.
3. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.
4. Section 334600 "Subdrainage" for below-grade drainage of landscaped areas.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" and drawing designations for planting soils.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Native Grass Seed Mix, including seed vendor’s certification of grass seed, written instructions for installation and seeding rate.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf and native grass mix during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and native grass mix establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: After Spring thaw.
2. Fall Planting: Prior to consistent ground freeze.

"Spring thaw" shall be defined as the earliest date in a new calendar year in which seed can be buried ½ inch into the surface soil or planting soil through normal drill seeding methods.

"Consistent ground freeze" shall be defined as that time during the fall months in which the surface soil or planting soil, due to freeze conditions, prevents burying the seed ½ inch through normal drill seeding operations. Seed shall not be sown, drilled or planted when the surface soil or planting soil is in a frozen or crusted state.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 NATIVE GRASS SEED MIX

A. Native-Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:

1. 15 percent Bouteloua gracilis, Blue Grama.
2. 70 percent Nassella tenuissima, Mexican Feathergrass.
3. 15 percent Pascopyrum smithii 'Arriba', 'Arriba' Western Wheatgrass.

    a. Install per seed vendor's recommendations and as directed by Owner's Representative and Landscape Architect.
    b. Seeding Rate: 8 – 12 PLS lbs per acre (1/2 – 1 PLS lbs per 1000 sq. ft.)

B. Seed Carrier: As required, Inert material, sharp clean sand or perlite.

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
2. Do not apply fertilizer in areas to receive native grass seed mix unless otherwise directed by Owner's Representative, Landscape Architect or written instructions from seed vendor.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
2. Do not apply fertilizer in areas to receive native grass seed mix unless otherwise directed by Owner's Representative, Landscape Architect or written instructions from seed vendor.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Sphagnum Peat Mulch: Partially decomposed sphagnum peat moss, finely divided or of granular texture, and with a pH range of 3.4 to 4.8.

C. Muck Peat Mulch: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inchsieve; soluble salt content of 2 to 5 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:

1. Organic Matter Content: 50 to 60 percent of dry weight.
2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.

E. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

F. Non-asphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

G. Asphalt Emulsion: ASTM D 977, Grade SS-1; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner's Representative and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 TURF AREA PREPARATION

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: In accordance to Section 329113 "Soil Preparation."

1. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain Owner’s Representative's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 1 lb/1000 sq. ft.

C. Rake seed lightly into top 1/4 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:3 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

F. Protect seeded areas from hot, dry weather or drying winds by applying compost mulch or planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth only as directed by Owner’s Representative.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with fiber-mulch manufacturer's recommended tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.

3.6 SODDING

A. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Owner’s Representative prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

C. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow Kentucky bluegrass to a height of 1-1/2 to 2 inches.

D. Turf Postfertilization: Apply commercial fertilizer or slow-release fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Owner's Representative and Landscape Architect:

1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 NATIVE GRASS SEED MIX

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Before sowing, mix seed with seed carrier at a ratio as recommended by Seed Supplier.
2. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
3. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate of 1 lb/1000 sq. ft.

C. Brush seed into top 1/4 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying peat or compost mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth only as directed by Owner's Representative.

E. Water newly planted areas and keep moist until native grass seed mix is established.

3.10 NATIVE GRASS SEED MIX MAINTENANCE

A. Maintain and establish native grass seed mix by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable native grass seed mix. Roll, regrade, and replant bare or eroded areas and re-mulch. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and native grass seed mix damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep native grass seed mix and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and native grass seed mix watering equipment to convey water from sources and to keep native grass seed mix uniformly moist.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water native grass seed mix with fine spray at a minimum rate of 1/2 inch per week for up to eight weeks after planting unless rainfall precipitation is adequate or otherwise directed by Owner’s Representative.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations. Notify Owner before each application is performed.

3.12 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove non-biodegradable erosion-control measures after grass establishment period.

3.13 MAINTENANCE SERVICE

A. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Sodded Turf: From date of planting completion until Final Acceptance by Owner's Representative and Landscape Architect.

B. Native Grass Seed Mix Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Native Grass Seed Mix Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable native grass seed mix is established, but for not less than maintenance period below.

1. Maintenance Period: From date of planting completion until Final Acceptance by Owner's Representative and Landscape Architect.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Native Grass Seed Mix: Measurement will be made per square foot of native grass seed mix. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, installation and mulching of native grass seed mix as defined herein.

B. Sodding: Measurement will be made per square foot of sodding. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing and installation of sodding as defined herein.

C. Pesticide and Herbicide Application: If required by Owner's Representative, Measurement will be made per square foot of pesticide and herbicide application. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, treatment and protection as defined herein and per requirements set forth by Owner's Representative.

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Plants (trees).
2. Tree stabilization.
3. Landscape edgings.

B. Related Requirements:

1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 328400 “Planting Irrigation” for irrigation system.
3. Section 329113 "Soil Preparation" for preparation and placing planting soil.
4. Section 329200 "Turf and Grasses" for turf (lawn) and native seed mix planting.
5. Section 334600 "Subdrainage" for below-grade drainage of landscaped areas.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices."

B. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation" for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.5 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Mineral Mulch: 2 lb of each mineral mulch required, in sealed plastic bags labeled with source of mulch. Sample shall be typical of the lot of material to be delivered and installed on-site; provide an accurate indication of color, texture, and makeup of the material.
2. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree for height and spread; do not measure branches

or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

D. Plant Material Observation: Owner's Representative and Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Owner's Representative and Landscape Architect may also observe trees further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees immediately from Project site.

1. Notify Owner's Representative and Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Bare-root stock plants are not allowed.

D. Do not prune trees before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

E. Handle planting stock by root ball.

F. Apply antidesiccant to trees using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.

1. If deciduous trees are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

G. Wrap trees with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

H. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.11 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: After Spring thaw.
2. Fall Planting: Prior to consistent ground freeze.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.12 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

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

a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
b. Structural failures including plantings falling or blowing over.
c. Faulty performance of tree stabilization.
d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Periods: From date of Substantial Completion.

a. Trees: 12 months.

3. Include the following remedial actions as a minimum:

a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.

b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Owner's Representative and Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.2 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
1. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCHES

A. Mineral Mulch: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of the following type, size range, and color:

1. Type: Crushed stone or gravel to match Decomposed Stone Surfacing.
2. Size Range: 1/2 inch maximum, 1/4 inch minimum.
3. Color: Uniform tan-beige color range to match Decomposed Stone Surfacing.

2.4 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
3. Tree Straps: 12 inch, woven polypropylene with brass grommets, minimum tear strength of 200 lbs., color – beige.
4. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.
5. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

2.6 LANDSCAPE EDGINGS

A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Basis of Design Product: Steel landscape edging, as manufactured by Pro-Steel, Fort Worth, TX, 817-572-4959 or approved equal.
2. Edging Size: 3/16 inch thick by 4 inches deep, 14 Gauge.
3. Stakes: Tapered steel, a minimum of 12 inches long.
4. Accessories: Standard tapered ends, corners, and splicers.
5. Finish: Manufacturer's standard powder coat paint.

    a. Paint Color: Black.

2.7 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner’s Representative and Landscape Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner’s Representative and Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Owner’s Representative and Landscape Architect. Stake locations of individual trees and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Section 329113 "Soil Preparation."

B. Placing Planting Soil: In accordance with Section 329113 "Soil Preparation."

C. Before planting, obtain Owner’s Representative and Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil removed from excavations may not be used as backfill soil unless otherwise directed by Owner’s Representative. See also Section 329113 "Soil Preparation."

C. Obstructions: Notify Owner’s Representative and Landscape Architect if unexpected rock or obstructions detrimental to trees are encountered in excavations.

1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Owner’s Representative and Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees.

3.5 TREE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as indicated on Drawings.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: As required per Manufacturer's written recommendations for type of tree planting.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.

1. Backfill: Planting soil as indicated on Drawings.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: As required per Manufacturer's written recommendations for type of tree planting.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees as directed by Owner's Representative and Landscape Architect.

C. Prune, thin, and shape trees according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Owner's Representative and Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying: Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension indicated on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply mineral mulch ring of 3-inch average thickness, with 18-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks.
2. Mineral Mulch in Planting Areas: Apply 4-inch average thickness of mineral mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks.

3.9 EDGING INSTALLATION

A. Steel Edging: Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging.

3.10 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or

vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.12 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Owner’s Representative and Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Owner’s Representative and Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced.
2. Species of Replacement Trees: Same species being replaced unless directed otherwise by Owner’s Representative and Landscape Architect.

3.13 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Deciduous Tree Planting: Measurement and Payment for deciduous tree planting will be made under Deciduous Tree Planting in Decomposed Gravel Type 1 and Deciduous Tree Planting in Decomposed Gravel Type 2.

B. Deciduous Tree Planting in Decomposed Gravel Type 1: Measurement will be made per each for installation of deciduous tree planting in decomposed gravel type 1. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, installation and staking of deciduous tree planting as defined herein. Measurement and payment of decomposed stone surfacing shall be in accordance to Section 321540 “Crushed Stone Surfacing”.

C. Landscape Edging: Measurement will be made to the nearest linear foot for installation of the landscape edging around deciduous tree planting in decomposed gravel type 2 in native grass seed mix areas. Payment will be made at the contract unit price and shall include all costs associated the satisfactory furnishing and installation as defined herein.

D. Pesticide and Herbicide Application: If required by Owner’s Representative, Measurement will be made per square foot of pesticide and herbicide application. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing, treatment and protection as defined herein and per requirements set forth by Owner’s Representative.

END OF SECTION 329300

SECTION 334600 - SUBDRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Soundboard Trench.

1.3 ACTION SUBMITTALS

A. Product Data.

B. Samples: One full-size unit for verification.

C. Shop Drawings.

PART 2 - PRODUCTS

2.1 SOUNDBOARD TRENCH

A. Basis of Design Product: Provide one piece pedestrian trench, 5,000 psi, steel reinforced, wet cast concrete, 10 inch inside width by 12 inch depth, with open bottom, and rust-proof, tamperproof, aluminum lid as manufactured by Trenwa, Inc., Fort Thomas, KY, 859-781-0831, or approved equal.

1. Provide Manufacturer’s standard accessories and anchors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Coordinate installation of subdrainage systems with adjacent Work and any work that may impact satisfactory installation. Bring to the attention of the Owner's Representative immediately any discrepancies or issues that would inhibit successful installation.

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

3.2 SOUNDBOARD TRENCH INSTALLATION

A. Install in accordance with Manufacturer's written recommendations and as directed by Owner's Representative.

PART 4 - PART IV - MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. Soundboard Trench: Measurement will be made per linear foot for installation of soundboard trench. Payment will be made at the contract unit price and shall include all costs associated with the satisfactory furnishing and installation of soundboard trench as defined herein.

END OF SECTION 334600

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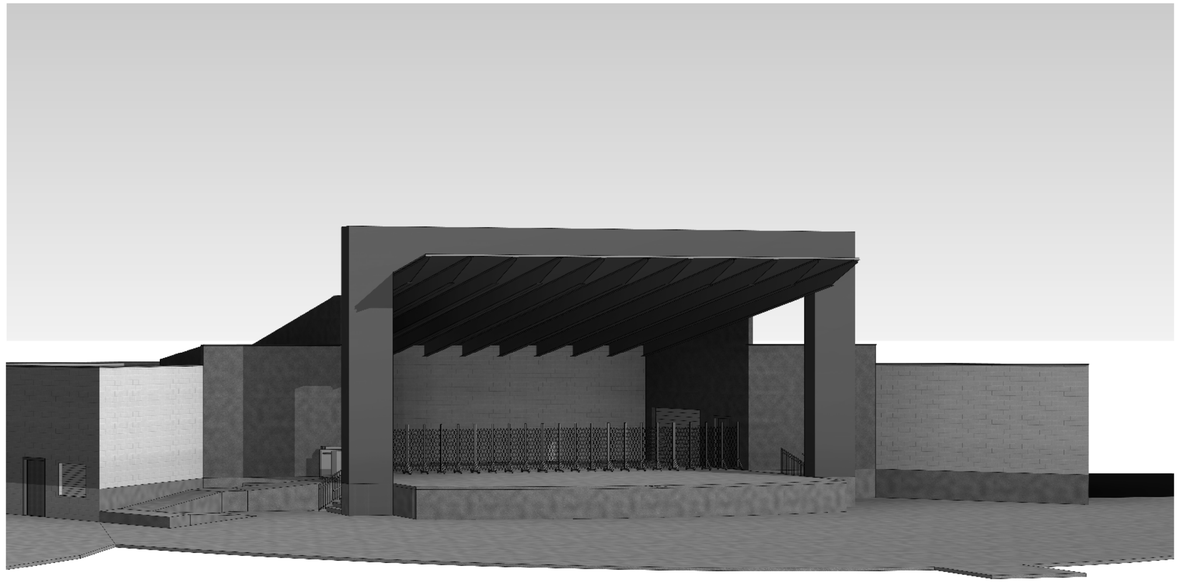


LAS COLONIAS AMPHITHEATER

100% CONSTRUCTION DOCUMENTS July 15, 2016

STATE OF COLORADO
KELLY BOYD MORGAN
ARC.0011593
LICENSED ARCHITECT
7-15-16

METHOD STUDIO INC.
925 south west temple
salt lake city, utah 84101
phone:(801) 532-4422

consultant:
DESIGNWORKSHOP

project:
LAS COLONIAS AMPHITHEATER

Grand Junction, CO

CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Cover Sheet

sheet:
G001

100% CONSTRUCTION DOCUMENTS

ABBREVIATION SCHEDULE

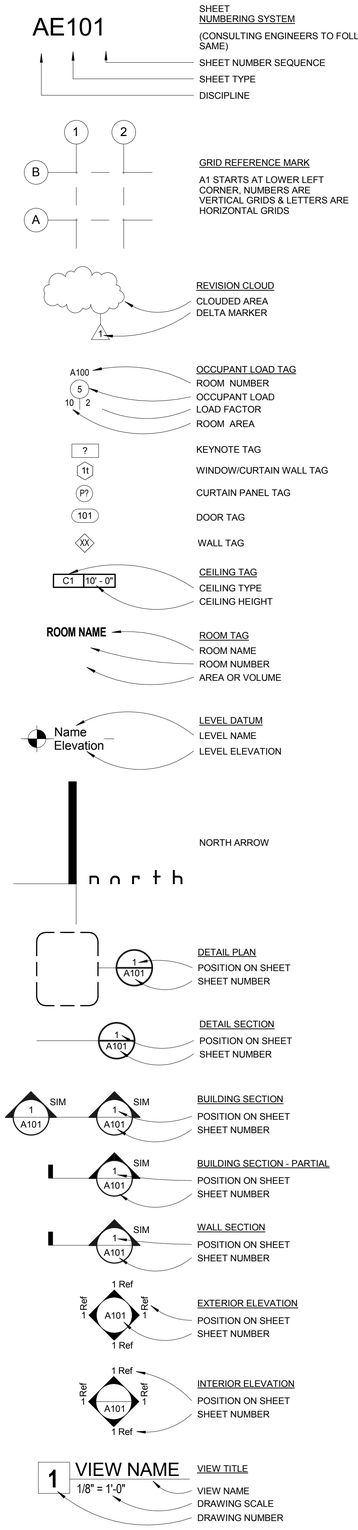
Abbrev.	Description
0	
#	NUMBER OR POUND
&	AND
2:1 SL	2 HORIZONTAL TO 1 VERTICAL SLOPE
@	AT
[	CHANNEL
AD	AREA DRAIN
CL	CENTERLINE
L	ANGLE
±	PLUS MINUS
≤	LESS THAN OR EQUAL TO
≥	GREATER THAN OR EQUAL TO
A	
AB	ANCHOR BOLT
AC	APSHALTIC CONCRETE
ACST	ACOUSTIC
ADJ	ADJUSTABLE
AFF	ABOVE FINISH FLOOR
AL	ALUMINUM
ALT	ALTERNATE
ARCH	ARCHITECTURAL, ARCHITECT, ARCHITECTURE
ASPH	ASPHALT
B	
B	BASELINE
B	BOTTOM
BEJ	BRICK EXPANSION JOINT
BLDG	BUILDING
BLK	BLOCK
BM	BEAM
BO	BOARD
BRG	BEARING
BSMT	BASEMENT
C	
C&G	CURB & GUTTER
CAP	CAPACITY
CEM	CEMENT
CG	CORNER GUARD
CIP	CAST IN PLACE, CAST IRON PIPE
CIR	CIRCULATING
CJ	CONTROL JOINT
CL	CENTERLINE
CLG	CEILING
CLR	CLEAR
CMU	CONCRETE MASONRY UNITS
COL	COLUMN
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION
CONT	CONTINUOUS
CPT	CARPET
CSK	COUNTERSUNK
CT	CERAMIC TILE
CTR	CENTER
D	
D	DEPTH
DET	DETAIL
DF	DRINKING FOUNTAIN
DIA	DIAMETER
DIM	DIMENSION
DN	DOWN
DS	DOWNSPOUT
DWG	DRAWING
E	
E	EAST
E/P	EDGE OF PAVEMENT
EA	EACH
EL	ELEVATION
ELECT	ELECTRICAL
ELEV	ELEVATOR
EMER	EMERGENCY
EQ	EQUAL
EQUIP	EQUIPMENT
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EXIST	EXISTING
EXP	EXPANSION
EXP JT	EXPANSION JOINT
EXT	EXTERIOR
F	
FD	FLOOR DRAIN
FDN	FOUNDATION
FE	FIRE EXTINGUISHER
FFE	FINISHED FLOOR ELEVATION
FH	FIRE HYDRANT
FHC	FIRE HOSE CABINET
FIN	FINISH
FLR	FLOOR
FR	FRAME
FTG	FOOTING
FXTR	FIXTURE
G	
G	GROUND
GA	GA
GALV	GALVANIZED
GL	GLASS
GR	GRADE
GRD	GROUND
GWB	GYPSUM WALL BOARD
H	
HB	HOSE BIBB
HC	HANDICAPPED
HDW	HARDWARE
HGT	HEIGHT
HORZ	HORIZONTAL
HR	HOUR
HW	HOT WATER
I	
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
INSUL	INSULATION
INT	INTERIOR
INTX	INTERSECTION
INV	INVERT
J	
JB	JUNCTION BOX
JCT	JUNCTION
JST	JOIST
JT	JOINT

ABBREVIATION SCHEDULE

Abbrev.	Description
L	
L	LENGTH
LC	LENGTH OF CURVE
LDC	LEAD COVERED
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LT	LIGHT
M	
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MISC	MISCELLANEOUS
MO	MASONRY OPENING
MTD	MOUNTED
MTG	MOUNTING
MULL	MULLION
MWP	MEMBRANE WATERPROOFING
N	
N	NORTH
NA	NOT APPLICABLE
NE	NORTHEAST
NEC	NATIONAL ELECTRIC CODE
NEUT	NEUTRAL
NIC	NOT IN CONTRACT
NO	NUMBER
NOM	NOMINAL
NTS	NOT TO SCALE
NW	NIORTHWEST
O	
OA	OUTSIDE AIR
OA	OUTSIDE AIR
OC	ON CENTER
OPP	OPPOSITE
OVHD	OVERHEAD
P	
PI	POINT IF INTERSECTION
PL	PLATE
PLAS	PLASTER
PLYWD	PLYWOOD
PNL	PANEL
PNT	PAINT
PRELIM	PRELIMINARY
PRESS	PRESSURE
PRIM	PRIMARY
PRTN	PARTITION
PT	POINT, POINT OF TANGENT
Q	
QT	QUARRY TILE
R	
R	RADIUS
RA	RETURN AIR
RB	RESILIENT VINYL BASE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RECP	RECEPTACLE
REINF	REINFORCEMENT
REQD	REQUIRED
REV	REVISION
RF	ROOF
RFLCP	REFLECTIVE CEILING PLAN
RM	ROOM
RVT	RESILIENT VINYL TILE
S	
S	SOUTH
SCH	SCHEDULE
SD	STORM DRAIN
SE	SOUTHEAST
SECT	SECTION
SHT	SHEET
SIM	SIMILIAR
SL	SLOPE
SPEC	SPECIFICATION
SQ	SQUARE
STL	STEEL
SUSP	SUSPENDED
T	
T	TOP
T&B	TOP AND BOTTOM
TEL	TELEPHONE
TEMP	TEMPORARY
TERM	TERMINAL
THRSLD	THRESHOLD
TO	TOP OF
TOS	TOP OF STEEL, TOP OF SLAB
TOW	TOP OF WALL
TYP	TYPICAL
V	
VCT	VINYL COMPOSITION TILE
VENT	VENTILIATING
VERT	VERTICAL
VEST	VESTIBULE
VWC	VINYL WALL COVERING
W	
W	WIDTH, WEST
W/	WITH
W/O	WITHOUT
WC	WATER CLOSET
WD	WIDTH
WT	WEIGHT
WWF	WELDED WIRE FABRIC
X	
X	TRANSFORMER

ARCHITECTURAL SYMBOLS

(SEE RESPECTIVE DISCIPLINES FOR SYMBOLS)



MATERIAL LEGEND

02 SITE CONSTRUCTION

- EARTH (existing)
- EARTH (backfill)
- DRAINAGE FILL COMPACTED FILL

03 CONCRETE

- CONCRETE - CAST-IN-PLACE
- CONCRETE - PRECAST

04 MASONRY

- BRICK
- CONCRETE MASONRY UNITS
- GLASS BLOCK
- STONE
- CAST STONE
- GROUT

05 METALS

- STEEL
- ALUMINUM

06 WOODS AND PLASTICS

- CONTINUOUS WOOD
- INTERMITTENT WOOD
- SHEATHING
- FINISH WOOD
- HARDBOARD
- PARTICLE BOARD

07 THERMAL & MOISTURE PROTECTION

- BATT INSULATION
- LOOSE FILL INSULATION
- RIGID INSULATION

09 FINISHES

- GYPSUM BOARD

MISCELLANEOUS GENERAL NOTES

1. THE PROJECT MANUAL, UNDER SEPARATE COVER, IS AN INTEGRAL PART OF THESE CONSTRUCTION DRAWINGS.
2. PLANS, SECTIONS, ELEVATIONS, DETAILS AND DIMENSIONS LABELED "TYPICAL" SHALL APPLY TO ALL SITUATION OCCURRING THAT ARE THE SAME OR SIMILAR TO THOSE SPECIFICALLY KEYED ON THE DRAWINGS.
3. ALL WORK, MATERIALS, AND METHODS SHALL BE IN CONFORMANCE WITH THE CODES, ORDINANCES AND REGULATIONS OF ALL GOVERNMENTAL AGENCIES HAVING JURISDICTION AT THE PROJECT LOCATION.
4. UNLESS OTHERWISE INDICATED IN THE CONSTRUCTION DOCUMENTS AS BEING NOT IN CONTRACT (N.I.C.) OR EXISTING, ALL ITEMS, MATERIALS AND INSTALLATION OF SAME ARE PART OF THE CONTRACT AS DEFINED BY THE CONSTRUCTION DOCUMENTS. THE CONTRACTOR SHALL PROVIDE AND INSTALL ALL ACCESSORIES, COMPONENTS AND ASSEMBLIES REQUIRED FOR THE WORK DEPICTED OR SPECIFIED.
5. CONTRACTORS ARE RESPONSIBLE FOR ALL WORK REGARDLESS OF THE LOCATION OF THE INFORMATION ON THE DOCUMENTS.
6. KEEP SITE CLEAN AND CLEAR OF DEBRIS AND IN ORDERLY CONDITION THAT DOES NOT DETRACT FROM THE SURROUNDING SITE AND REPAIR ANY DAMAGE CAUSED BY WORK OF THE CONTRACT.
7. ALL DIMENSIONS ARE TO THE FACE OF METAL OR WOOD STUD FRAMED WALLS AND TO THE FACE OF CONCRETE AND MASONRY WALLS AS SHOWN, UNLESS NOTED OTHERWISE.
8. INSTALL SEALANT AT EXTERIOR SIDE OF ALL JOINTS, SEAMS, CONNECTIONS OR OPENINGS WHICH WOULD ALLOW WATER OR AIR INFILTRATION EXCEPT AS NOTED OTHERWISE. SEALANT COLOR TO MATCH ADJACENT SURFACE. COLOR REQUIRES ARCHITECTS APPROVAL.
9. DOOR OPENINGS IN FRAME CONSTRUCTION WHICH ARE NOT DIMENSIONED ARE EITHER CENTERED IN THE WALL, FACE OF JAMB OR LOCATED 4" FROM THE FACE OF STUD TO THE FINISHED JAMB.
10. ALL SPECIAL ACCESSIBLE FACILITIES SHALL BE IDENTIFIED WITH APPROVED SIGNAGE.
11. THE CONTRACTOR IS RESPONSIBLE FOR PRODUCING A WEATHER TIGHT BUILDING, DETAILS AND OMISSIONS TO DRAWINGS NOTWITHSTANDING. ALL DRAWING CONFLICTS WHICH MAY NOT ALLOW A WEATHERTIGHT CONDITION SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT.
12. DISCREPANCIES BETWEEN ACTUAL CONDITIONS AND PLANS SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT. CONTRACTOR SHALL SUBMIT SPECIFIC DISCREPANCIES FOR ARCHITECT REVIEW.
13. PROVIDE FULL METAL BACKING PLATE (16 GAUGE X 6" HIGH SECURED TO 3 STUDS MIN.) OR WOOD BLOCKING AS REQUIRED TO SECURELY ANCHOR ALL WALL MOUNTED EQUIPMENT (CABINETS, TOILET ROOM ACCESSORIES, HARDWARE, ETC.). BLOCKING SHALL PROVIDE A RIGID CONNECTOR CAPABLE OF SUPPORTING DESIGN LOADS. PROVIDE A 16 GAUGE X 6" STL. STUD/TRACK SECURED TO 2 STUDS TO SECURELY SUPPORT ALL WALL STOPS (DOOR BUMPER).
14. COORDINATE WITH ALL TRADES, SIZES AND LOCATIONS OF ALL OPENINGS FOR MECHANICAL, PLUMBING AND ELECTRICAL EQUIPMENT, EQUIPMENT PADS OR BASES, AS WELL AS ELECTRIC POWER, WATER, AND DRAIN INSTALLATIONS, BEFORE PROCEEDING WITH WORK. CONTRACTOR SHALL PROVIDE COORDINATION DRAWINGS FOR PROPER PLACEMENT OF ALL TRADES' WORK. ANY CONCERNS, SPACE LIMITATIONS OR STRUCTURAL CONFLICTS, SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT. A REASONABLE RESPONSE TIME SHALL BE ALLOWED AS NOTED IN THE SPECIFICATIONS.
15. ALL FLOOR OR WALL OPENINGS REQUIRED FOR PIPES, DUCTS, CONDUITS,ETC. SHALL BE SEALED IN AN APPROVED MANNER.
16. FIRE SPRINKLER DESIGN TO BE DONE BY A CERTIFIED SUB-CONTRACTOR AND WILL REQUIRE APPROVALS BY THE CITY AND STATE FIRE MARSHAL. APPROVALS BY THE FIRE MARSHAL ARE TO BE OBTAINED BY THE CONTRACTOR PRIOR TO SUBMITTAL TO ARCHITECT. SUBMITTAL TO THE ARCHITECT ALSO INDICATES THAT THE CONTRACTOR HAS REVIEWED AND COORDINATED FIRE-SPRINKLER PIPING LOCATIONS WITH ALL TRADES.
17. ROOMS ENCLOSED WITH RATED WALLS REQUIRE RATED DOORS. ANY DUCTS PASSING THROUGH WALLS REQUIRE FIRE DAMPERS AND OR FIRE/SMOKE DAMPERS. ANY CONDUIT OR PIPING REQUIRES RATED SEALANT AT JOINTS.
18. GENERAL STRUCTURAL NOTES GOVERN TYPICAL CONDITIONS WHETHER OR NOT SPECIFICALLY DETAILED OR NOTED.
19. IT IS THE CONTRACTOR'S RESPONSIBILITY TO COORDINATE AND LOCATE ELECTRICAL, DATA AND PHONE RECEPTACLES, SWITCHES, ETC. TO AVOID CASEWORK, DOORS, ETC.
20. THE DRAWINGS AND SPECIFICATIONS INDICATE THE GENERAL SCOPE OF THE PROJECT IN TERMS OF THE ARCHITECTURAL AND STRUCTURAL DESIGN CONCEPT. THE DIMENSIONS OF THE BUILDING, THE TYPE OF STRUCTURAL, MECHANICAL, ELECTICAL AND UTILITY SYSTEMS AND MAJOR ARCHITECTURAL ELEMENTS OF CONSTRUCTION AS "SCOPE" DOCUMENTS.
21. THE DRAWINGS AND SPECIFICATIONS DO NOT NECESSARILY INDICATE OR DESCRIBE ALL WORK REQUIRED FOR THE FULL PERFORMANCE AND COMPLETION OF THE WORK. CONTRACTS SHALL BE LET ON THE BASIS OF SUCH DOCUMENTS, WITH THE UNDERSTANDING THAT THE CONTRACTOR IS TO FURNISH ALL ITEMS REQUIRED FOR PROPER COMPLETION OF THE WORK WITH OUT ADJUSTMENT TO CONTRACT PRICE. IT IS INTENDED THAT THE WORK TO BE OF SOUND AND QUALITY CONSTRUCTION AND THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE INCLUSION OF ADEQUATE AMOUNTS TO COVER INSTALLATION OF ALL ITEMS INDICATED, DESCRIBED OR REASONABLY IMPLIED.

DRAWING INDEX

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Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
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General Information

sheet:
G002

100% CONSTRUCTION DOCUMENTS

Legend

- T — EXIST. TELEPHONE LINE
- G — EXIST. GAS LINE
- C — EXIST. CABLE TELEVISION LINE
- E — EXIST. UNDERGROUND ELECTRICAL LINE
- OE — EXIST. OVERHEAD ELECTRICAL LINE
- 12"DR — EXIST. DRAIN LINE & SIZE
- 8"W — EXIST. WATER LINE & SIZE
- 4"WS — EXIST. WATER SERVICE LINE & SIZE
- 8"S — EXIST. SEWER LINE & SIZE
- 4"SS — EXIST. SEWER SERVICE LINE & SIZE
- C — NEW CABLE LINE
- E — NEW ELECTRIC LINE
- T — NEW TELEPHONE LINE
- G — NEW GAS LINE
- 12"DR — NEW DRAIN LINE & SIZE
- 8"W — NEW WATER LINE & SIZE
- 4"WS — NEW WATER SERVICE LINE & SIZE
- 8"S — NEW SEWER LINE & SIZE
- 4"SS — NEW SEWER SERVICE LINE & SIZE
- 18" CMP / 24" CMP — EXIST. CULVERT & SIZE
- NEW CULVERT W/ FLARED END SECTION
- SWALE FLOWLINE
- EXIST. FENCE LINE
- NEW PERIMETER FENCE LINE
- ROCK WALL
- EXIST. EDGE OF PAVEMENT
- NEW EDGE OF PAVEMENT
- PROPERTY LINE
- DECIDUOUS TREE
- EVERGREEN TREE
- MONUMENT MARKER
- TELEPHONE RISER
- CABLE RISER
- ELECTRIC TRANSFORMER
- GAS METER
- EXIST. ELECTRIC MANHOLE/METER
- EXIST. TELEPHONE MANHOLE
- EXIST. STORM DRAIN MANHOLE
- EXIST. STORM DRAIN INLET
- EXIST. SEWER MANHOLE
- EXIST. CLEAN-OUT
- EXIST. WATER VALVE
- NEW WATER VALVE
- EXIST. FIRE HYDRANT
- NEW FIRE HYDRANT
- NEW WATER SHUT-OFF VALVE
- EXIST. WATER METER
- NEW WATER METER
- NEW CURB STOP
- NEW YARD HYDRANT
- SPRINKLER IRRIGATION HEAD
- SOIL BORING LOCATION
- EXIST. POWER POLE
- NEW POWER POLE
- EXIST. STREETLIGHT POLE
- NEW STREETLIGHT POLE
- EXIST. SIGN
- NEW SIGN
- GAS VALVE
- NEW SEWER/STORM DRAIN MANHOLE W/ RIM LOCATION
- NEW CLEAN-OUT
- NEW DRAIN INLET
- NEW CURB INLET
- 42.77FL — FINISHED SPOT ELEV. W/ DESCRIPTION
- NEW FLARED END SECTION (HDPE)
- NEW FLARED END SECTION (CMP)
- FO — FIBER OPTIC LINE MARKER

- ASPHALT MILLINGS (CHIPPED AND SEALED)
- HOT MIX ASPHALT – 3" THICK ON 13" MILLINGS ABC
- HOT MIX ASPHALT – 4" THICK ON 13" MILLINGS ABC
- 6" CONCRETE
- 5" CONCRETE
- ASPHALT PATCH – PER CITY STANDARD
- LANDSCAPE AREA – SEE DESIGN WORKSHOP LS PLANS
- SPILL GUTTER

Abbreviations

AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ABC	AGGREGATE BASE COURSE
ADT	AVERAGE DAILY TRAFFIC
AP	ANGLE POINT
AS	ASPHALT
ASPH	ASPHALT
BC	BUILDING CORNER
BF	BLOCK FACING
BMP	BEST MANAGEMENT PRACTICES
BOW	BACK OF SIDEWALK
BP	BEGIN PROJECT
BVCE	BEGIN VERTICAL CURVE ELEVATION
BVCS	BEGIN VERTICAL CURVE STATION
BW	BOTTOM WALL
C	CURB
CC	CURB CUT
CDOT	COLORADO DEPARTMENT OF TRANSPORTATION
CDPHE	COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
CG	CURB AND GUTTER
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CO	CONCRETE
CONC	CONCRETE
CONST	CONSTRUCTION
CONT.	CONTINUOUS
COR.	CORNER
CTB	CONCRETE THRUST BLOCK
CU	CUBIC
D	DEEP
DR	DRAIN
DW	DRIVEWAY
E	EASTING
EA.	EACH
EG	EXISTING GRADE
EL	ELEVATION
ELEV	ELEVATION
EOA	EDGE OF ASPHALT
EOC	EDGE OF CONCRETE
E.O.C.	EDGE OF CONCRETE
EOD	EDGE OF DRIVEWAY
EOP	EDGE OF PAVEMENT
EOG	EDGE OF GRAVEL
EP	END PROJECT
ESMT.	EASEMENT
EVCE	END VERTICAL CURVE ELEVATION
EVCS	END VERTICAL CURVE STATION
EX.	EXISTING
EXIST.	EXISTING
FF	FINISH FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FHWA	FEDERAL HIGHWAY ADMINISTRATION
FL	FLOWLINE
FT.	FEET
GB	GRADE BREAK
GR	GRAVEL
GRAV.	GRAVEL
HC	HANDICAP RAMP
HMA	HOT MIX ASPHALT
HORIZ.	HORIZONTAL
HP	HIGH POINT
HPG	HIGH PRESSURE GAS
HWY	HIGHWAY
HYD	HYDRANT
INV.	INVERT
L	LEFT
LF	LINEAL FEET
LP	LOW POINT
L.S.	LANDSCAPED AREA
MAT'L	MATERIAL
MAX.	MAXIMUM
MIN.	MINIMUM
MHT	METHOD OF HANDLING TRAFFIC
ML	MEGALUG
MLW	MASONRY LANDSCAPE WALL
MPH	MILES PER HOUR
N	NORTHING
N/A	NOT APPLICABLE
NAT.	NATIVE GRASS AREA
NE	NORTH EAST
NHS	NATIONAL HIGHWAY SYSTEM
NO.	NUMBER
N.T.S.	NOT TO SCALE
NW	NORTH WEST
OC	ON CENTER
O/S	OFFSET
PB	POND BOTTOM
PC	POINT OF CURVATURE
PERM	PERMANENT
PG	PAGE
PGL	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
PL	PROPERTY LINE
PNT	POINT
PROP	PROPOSED
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
PVI	POINT OF VERTICAL INTERSECTION
PVMT	PAVEMENT
R	RIGHT
R&R	REMOVE & REPLACE
RAD.	RADIUS
RCP	REINFORCED CONCRETE PIPE
REF.	REFERENCE
REQ.	REQUIRED
REQ'D	REQUIRED
REVEG	REVEGETATE
ROW	RIGHT-OF-WAY
RP	RADIUS POINT
RW	RETAINING WALL
SD	STORM DRAIN
SECT.	SECTION
SF	SQUARE FEET
SHDR	SHOULDER
SMH	SEWER MANHOLE
SOD	GRASS AREA
S.S.D.	STOPPING SIGHT DISTANCE
STA.	STATION
SE	SOUTH EAST
SL	SEWER LINE
SW	SIDEWALK
T	TREAD STAIRS
T.B.C.	TOP BACK CURB
TBC	TOP BACK CURB
TC	TOP CURB
TELE.	TELEPHONE
TEMP	TEMPORARY
TP	TOP OF PIPE
TRANS.	TRANSITION
TR.FLG.	TRAFFIC FLANGE ON FIRE HYD.
TW	TOP OF WALL
TYP.	TYPICAL
VC	VERTICAL CURVE
V.P.	VALLEY PAN
W	WIDE
W/	WITH
WC	WALL CORNER
WL	WATER LINE
W.W.M.	WELDED WIRE MESH
X-S	CROSS SLOPE

Sheet Index

UTILITY CONTACT INFORMATION:

ELECTRICAL AND GAS UTILITY CONTACT: JON PRICE, XCEL ENERGY (970) 244-2693

CABLE TV UTILITY CONTACT: EDWARD PACHECO, CHARTER COMMUNICATIONS (970) 986-1195

PHONE UTILITY CONTACT: CHRIS JOHNSON, CENTURYLINK (970) 244-4311

WATER AND SEWER UTILITY CONTACT: BRET GUILLORY (970) 244-1590

GENERAL NOTES:

1. THE CITY OF GRAND JUNCTION HAS PROVIDED A SURVEY FOR THE BASIS OF DESIGN. THE SURVEY DATA INCLUDED IN THIS SET IS FOR GENERAL INFORMATION PURPOSES ONLY AND INTENDED TO ASSIST THE CONTRACTOR IN UNDERSTANDING THE PROPOSED DESIGN RELATIONSHIPS AND TO PROVIDE A GENERAL ORIENTATION OF THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING AND DETERMINING THE SUITABILITY OF THE DATA PRIOR TO BIDDING AND CONSTRUCTION OF THE PROJECT. ANY DEVIATIONS OR OMISSIONS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE, IN WRITING, FOR CLARIFICATION AND DIRECTION.
2. THE BASIS OF SURVEY COORDINATE GEOMETRY ASSUMED TO BE MESA COUNTY LOCAL COORDINATE SYSTEM, ZONE "A". CONTRACTOR TO VERIFY.
3. EXISTING FIELD CONDITIONS VARY FROM CONTRACT BID DOCUMENTS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BIDDING PROJECT.
4. ALL MATERIALS, EQUIPMENT, INSTALLATION AND CONSTRUCTION ON THIS PROJECT SHALL BE IN ACCORDANCE WITH THE CITY OF GRAND JUNCTION DEVELOPMENT STANDARDS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, THE CITY OF GRAND JUNCTION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF UNDERGROUND UTILITIES. AND STANDARD DETAILS OF STREETS, STORM DRAINS AND UTILITIES.
5. A GEOTECHNICAL INVESTIGATION FOR THE PROJECT WAS PERFORMED BY HUDDLESTONE-BERRY, PROJECT #00208-0057, JANUARY 27, 2015 AND IS AVAILABLE FOR REVIEW AT THE CITY OF GRAND JUNCTION PARKS AND RECREATION DEPARTMENT.
6. THIS PLANSET PROVIDES PAVEMENT SECTIONS AND THE USE OF ASPHALT MILLINGS AS DIRECTED BY THE CITY OF GRAND JUNCTION.
7. RADIOACTIVE MATERIALS MAY BE ENCOUNTERED ON THIS PROJECT. SEE DEMOLITION NOTES.
8. ALL MATERIAL GENERATED FROM EXCAVATION ON THE SITE IS TO REMAIN ON SITE AND UTILIZED IN AREAS OF FILL.
9. THE CONTRACTOR SHALL PROVIDE SANITARY FACILITIES AT THE JOB SITE AT ALL TIMES.
10. THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION STAKING.
11. ALL WORK AND EQUIPMENT STAGING SHALL BE PERFORMED WITHIN THE PROJECT SITE.
12. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS REQUIRED FOR THIS PROJECT PRIOR TO THE START OF CONSTRUCTION.
13. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LINES, LEVELS, MATERIALS, ETC. PRIOR TO THE START OF CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES IN WRITING.

GENERAL ROAD NOTES:

1. LIMITS OF CONSTRUCTION SHALL BE 5' BEYOND GRADING LIMITS, BASE OF FILL SLOPES OR TOP OF CUT SLOPES, AND 20' EITHER SIDE OF THE CENTERLINE OF UTILITY INSTALLATIONS, BUT NOT BEYOND FENCE LINE OR RIGHT-OF-WAY LINES. PROJECT LIMITS SHALL ADDITIONALLY INCLUDE ANY DESIGNATED BORROW AREAS, EXCAVATION DISPOSAL AREAS OR MATERIAL OR TOPSOIL STOCKPILE AREAS. RESPECT ALL TREE/VEGETATION PRESERVATION ZONES (PER SPECS).
2. MEASUREMENT AND PAYMENT OF ROAD CONSTRUCTION MATERIALS WILL BE IN SQUARE YARDS PER MATERIAL THICKNESS COMPLETE-IN-PLACE. ASPHALT MILLINGS PROVIDED, AND TRANSPORTED TO THE SITE, BY THE CITY WILL BE USED FOR ALL CLASS 6 AGGREGATE BASE COURSE SECTIONS. THE CONTRACTOR SHALL BE PREPARED TO PROCESS THE ASPHALT MILLINGS TO MEET GRADATION SPECIFICATIONS OF CDOT CLASS 6 AGGREGATE BASE COURSE. PROCESSING WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN WORK. UNIT PRICE FOR PARKING LOT PAVING SECTION (EAST SIDE) SHALL INCLUDE MIRAFI RS508I GEOSYNTHETIC AND CHIP AND SEAL TACK COAT. SEE NOTE 9 BELOW.
3. TRAFFIC CONTROL REQUIREMENTS:
   - 3.a. MAINTAIN ACCESS TO OTHER STRUCTURES AT ALL TIMES. TEMPORARY CLOSURE ALLOWED FOR UTILITY WORK -- PROVIDE FOR EMERGENCY ACCESS CONTINUOUSLY.
   - 3.b. PROVIDE SAFETY CONES, FLAG PERSONS, VERTICAL PANELS WITH BEACONS, SIGNAGE AND BARRICADES AS NECESSARY TO PROTECT PUBLIC AND WORK SITE.
   - 3.c. PROVIDE SIGNAGE AS REQUIRED BY OWNER AND LOCAL GOVERNMENT WITH JURISDICTION OVER ADJACENT ROADS.
4. PRIME COAT NOT REQUIRED UNLESS INDICATED ON DRAWINGS. PREPARED BASE COURSES SHALL BE PRIMED AT CONTRACTOR'S EXPENSE IF THE SURFACE HAS DETERIORATED DUE TO TRAFFIC, WEATHER OR TIME LAPSE BETWEEN SURFACE PREPARATION AND PLACEMENT OF BITUMINOUS MATERIALS, SUCH THAT, IN THE OPINION OF THE ENGINEER, USE OF PRIME COAT IS REQUIRED. APPLICATION RATE SHALL BE 0.3 GALS/SQ.YD.
5. DILUTED EMULSIFIED ASPHALT OR TACK COAT SHALL CONSIST OF 1 PART EMULSIFIED AND 1 PART WATER. RATES OF APPLICATION SHALL BE DETERMINED BY THE ENGINEER AT THE TIME OF APPLICATION. APPROXIMATE RATE SHALL BE 0.1 GALS./SQ.YD.
6. THE FOLLOWING SHALL BE USED WITH EACH BITUMINOUS PAVER:
   - 6.a. A SKI-TYPE DEVICE AT LEAST 30 FEET IN LENGTH.
   - 6.b. SHORT SKI OR SHOE.
7. PAVEMENT MARKING AND SIGNS TO INCLUDE THE FOLLOWING:
   - 7.a. PARKING STALLS, SINGLE WHITE LINE.
   - 7.b. HANDICAP SYMBOLS AND/OR ACCESS AISLE SYMBOLS
   - 7.c. STOP BAR AND X-WALK BARS
   - 7.d. R1-1 CLASS 1 SIGN. PAY ITEM TO INCLUDE ALL MATERIALS, LABOR AND INSTALLATION FOR EACH SIGN.
   - 7.e. R7-8 CLASS 1 SIGNS. PAY ITEM TO INCLUDE ALL MATERIALS, LABOR AND INSTALLATION FOR EACH SIGN.
8. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH APPLICABLE SECTIONS OF THE SITE SUBSOIL STUDY. CONTRACTOR TO NOTE REQUIREMENTS FOR EXCAVATION, BACKFILL AND SUPPORT MATERIALS.
9. ASPHALT MILLINGS SHALL PLACED IN LIFTS NO GREATER THAN 6" AND COMPACTED TO 95% STANDARD PROCTOR. IF CHIP AND SEAL SURFACE IS SPECIFIED APPLY TACK COAT AT 0.29 GALLON AND FOG CRS-2R OIL AT 0.10 OF A GALLON DILUTED 50% WITH WATER. CHIPS SHALL MEET ½" MODIFIED CDOT SPECIFICATION 703.05, TYPE 1 100% FRACTURED FACE, NO MORE THAN 8% PASSING THE NO. 4 SIEVE WITH ALL WASHED AGGREGATE.
10. SLOPE SOILS AWAY FROM BUILDING AS PER SITE GEOTECHNICAL REPORT. SLOPE ASPHALT/CONCRETE AWAY FROM BUILDING AS SHOWN ON GRADING PLAN.
11. SPOT ELEVATIONS ALONG CURB/GUTTER ARE TO TOP BACK OF CURB UNLESS OTHERWISE NOTED.
12. THROUGHOUT ALL PHASES OF CONSTRUCTION, UNTIL THE FINAL ACCEPTANCE OF THE PROJECT, THE CONTRACTOR SHALL KEEP THE WORK SITE CLEAN AND FREE FROM RUBBISH AND DEBRIS. THE CONTRACTOR SHALL ALSO ABATE DUST NUISANCE AS NECESSARY BY CLEANING, SWEEPING AND SPRINKLING WITH WATER OR OTHER MEANS AS NECESSARY. THE CONTRACTOR SHALL HAVE TWENTY-FOUR (24) HOURS AFTER THE DEPOSIT OF ANY EARTH, GRAVEL OR OTHER EXCAVATED MATERIAL TO REMOVE SUCH DEPOSIT. IN THE EVENT THAT THE EARTH, GRAVEL OR OTHER EXCAVATED MATERIAL IS NOT REMOVED, THE ENGINEER SHALL CAUSE SUCH REMOVAL AND THE COST INCURRED SHALL BE DEDUCTED FROM THE BOND. DUST CONTROL WILL ONLY BE REQUIRED IF ADJACENT PROPERTY OWNERS ARE ADVERSELY AFFECTED OR IF DUST ADVERSELY AFFECTS MAINTENANCE OF TRAFFIC DURING THE PROJECT SUCH THAT, IN THE OPINION OF ENGINEER, A WATERING PROGRAM IS APPROPRIATE. IT IS ANTICIPATED DUST CONTROL WILL BE REQUIRED ON THIS PROJECT.
13. THE PAY ITEM FOR SUBGRADE STABILIZATION SHALL INCLUDE THE EXCAVATION AND ALL MATERIAL, INCLUDING MIRAFI RS508I GEOSYNTHETIC, LABOR, EQUIPMENT AND INSTALLATION COMPLETE-IN-PLACE PER CUBIC YARD. ALL MATERIAL GENERATED FROM THE SITE SHALL BE UTILIZED IN EMBANKMENT OF THE AMPHITHEATER.

EROSION CONTROL NOTES:

1. THE CONTRACTOR SHALL COORDINATE THE CONSTRUCTION OF TEMPORARY BMP'S WITH THE CONSTRUCTION OF PERMANENT BMP'S TO ASSURE ECONOMICAL, EFFECTIVE, AND CONTINUOUS EROSION AND SEDIMENT CONTROL THROUGHOUT THE CONSTRUCTION PERIOD. DUE TO THE DYNAMIC PHASING OF THIS PROJECT THE DEVELOPMENT OF AN EFFECTIVE STORM WATER MANAGEMENT PLAN BY CIVIL IS IMPRACTICABLE. THE CONTRACTOR SHALL COORDINATE WITH OTHER CONSTRUCTION ACTIVITIES IMPACTING THE DEVELOPMENT OF THE SITE AND PREPARE AND EXECUTE THE SWMP AS SITE CONDITIONS CHANGE.
2. POST CONSTRUCTION STORMWATER IS DESIGNED TO RUNOFF COMPLETELY TO THE CITY'S WATER QUALITY CONTROL DETENTION BASIN WEST OF THE SITE. THE CONTRACTOR SHOULD ALSO UTILIZE THE BASIN DURING CONSTRUCTION. BMP'S SHALL BE PLACED TO ENSURE RUNOFF IS FREE OF SEDIMENT AND DEBRIS BEFORE ENTERING THE BASIN.

GENERAL UTILITY NOTES:

1. THE APPROXIMATE LOCATION OF ALL KNOWN UTILITIES (WATER, SEWER, GAS, PHONE, ELECTRIC, CABLE, ETC.) ARE SHOWN ON THE DRAWINGS. THE CONTRACTOR SHALL CONTACT ALL UTILITY OWNERS TO VERIFY BOTH LOCATION AND DEPTH OF UTILITIES BEFORE ANY WORK BEGINS. CONTRACTOR SHALL BEAR THE RESPONSIBILITY FOR THE PROTECTION OF UTILITIES DURING CONSTRUCTION. NO ADDITIONAL PAYMENT WILL BE MADE FOR UTILITIES LOCATED BUT NOT SHOWN IN DRAWINGS. THE CONTRACTOR IS RESPONSIBLE FOR MAKING HIS OWN DETERMINATIONS AS TO THE TYPE AND LOCATION OF EXISTING UTILITIES, INCLUDING ANY UTILITIES NOT SHOWN IN THE DRAWINGS.
2. THE CONTRACTOR WILL BE RESPONSIBLE FOR RESTORING ANY DISTURBED AREAS IN ACCORDANCE WITH SPECIFICATIONS.
3. ALL KNOWN SERVICES WHICH TIE INTO THE EXISTING MAIN ARE SHOWN. ANY SERVICE WHICH IS NOT SHOWN BUT TIES INTO MAIN SHALL BE REPLACED AND TIED INTO NEW MAIN.
4. CONTRACTOR, AT HIS OWN EXPENSE, SHALL FIELD VERIFY LOCATIONS OF ALL UTILITY LOCATES BY POT HOLING PRIOR TO CONSTRUCTION. IF ANY GRADE CONFLICTS OCCUR WITH UTILITY CROSSINGS, CONTACT OWNER REPRESENTATIVE SO THAT GRADES CAN BE ADJUSTED.
5. FOLLOW ALL CDPHE (COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENT) REGULATIONS FOR WATER AND SEWER LINE CROSSINGS.
6. REPLACE ALL DISTURBED ASPHALT WITH 3" ASPHALT AND 8" CL. 6 BASE COURSE. ALL ASPHALT WORK SHALL BE PERFORMED WITH A LAYDOWN MACHINE.

GENERAL SEWER NOTES:

1. ALL SANITARY SEWER MAINS, SERVICES AND APPURTENANCES SHALL BE INSTALLED IN ACCORDANCE WITH THE CITY OF GRAND JUNCTION STANDARD SPECIFICATIONS AND DETAILS FOR CONSTRUCTION OF UNDERGROUND UTILITIES.
2. MARK ENDS OF ALL SEWER SERVICE LINES WITH FENCE POST, 3-WAY SWING TIES AND DEPTH TO SERVICE.
3. CONTRACTOR TO VERIFY THE GRADE OF ALL EXISTING SEWER LINES BEFORE INSTALLING ANY PIPE TO VERIFY INVERT ELEVATIONS. CONTACT ENGINEER WITH ANY DIFFERENCES IN ELEVATIONS SO THAT GRADES CAN BE ADJUSTED.
4. PLAN VIEW DISTANCE BETWEEN MANHOLES IS CENTERLINE TO CENTERLINE OF MANHOLES. PROFILE DISTANCE AND SLOPE BETWEEN MANHOLES IS FROM INVERT OUT TO INVERT IN OF MANHOLES (CL. TO CL. MANHOLE DISTANCE MINUS 1/2 INSIDE DIAMETER OF EACH MANHOLE).
5. THE SEWER MANHOLES SHOWN IN PLAN VIEW INDICATE THE LOCATION OF THE STEPS WITHIN THE MANHOLE AND MANHOLE RIM LOCATION BY A BLACKENED CIRCLE. THIS WILL BE THE REQUIRED LOCATION FOR EACH MANHOLE SHOWN.
6. CUTOFF WALLS SHALL BE INSTALLED PER CITY OF GRAND JUNCTION STANDARD SPECIFICATIONS FOR SANITARY SEWERS 103.10. COST IS INCIDENTAL TO THE COST OF THE GRAVITY SEWER PIPE AND WILL NOT BE PAID FOR SEPARATELY.

GENERAL WATER NOTES:

1. ALL WATER MAINS, SERVICES AND APPURTENANCES SHALL BE INSTALLED IN ACCORDANCE WITH THE CITY OF GRAND JUNCTION STANDARD SPECIFICATIONS AND DETAILS FOR CONSTRUCTION OF UNDERGROUND UTILITIES.
2. ALL PRESSURE PIPELINE SHALL BE LAID TO A DEPTH TO PROVIDE A MINIMUM COVER OF 48 INCHES.
3. ALL MECHANICAL COUPLINGS REQUIRED FOR THE TIE-INS TO THE EXISTING WATERLINES ARE NOT SHOWN ON THE DRAWINGS. THESE SHALL BE PROVIDED AS REQUIRED BY THE CONTRACTOR AS PART OF TIE-IN TO EXISTING SYSTEM BID ITEM.
4. ALL REMOVED WATER LINE APPURTENANCES TO BE SUPPLIED TO OWNER.
5. THE WATER LINE LOCATION SHOWN UTILIZES JOINT DEFLECTION. (A MAX. OF 3° PER JOINT) IN NO CASE SHALL FIELD DEFLECTIONS EXCEED MANUFACTURERS RECOMMENDATION'S.
6. THE CONTRACTOR SHALL ENSURE PIPES ARE FREE OF GRAVEL AND DEBRIS PRIOR TO BEING INSTALLED IN THE TRENCH. IF THE PIPE IS DIRTY, HAS GRAVEL OR DEBRIS INSIDE, OR HAS SAT UNUSED FOR A LONG PERIOD OF TIME, THE PIPE WILL REQUIRE CLEANING PRIOR TO INSTALLATION.
7. A CHLORINATION/BACTERIOLOGICAL, HYDROSTATIC/LEAKAGE AND CONDUCTIVITY TEST WILL BE REQUIRED ON ALL NEW LINES AND SYSTEMS BEFORE ACCEPTANCE BY THE CITY UTILITY DEPARTMENT. THESE TESTS SHALL BE PERFORMED AS PER APPLICABLE ANSI/AWWA STANDARD C651.
8. PAY ITEM FOR YARD HYDRANTS PROVIDED IN THE CONCESSION AREAS SHALL INCLUDE ALL MATERIALS, LABOR AND INSTALLATION FOR EACH.
9. PAY ITEM FOR FIRE HYDRANT ASSEMBLY SHALL INCLUDE GATE VALVE, REQUIRED RESTRAINTS AND ALL MATERIALS, LABOR, EQUIPMENT AND INSTALLATION FOR EACH.

SHALLOW UTILITY NOTES:

1. EXISTING UTILITY LOCATIONS ARE A COMBINATION OF SURVEYED FIELD LOCATIONS, OBSERVATIONS, AND EXISTING MAPPING. CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION.
2. MINIMUM COVER FOR THE FOLLOWING SHALLOW UTILITIES: 4' PRIMARY ELECTRIC, 3' GAS, PHONE & CABLE.
3. ALL WORK TO BE DONE IN STRICT COMPLIANCE WITH RESPECTIVE UTILITY COMPANY REQUIREMENTS.
4. SHALLOW UTILITIES SHOWN ON THE PLANS ARE SCHEMATIC IN NATURE. FINAL UTILITY ALIGNMENT TO BE BASED ON FIELD REQUIREMENTS.
5. THE PLAN PROVIDES A SINGLE UTILITY TRENCH THAT COMBINES ELECTRIC(4"), GAS(2"), CHARTER COMMUNICATIONS(2"), CENTURYLINK(2") AND ADDITIONAL IT CONDUITS(2-2").
6. UTILITY PROVIDERS WILL PROVIDE AND INSTALL REQUIRED CONDUITS, PEDESTALS AND PULL BOXES. XCEL ENERGY WILL PROVIDE PRIMARY CONDUIT TO TRANSFORMER AND GAS CONDUIT TO METER.
7. CONTRACTOR TO COORDINATE ALL UTILITY WORK AND HOLD A UTILITY PRE-CONSTRUCTION MEETING PRIOR TO START OF UTILITY CONSTRUCTION.
8. THE CONTRACTOR IS RESPONSIBLE FOR EXCAVATING THE UTILITY TRENCH, SUPPLYING AND INSTALLING THE IT 2" CONDUIT AND THE EXTRA 2" CONDUIT. THIS WORK AND MATERIAL, COMPLETE IN PLACE, WILL BE PAID FOR UNDER THE SHALLOW UTILITIES LUMP SUM ITEM.

DEMOLITION NOTES:

1. DEMOLISHED MATERIALS GENERATED ON SITE WILL BE BURIED IN THE EMBANKMENT OF THE AMPHITHEATER PER THE DIRECTION OF THE CITY OF GRAND JUNCTION. PRIOR TO ANY MATERIALS THAT THE CITY OF GRAND JUNCTION MAY DIRECT TO BE REMOVED FROM THE SITE, MATERIALS MUST FIRST UNDERGO TESTING FOR RADIOACTIVITY. MATERIALS THAT ARE FOUND TO BE UNDER THE LIMITS AS DEFINED IN THE URANIUM MILL TAILINGS MANAGEMENT PLAN (UMTMP) MAY THEN BE REMOVED, BUT NOT BEFORE. A LOG OF THESE ACTIONS MUST BE KEPT. IF MATERIALS ARE NOT UNDER THE RADIOACTIVITY LIMITS, THEN THEY MAY LEAVE THE SITE TO A LICENSED DISPOSAL FACILITY OR TO THE INTERIM STORAGE FACILITY TO BE DEFINED BY THE CITY OF GRAND JUNCTION AND AS DESCRIBED IN THE UMTMP.
2. CONTRACTOR TO NOTE THE BERM, UTILITIES, LANDSCAPING, IRRIGATION AND LOCATIONS OF TREES ON SOUTH SIDE OF RIVERSIDE PARKWAY BETWEEN THE PARKWAY AND THE EXISTING SIDEWALK ARE NOT SHOWN IN THIS BASE SURVEY. CONTRACTOR TO FIELD VERIFY CONDITIONS PRIOR TO BIDDING AND CONSTRUCTION.
3. DEMOLISHED TRAIL AND OTHER CONCRETE MATERIAL DEMOLISHED AND UTILIZED IN THE EMBANKMENT OF THE AMPHITHEATER SHALL BE PLACED AS SPECIFIED IN SECTION 203.06 OF CDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
4. DEMOLITION FOR THIS PROJECT WILL BE PAID FOR AS A LUMP SUM ITEM AND CONSIST OF:
   - 4.1. DEMOLITION OF EXISTING RIVERFRONT TRAIL WITHIN THE PROJECT LIMITS TO BE UTILIZED IN THE AMPHITHEATER FILL.
   - 4.2. RIVERSIDE PARKWAY ENTRANCE: SAWCUT AND REMOVE CURB, GUTTER AND ASPHALT AND EXISTING 10' WIDE SIDEWALK AS REQUIRED. EXCAVATION OF BERM - QUANTITY UNKNOWN.
   - 4.3. STRUTHERS AVE: SAWCUT AND REMOVE EXISTING SIDEWALK CURB, GUTTER AND ASPHALT.
   - 4.4. SAWCUT AND ASPHALT PATCHING SHALL BE CONSIDERED INCIDENTAL TO THE LINE ITEM AND WILL NOT BE PAID FOR SEPARATELY.

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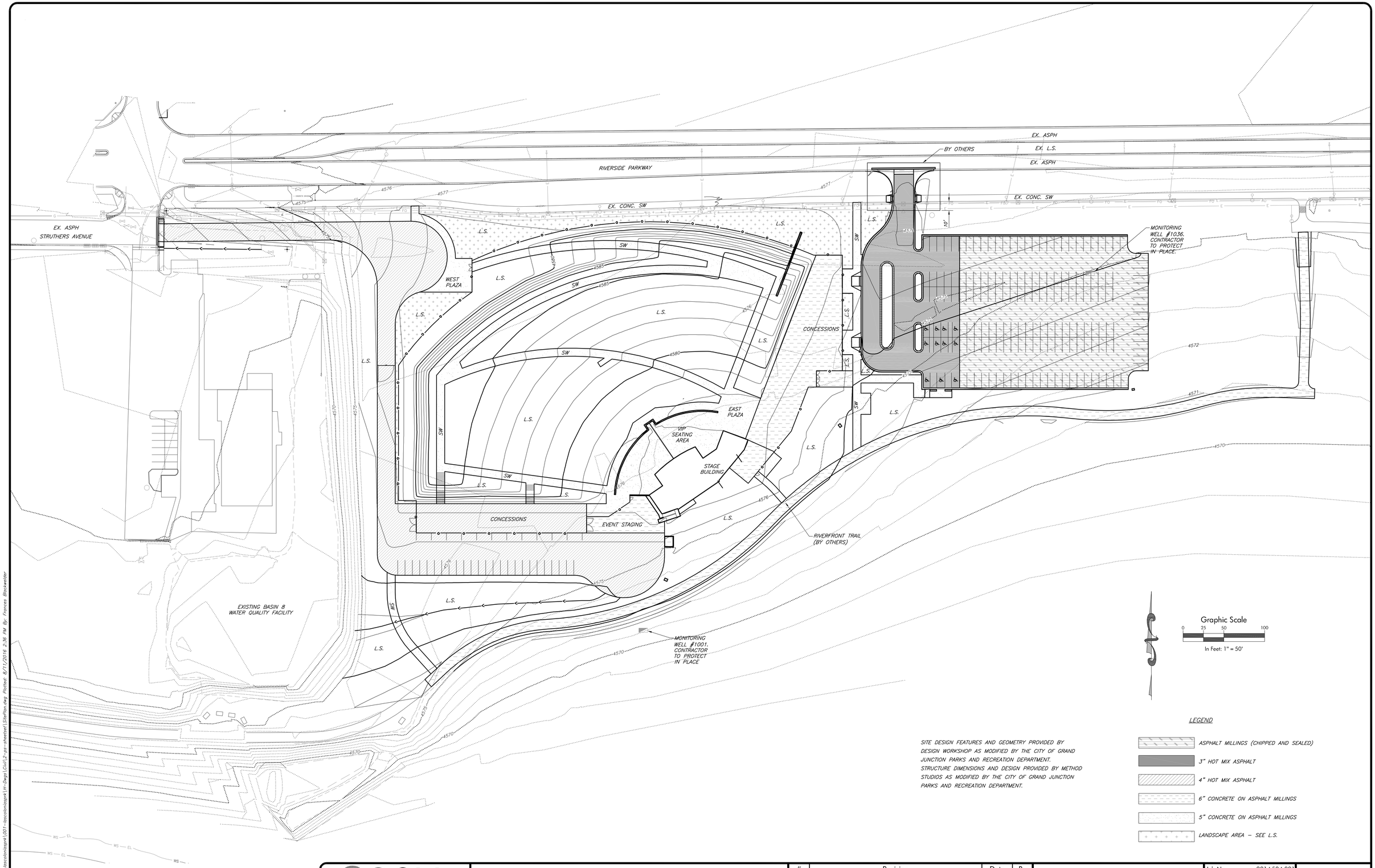
Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Legend, Notes, and Abbreviations

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	Admin		

C1
Of 19



LEGEND

- ASPHALT MILLINGS (CHIPPED AND SEALED)
- 3" HOT MIX ASPHALT
- 4" HOT MIX ASPHALT
- 6" CONCRETE ON ASPHALT MILLINGS
- 5" CONCRETE ON ASPHALT MILLINGS
- LANDSCAPE AREA – SEE L.S.

SITE DESIGN FEATURES AND GEOMETRY PROVIDED BY DESIGN WORKSHOP AS MODIFIED BY THE CITY OF GRAND JUNCTION PARKS AND RECREATION DEPARTMENT. STRUCTURE DIMENSIONS AND DESIGN PROVIDED BY METHOD STUDIOS AS MODIFIED BY THE CITY OF GRAND JUNCTION PARKS AND RECREATION DEPARTMENT.

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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Site Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	SitePlan		

C2
Of 19

Graphic Scale

0 15 30 60

In Feet: 1" = 30'

SEE ROADWAY PLAN AND PROFILE SHEETS C11 AND C12

CONCRETE DRIVEWAY

GRAVEL DRIVEWAY

BP: 0+00.00
N:1457.38
E:93466.57

CONTROL LINE

N90°00'00"E 1030.81'

L=382.71'
R=505.87'

L=403.77'
R=362.18'

L=333.16'
R=375.00'
L=200.82'
R=365.00'

L=333.16'
R=375.00'
L=142.86'
R=365.00'

10' SW

R54.00'

R44.00'

R40.00'

CONC. SW

18" RETAINING WALL (SEE L.S. PLAN)

CONC.

R106.73'

BLDG.

STAIRS (SEE L.S. PLAN)

PERIMETER FENCE (SEE L.S. PLAN)

RETAINING WALL (SEE L.S. PLAN)

MATCH LINE SEE SHEET C13 OF 19 STA. 5+70

RIVERFRONT TRAIL (SW SURFACE BY OTHERS)

BEGIN EX. SW DEMO BEGIN NEW SW STA.0+98.41; O/S 455.23'R

GENERAL NOTES:

1. THE CITY OF GRAND JUNCTION HAS PROVIDED A SURVEY FOR THE BASIS OF DESIGN. THE SURVEY DATA INCLUDED IN THIS SET IS FOR GENERAL INFORMATION PURPOSES ONLY AND INTENDED TO ASSIST THE CONTRACTOR IN UNDERSTANDING THE PROPOSED DESIGN RELATIONSHIPS AND TO PROVIDE A GENERAL ORIENTATION OF THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING AND DETERMINING THE SUITABILITY OF THE DATA PRIOR TO BIDDING AND CONSTRUCTION OF THE PROJECT. ANY DEVIATIONS OR OMISSIONS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE, IN WRITING, FOR CLARIFICATION AND DIRECTION.
2. THE BASIS OF SURVEY COORDINATE GEOMETRY ASSUMED TO BE MESA COUNTY LOCAL COORDINATE SYSTEM, ZONE "A". CONTRACTOR TO VERIFY.
3. EXISTING FIELD CONDITIONS VARY FROM CONTRACT BID DOCUMENTS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BIDDING PROJECT.
4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LINES, LEVELS, MATERIALS, ETC. PRIOR TO THE START OF CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES IN WRITING.
5. SEE SHEET C16 FOR GRADING PLAN.

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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Amphitheater
Horizontal Control Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	HorizControl		

C3
Of 19

Graphic Scale

0 10 20 40

In Feet: 1" = 20'

RIVERSIDE PARKWAY

EX. CONC. SW

BY OTHERS

CONTROL LINE

N90°00'00"E 1030.81'

RIVERFRONT TRAIL
(SW SURFACE BY OTHERS)

MATCH LINE: STA 5+70, SEE SHEET C4 OF 19

EP 10+30.81
N1177.38
E94497.38

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Design Workshop
Las Colonias Park Amphitheater

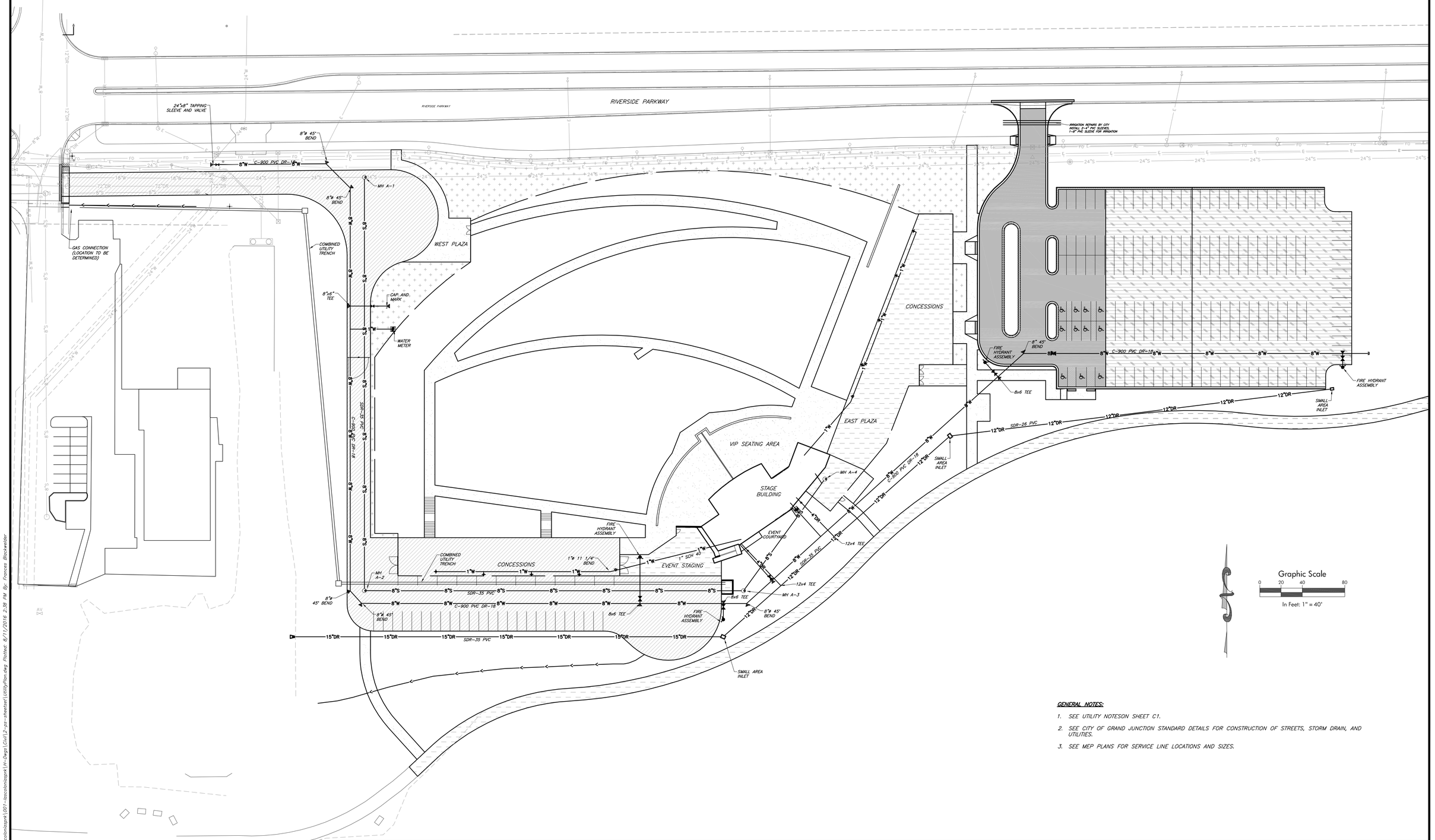
#	Revision	Date	By
1			

Parking Lot
Horizontal Control Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE:	BT	
File:	HorizControl		

C4

Of 19



GENERAL NOTES:

1. SEE UTILITY NOTESON SHEET C1.
2. SEE CITY OF GRAND JUNCTION STANDARD DETAILS FOR CONSTRUCTION OF STREETS, STORM DRAIN, AND UTILITIES.
3. SEE MEP PLANS FOR SERVICE LINE LOCATIONS AND SIZES.

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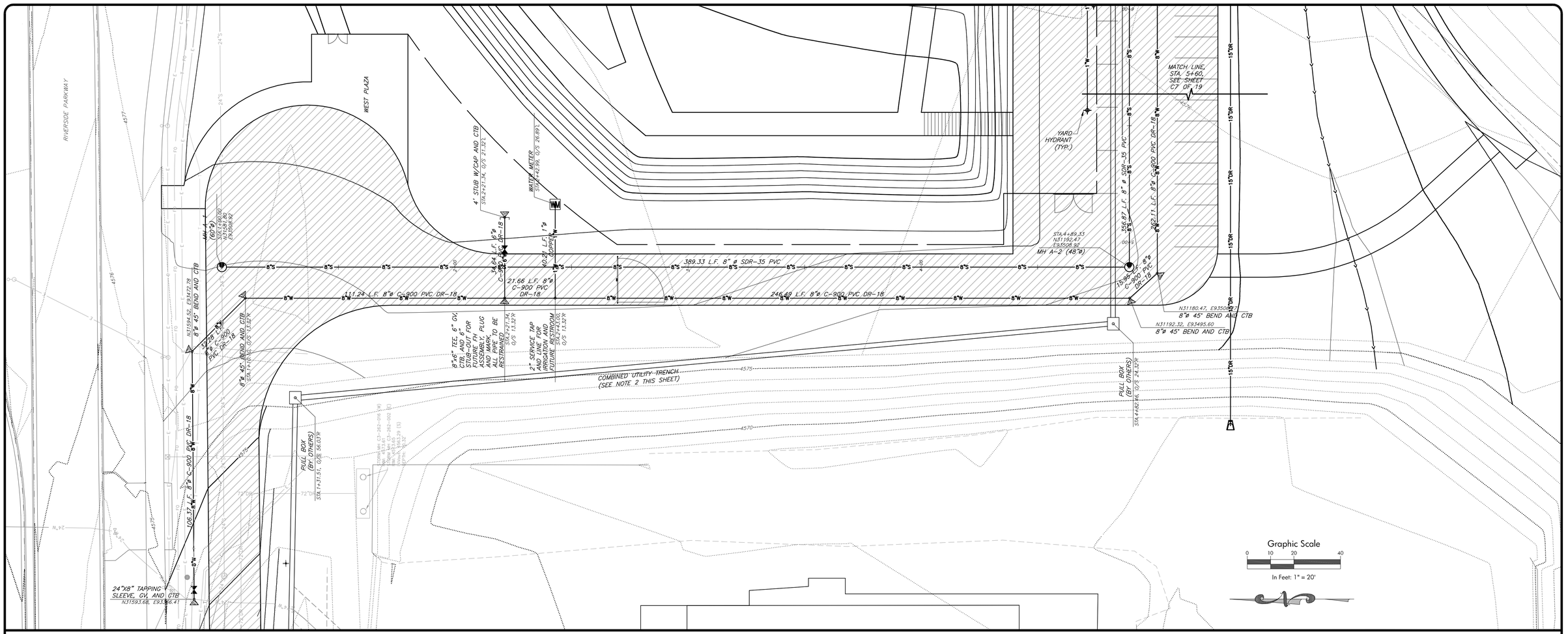
Design Workshop
Las Colonias Park Amphitheater

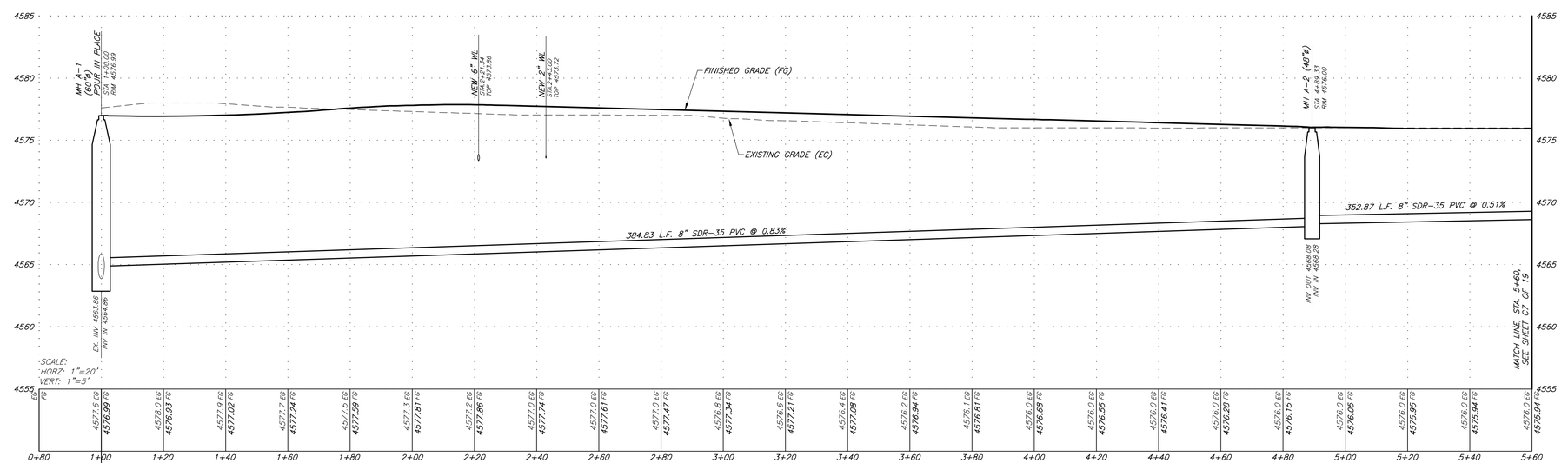
#	Revision	Date	By
1			

Utility Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	UtilityPlan		

C5
Of 19





GENERAL NOTES:

1. SEE CITY OF GRAND JUNCTION STANDARD DETAILS.
2. CONTRACTOR TO HOLD A PRECONSTRUCTION MEETING WITH SERVICE PROVIDERS TO COORDINATE INSTALLATION OF CONDUITS AND DETERMINE FINAL ALIGNMENT OF COMBINED UTILITY TRENCH AND PULL BOXES.

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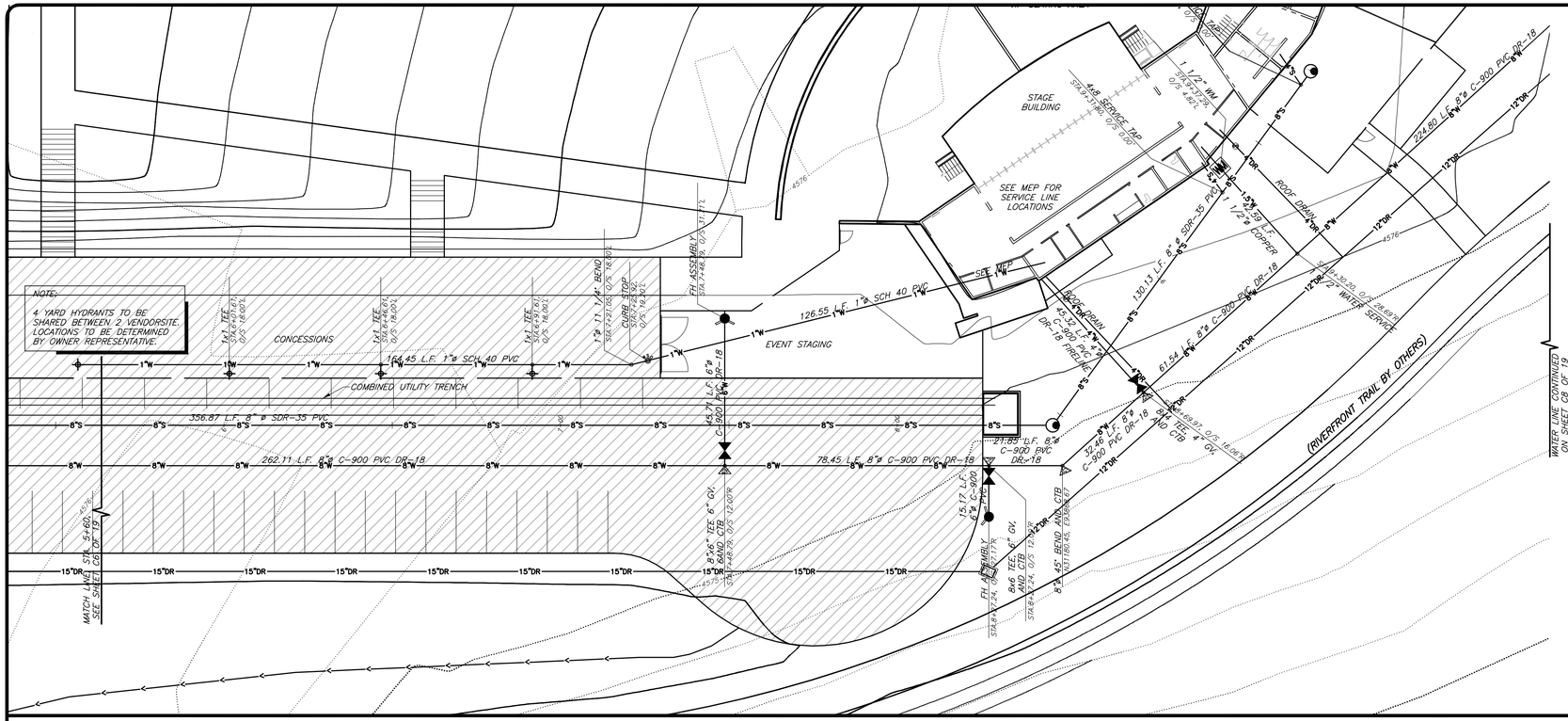
Design Workshop
Las Colonias Park Amphitheater

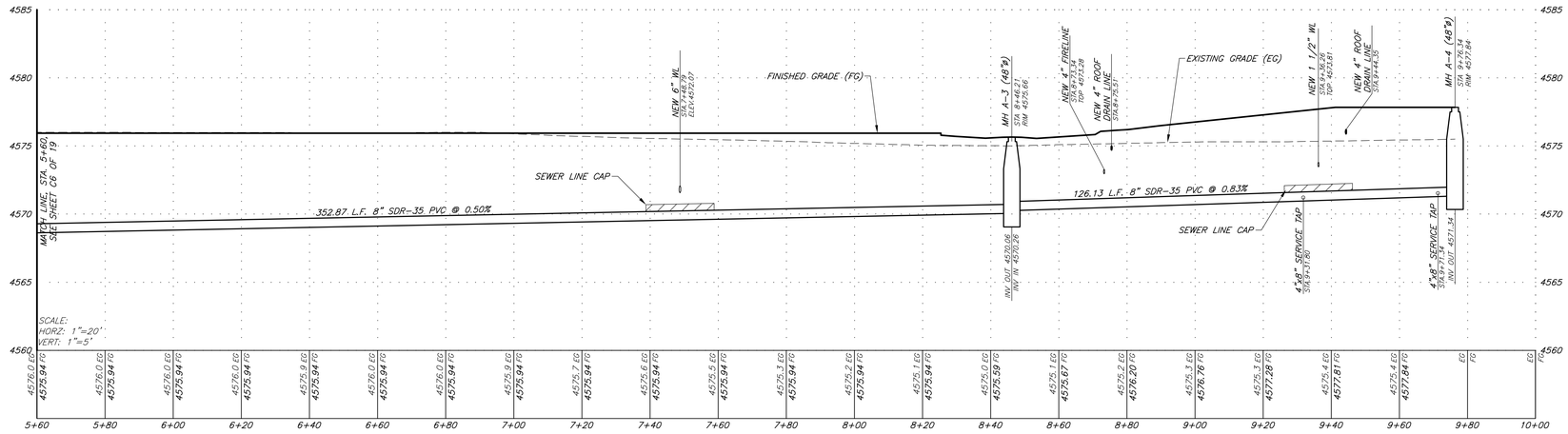
#	Revision	Date	By
1			

Water Plan
Sewer Line Plan and Profile
Sta. 1+00 to 5+60

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE:	BT	
File:	SewerPlanProfile		

C6
Of 19





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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Water Plan
Sewer Line Plan and Profile
Sta. 5+60 to 8+52.54

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	SewerPlanProfile		

C7
Of 19

NOTE:
4 YARD HYDRANTS TO BE SHARED BETWEEN 2 VENDORSITE. LOCATIONS TO BE DETERMINED BY OWNER REPRESENTATIVE.

CONCESSIONS

1" 90° N31430.13, E94426.48

1x1 TEE N31488.13, E94401.76

171.45 L.F. 8"ø SCH 40 PVC

1x1 TEE N31446.18, E93986.04

1x1 TEE N31404.20, E93979.83

CURB STOP N31374.74, E93968.45

EAST PLAZA

66.61 L.F. 8"ø SCH 40 PVC

4"ø SERVICE STA 9+71.30 OFF 0.00

SEE MEP

1 1/2" WM N31437.78, E94021.76

4"ø

TRAP

1 1/2"ø DRIPPER

50R-35 PVC

8"ø

130.13 L.F. 8"ø C-900 PVC DR-18

61.54 L.F. 8"ø C-900 PVC DR-18

8"ø 45° BEND AND CTB N31380.97, E94105.19

8"ø 45° BEND AND CTB N31393.98, E94105.40

8x6 TEE, 6" GV, AND CTB N31393.98, E94105.40

N31415.66, E94157.53 8" GV

N31415.86, E94129.67 8"ø 45° BEND AND CTB

308.8 L.F. 8"ø C-900 PVC DR-18

18.24 L.F. 8"ø C-900 PVC

8"ø

8"W

300.23 L.F. 8"ø C-900 PVC DR-18

12.99 L.F. 6"ø C-900 PVC DR-18

23.95 L.F. 8"ø C-900 PVC DR-18

8x6 TEE, 6" GV, AND CTB N31415.86, E94429.90

N31402.88, E94429.90 FH ASSEMBLY

8" CAP N31413.86, E94424.85

12"DR

RELOCATED RIVERFRONT TRAIL BY OTHERS

224.80 L.F. 8"ø C-900 PVC DR-18

900' DRAIN

1 1/2"ø DRIPPER

50R-35 PVC

8"ø

12"DR

STA 30+20.00 O/S 28.93' RT 12" WATER SERVICE

(RIVERFRONT TRAIL BY OTHERS)

WATER LINE CONTINUED ON SHEET C7 OF 19

4572

4571

4570

4576

4575

4574

4573

Graphic Scale

0 ## ## ##

In Feet: 1" = ##'

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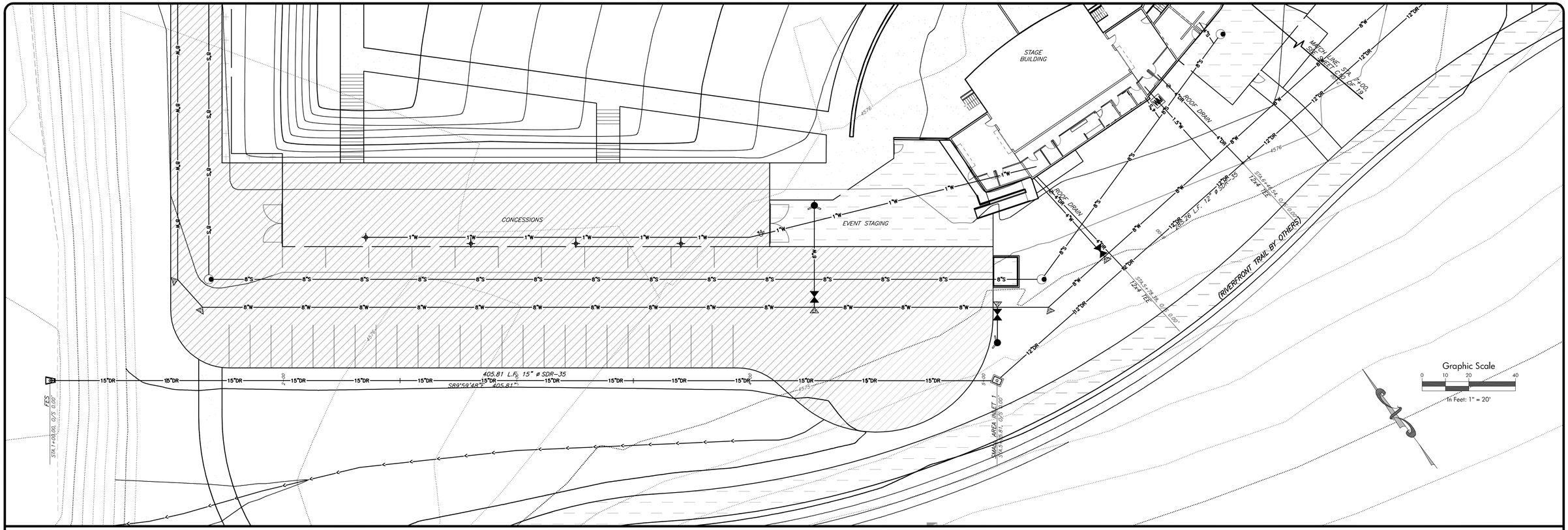
Design Workshop
Las Colonias Park Amphitheater

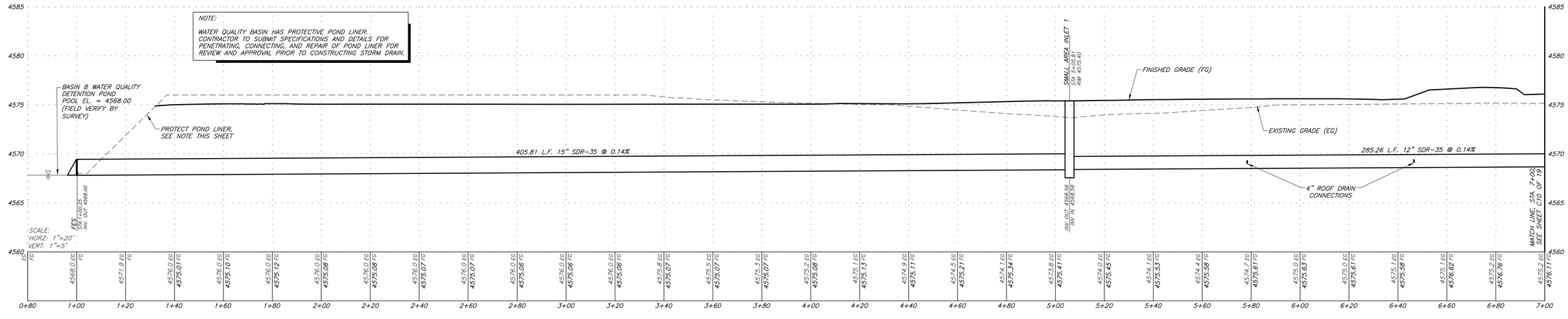
#	Revision	Date	By
1			

Easterly Water Plan

Job No.	2014-504.001
Drawn by:	FB
Date:	8/11/16
QC: DK	PE: BT
File:	SewerPlanProfile

C8
Of 19





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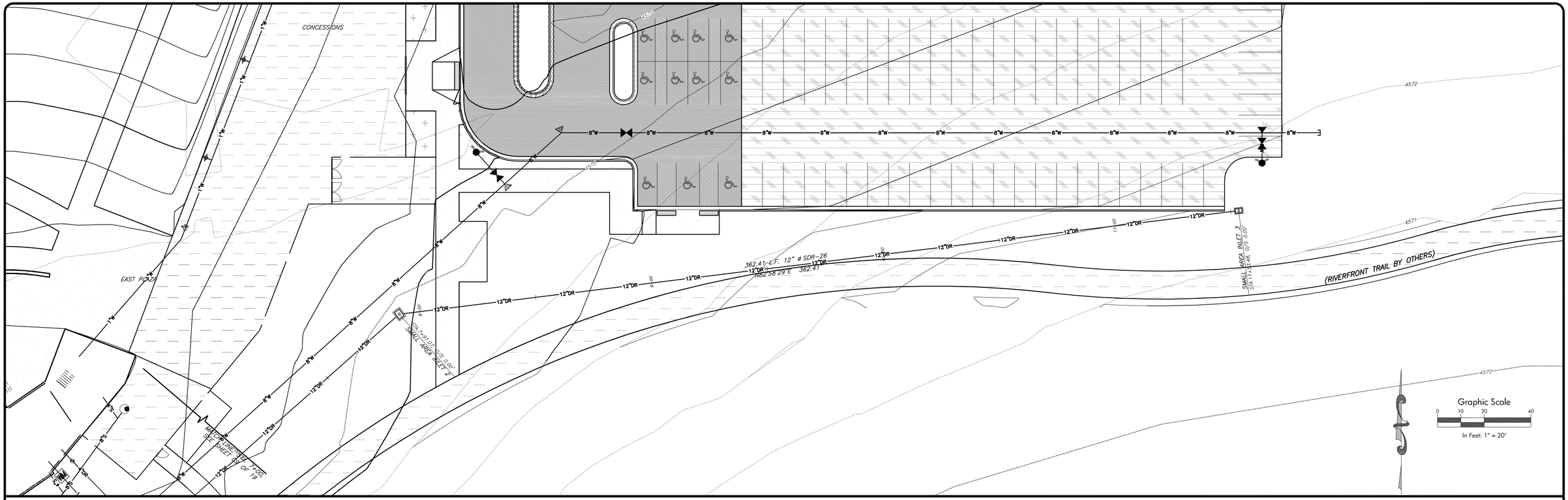
Design Workshop
Las Colonias Park Amphitheater

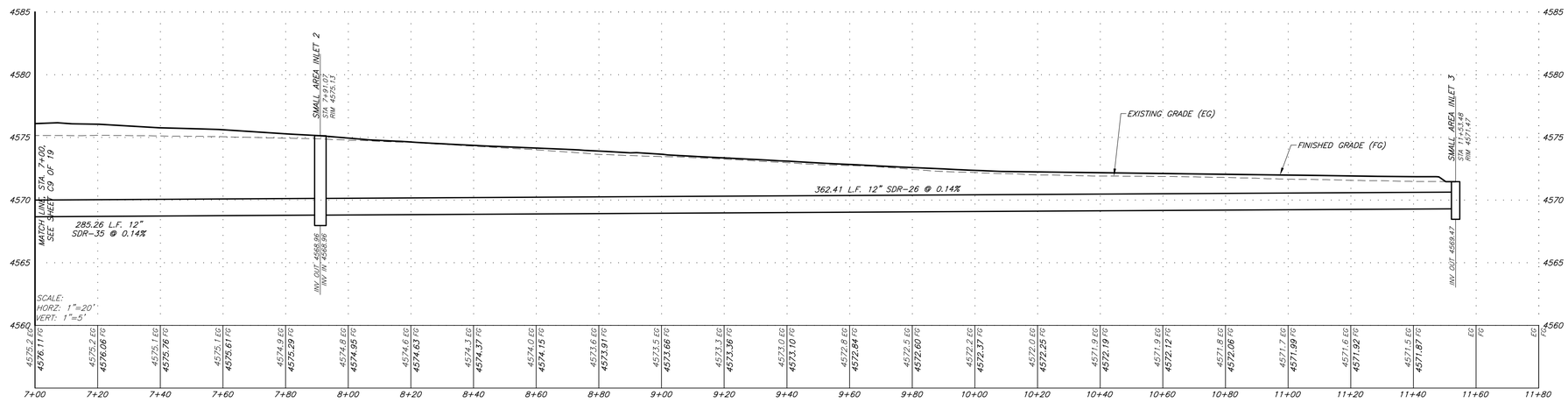
#	Revision	Date	By
1			

Storm Drain Plan and Profile
Sta. 1+00 to 7+00

Job No.	2014-504.001
Drawn by:	FB
Date:	8/11/16
QC: DK	PE: BT
File:	StormPlanProfile

C9
Of 19





Bid Set

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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Storm Drain Plan and Profile
Sta.7+00 to 10+60

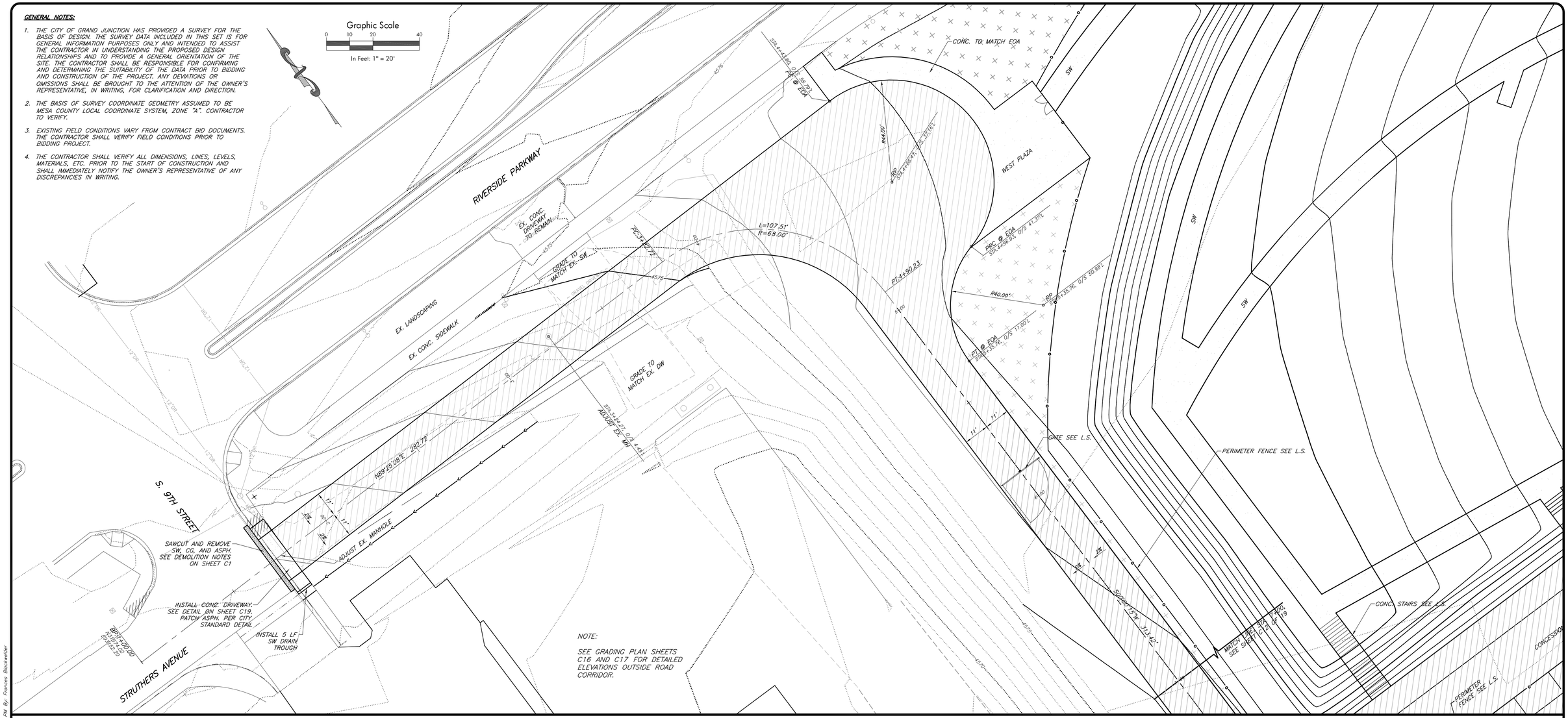
Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	StormPlanProfile		

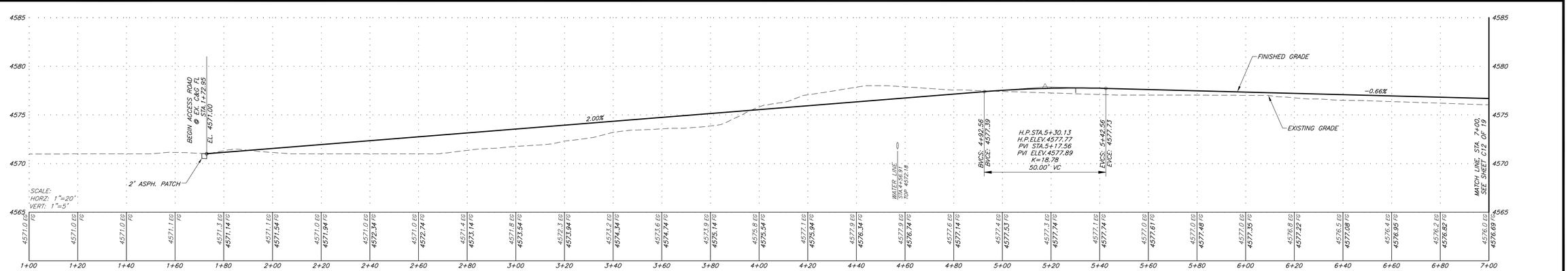
C10
Of 19

GENERAL NOTES:

1. THE CITY OF GRAND JUNCTION HAS PROVIDED A SURVEY FOR THE BASIS OF DESIGN. THE SURVEY DATA INCLUDED IN THIS SET IS FOR GENERAL INFORMATION PURPOSES ONLY AND INTENDED TO ASSIST THE CONTRACTOR IN UNDERSTANDING THE PROPOSED DESIGN RELATIONSHIPS AND TO PROVIDE A GENERAL ORIENTATION OF THE SITE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONFIRMING AND DETERMINING THE SUITABILITY OF THE DATA PRIOR TO BIDDING AND CONSTRUCTION OF THE PROJECT. ANY DEVIATIONS OR OMISSIONS SHALL BE BROUGHT TO THE ATTENTION OF THE OWNER'S REPRESENTATIVE, IN WRITING, FOR CLARIFICATION AND DIRECTION.
2. THE BASIS OF SURVEY COORDINATE GEOMETRY ASSUMED TO BE MESA COUNTY LOCAL COORDINATE SYSTEM, ZONE "A". CONTRACTOR TO VERIFY.
3. EXISTING FIELD CONDITIONS VARY FROM CONTRACT BID DOCUMENTS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BIDDING PROJECT.
4. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS, LINES, LEVELS, MATERIALS, ETC. PRIOR TO THE START OF CONSTRUCTION AND SHALL IMMEDIATELY NOTIFY THE OWNER'S REPRESENTATIVE OF ANY DISCREPANCIES IN WRITING.

Graphic Scale
0 10 20 40
In Feet: 1" = 20'





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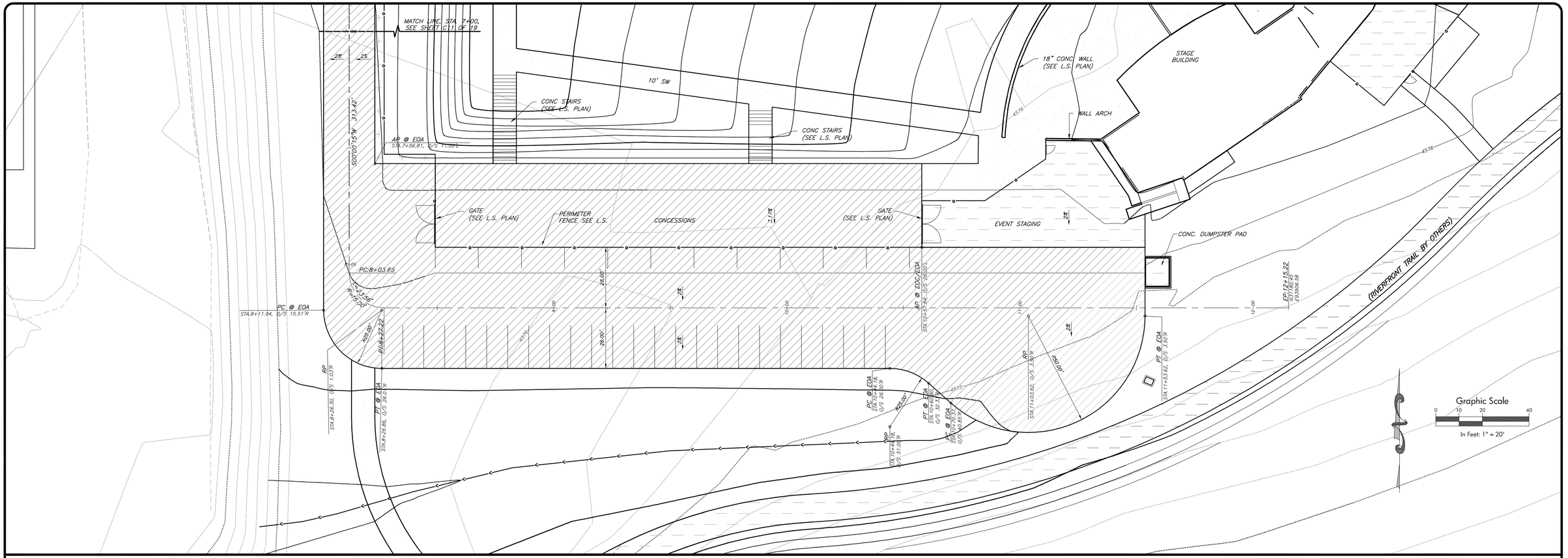
Design Workshop
Las Colonias Park Amphitheater

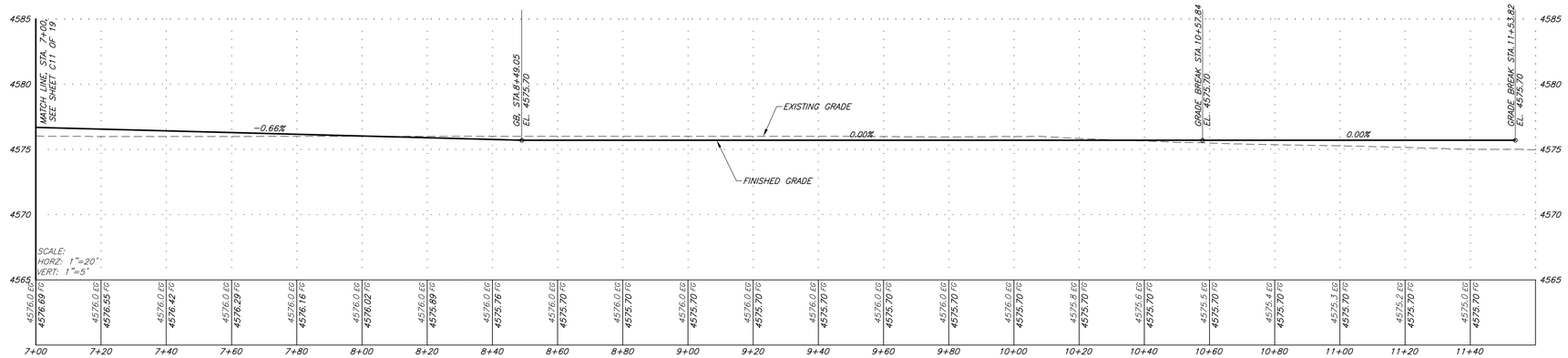
#	Revision	Date	By
1			

Roadway Plan and Profile, Sta. 1+72.95 to 7+00

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	PlanProfile		

C11
Of 19





NOTE:

SEE GRADING PLAN SHEETS C16 AND C17 FOR DETAILED ELEVATIONS OUTSIDE ROAD CORRIDOR.

Bid Set

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Design Workshop
Las Colonias Park Amphitheater

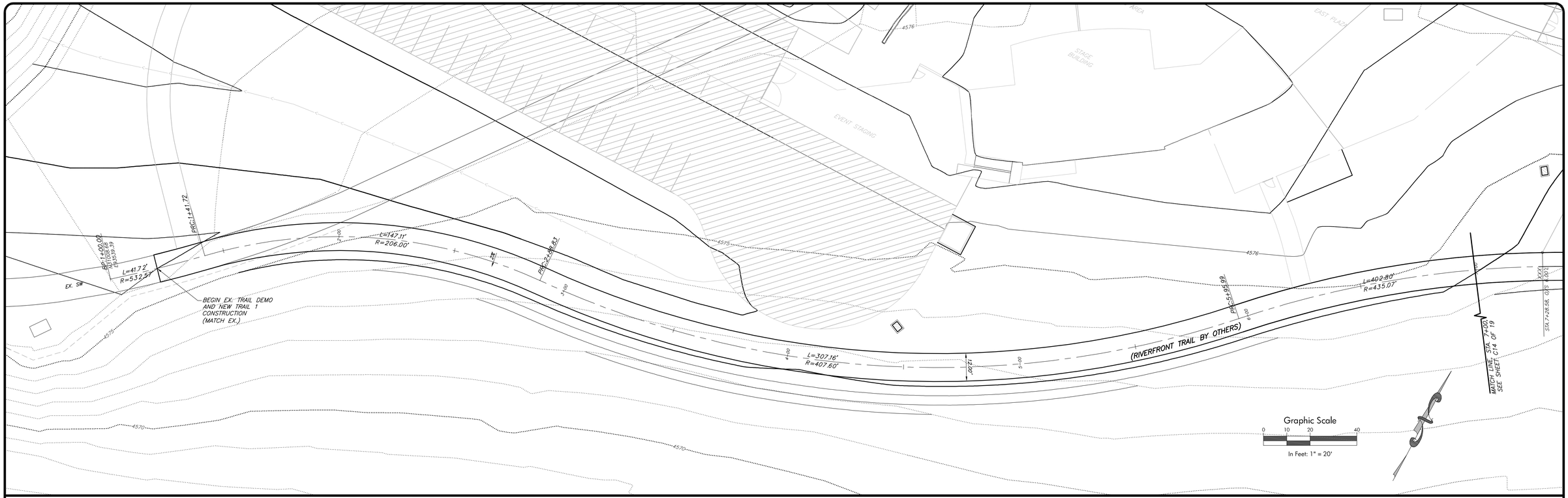
#	Revision	Date	By
1			

Roadway Plan and Profile, Sta.7+00 to 11+53.82

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	PlanProfile		

C12

Of 19



GENERAL NOTES:

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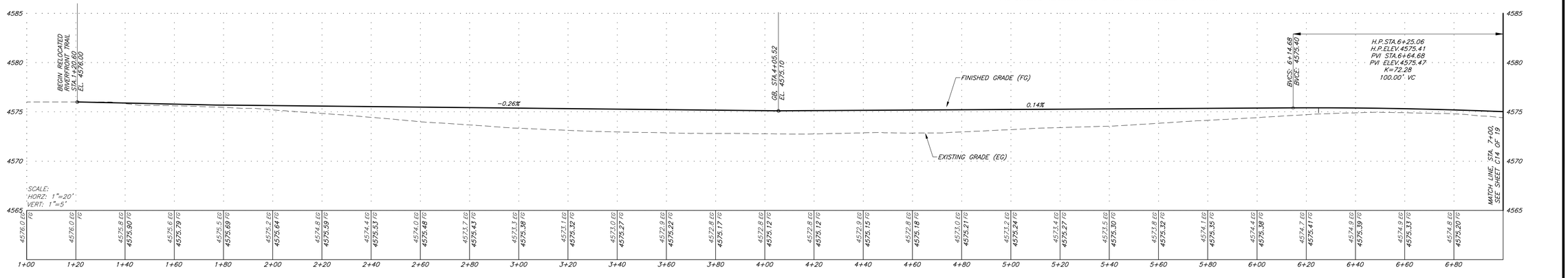

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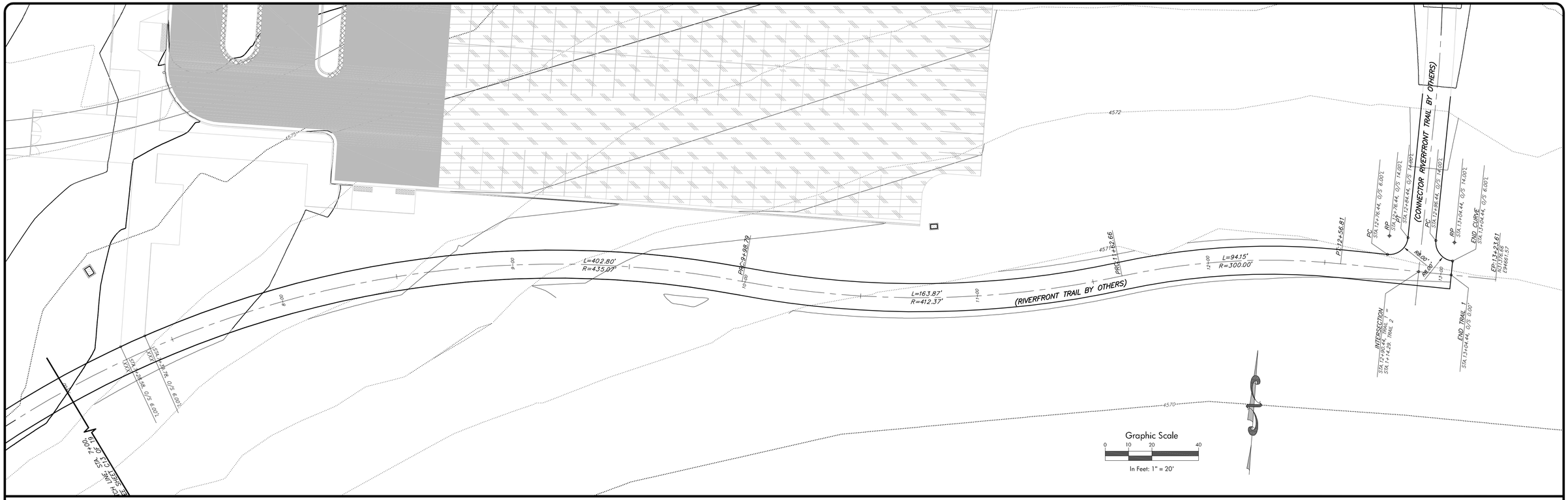
Design Workshop
Las Colonias Park Amphitheater

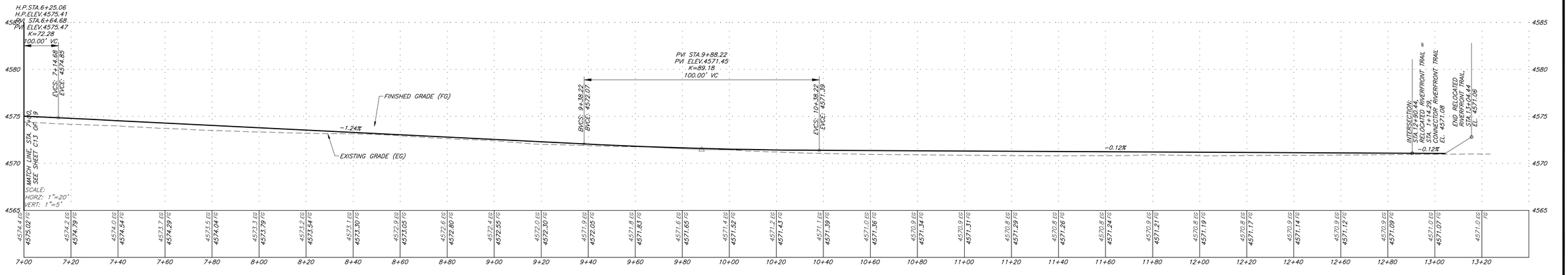
#	Revision	Date	By
1			

Riverfront Trail
Plan and Profile
Sta. 1+41.72 to 7+00

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	TrailPlanProfile		

C13
Of 19





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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Riverfront Trail
Plan and Profile
Sta. 7+00 to 13+08.99

Job No.	2014-504.001
Drawn by:	FB
Date:	8/11/16
QC: DK	PE: BT
File:	TrailPlanProfile

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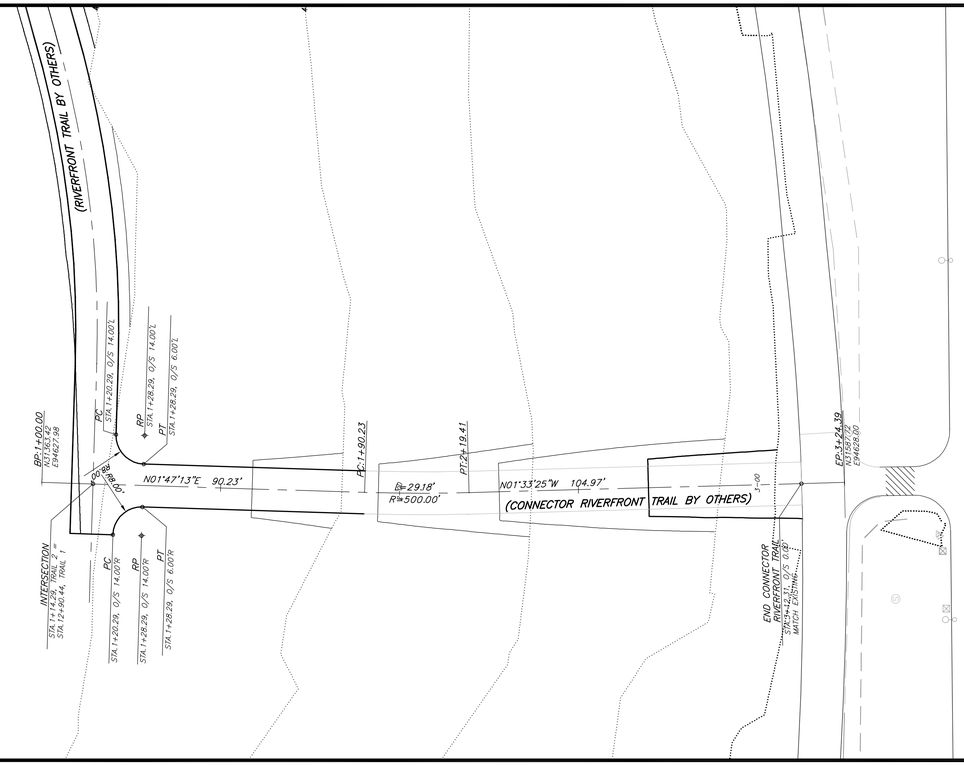
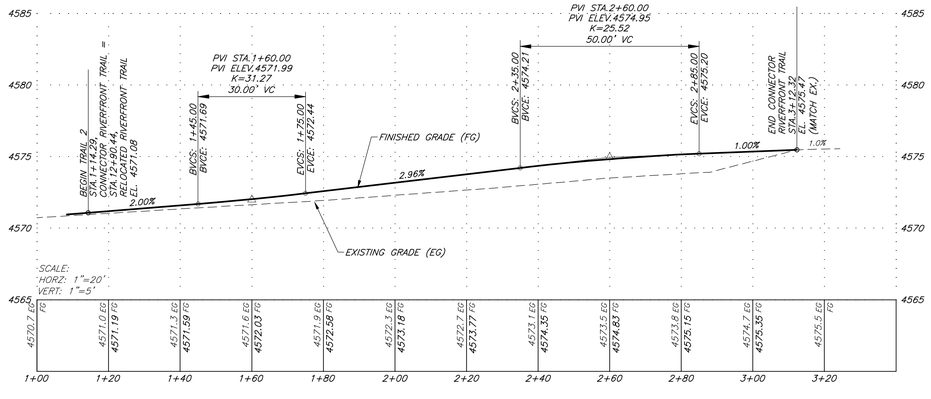
Of 19





Bid Set

SGM
744 Horizon Court, Suite 250
Grand Junction, CO 81506
970.245.2571 www.sgm-inc.com

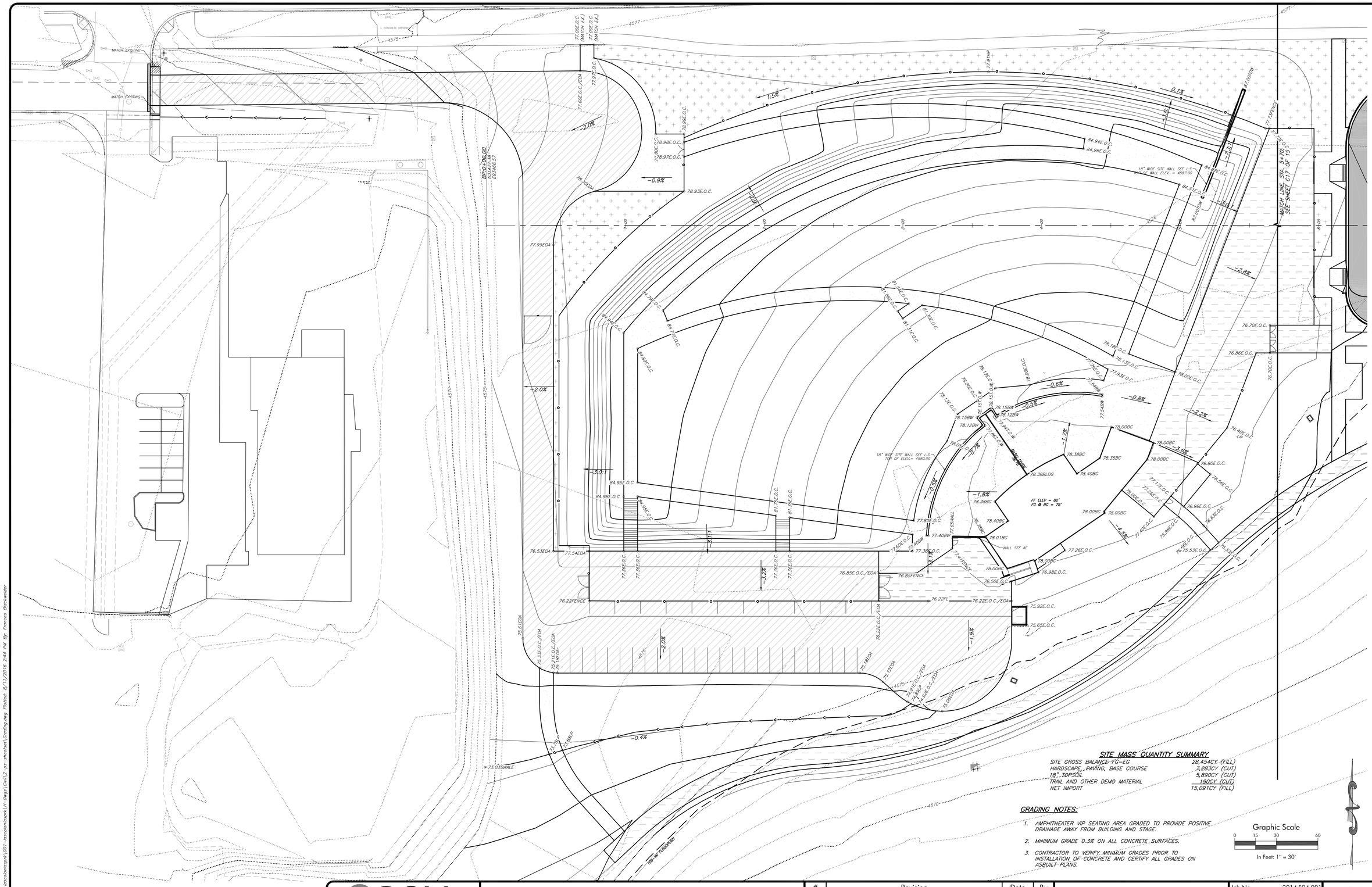
Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Connector Riverfront Trail
Plan and Profile

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	TrailPlanProfile		

C15
Of 19



SITE MASS QUANTITY SUMMARY

SITE GROSS BALANCE--FG--EG	28,454CY (FILL)
HARDSCAPE...PAVING, BASE COURSE	7,283CY (CUT)
18"...TOPSOIL	5,890CY (CUT)
TRAIL AND OTHER DEMO MATERIAL	190CY (CUT)
NET IMPORT	15,091CY (FILL)

GRADING NOTES:

1. AMPHITHEATER VIP SEATING AREA GRADED TO PROVIDE POSITIVE DRAINAGE AWAY FROM BUILDING AND STAGE.
2. MINIMUM GRADE 0.3% ON ALL CONCRETE SURFACES.
3. CONTRACTOR TO VERIFY MINIMUM GRADES PRIOR TO INSTALLATION OF CONCRETE AND CERTIFY ALL GRADES ON ASBUILT PLANS.

Graphic Scale
0 15 30 60
In Feet: 1" = 30'

Bid Set

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Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Amphitheater
Grading Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE:	BT	
File:	Grading		

C16
Of 19

RIVERSIDE PARKWAY

15" STM

76.37T.B.C.

77.25T.B.C./HP

76.95T.B.C./HP

76.60 (MATCH EX.)

76.55 (MATCH EX.)

76.44 (MATCH EX.)

(MATCH EX.)

76.65T.B.C.

TRANSITION CROWN TO 2% PARKING LOT GRADE

76.84T.B.C.

4576

77.63T.B.C.

75.50T.B.C.

75.58 EOA

74.84 EOA

75.17 EOA

-2.0%

77.33T.B.C.

77.33T.B.C.

76.98E.O.C.

76.92E.O.C.

76.33T.B.C.

76.68E.O.C.

76.40T.B.C.

76.58T.B.C.

76.22T.B.C.

76.16T.B.C.

75.75T.B.C.

75.70T.B.C.

4571

MATCH LINE, STA. 5+70, SEE SHEET C16 OF 19

16+00

-2.6%

76.57E.O.C.

76.26E.O.C.

76.14E.O.C.

75.82E.O.C.

75.07T.B.C.

75.01T.B.C.

75.41T.B.C.

74.97T.B.C.

74.60T.B.C.

74.54T.B.C.

75.48T.B.C.

76.02E.O.C.

75.36E.O.C.

75.13E.O.C.

76.27E.O.C.

74.93E.O.C.

74.96E.O.C.

74.87E.O.C.

74.63E.O.C.

74.74E.O.C.

74.50E.O.C.

74.41T.B.C.

74.29T.B.C.

74.22E.O.C.

74.06T.B.C.

74.91T.B.C.

4573

1% @ HC RAMPS

1"/FT. MAX

-2.0%

74.02E.O.C.

73.97E.O.C.

73.68E.O.C.

73.13E.O.C.

100-YR FLOODPLAIN

8+00

9+00

10+00

71.87E.O.A.

71.80E.O.A.

71.73E.O.A.

71.87T.B.C.

73.13T.B.C.

4572

4571

(RIVERFRONT TRAIL BY OTHERS)

4570

FD 10+38.61
RS 197.39
EP 4497.39

Graphic Scale
0 10 20 40
In Feet: 1" = 20'

Bid Set

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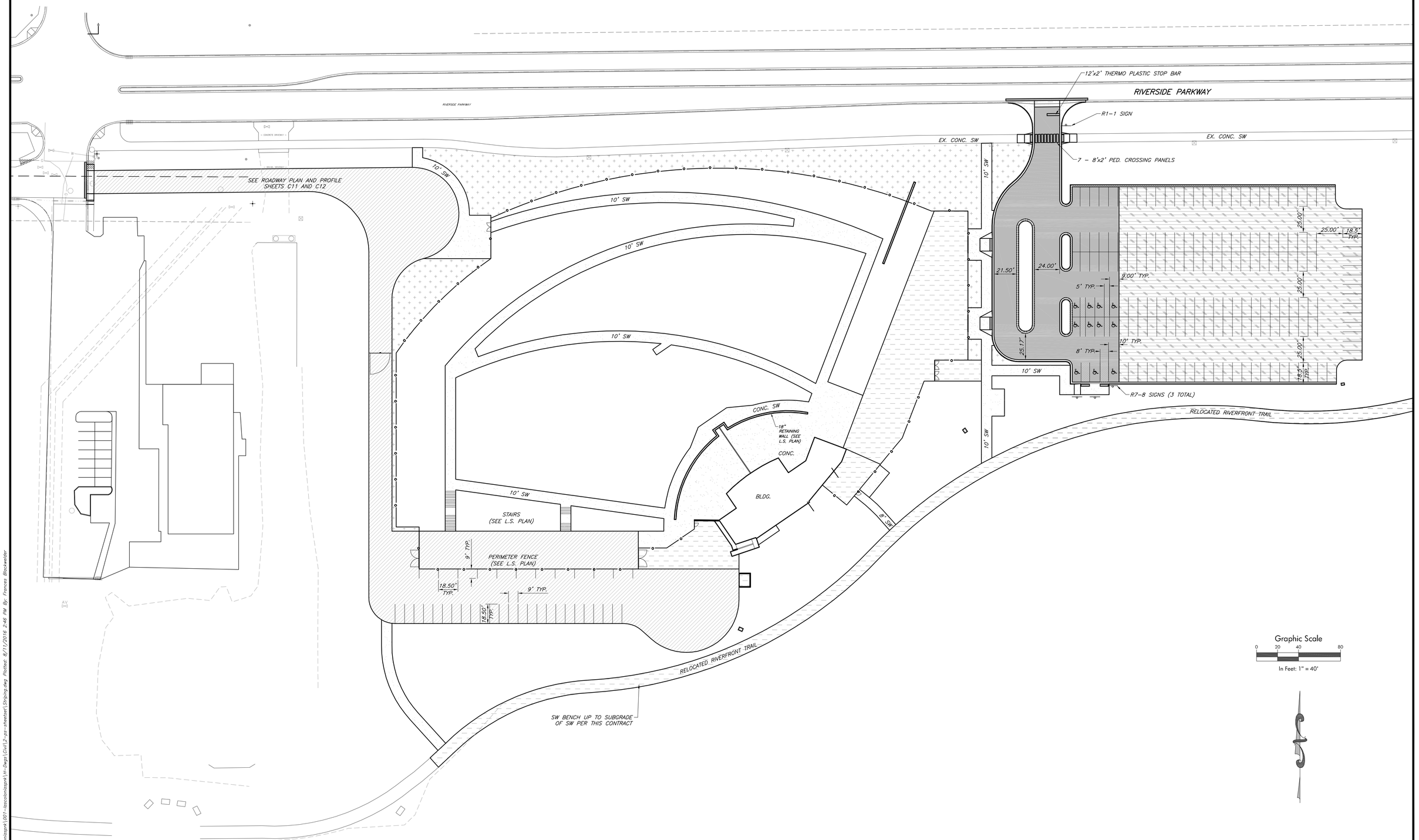
Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Parking Lot Grading Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC:	DK	PE:	BT
File:	Grading		

C17
Of 19



Bid Set

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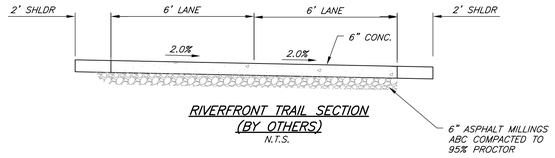
Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

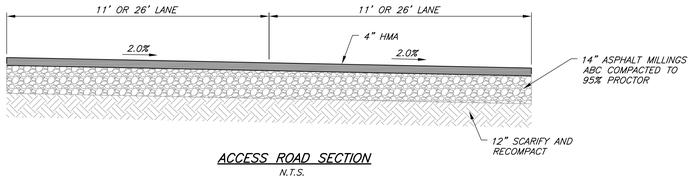
Signing and Striping Plan

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	Striping		

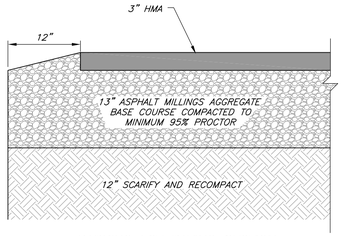
C18
Of 19



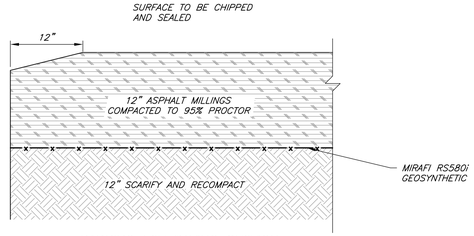
RIVERFRONT TRAIL SECTION
(BY OTHERS)
N.T.S.



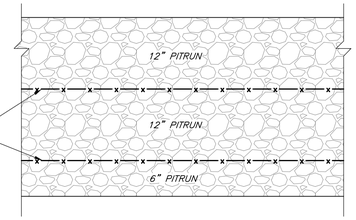
ACCESS ROAD SECTION
N.T.S.



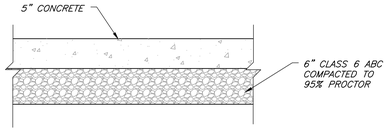
PARKING LOT PAVING SECTION
(WEST SIDE)
SCALE: 1" = 1'-0"



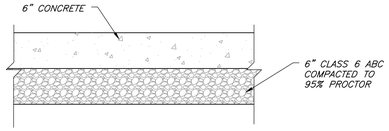
PARKING LOT PAVING SECTION
(EAST SIDE)
SCALE: 1" = 1'-0"



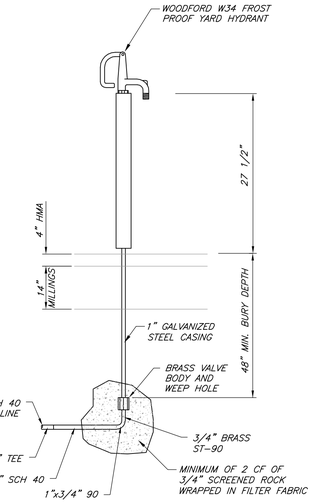
STABILIZATION SECTION
SCALE: 1" = 1'-0"



SIDEWALKS AND V.I.P. SEATING AREA
CONDENSOR PAD, BIKE PARKING PAD, AND WEST PLAZA
SCALE: 1" = 1'-0"



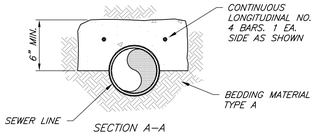
TRUCK LOADING AREA (WEST STAGE BUILDING)
EAST CONCESSION AREA AND DUMPSTER PAD
SCALE: 1" = 1'-0"



YARD HYDRANT DETAIL
EAST AND WEST CONCESSION AREA
NOT TO SCALE

GENERAL NOTES:

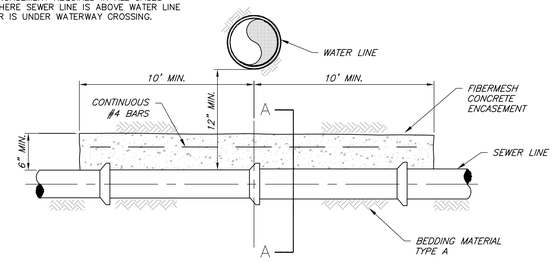
1. ALL MATERIALS, EQUIPMENT, INSTALLATION AND CONSTRUCTION ON THIS PROJECT SHALL BE IN ACCORDANCE WITH THE CITY OF GRAND JUNCTION DEVELOPMENT STANDARDS, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, THE CITY OF GRAND JUNCTION STANDARD SPECIFICATIONS FOR CONSTRUCTION OF UNDERGROUND UTILITIES. AND STANDARD DETAILS OF STREETS, STORM DRAINS AND UTILITIES. THOSE SPECIFICATIONS AND DETAILS CAN BE FOUND ONLINE AT GJCITY.ORG
2. ASPHALT MILLINGS TO BE PROVIDED BY THE CITY OF GRAND JUNCTION. CONTRACTOR SHALL BE PREPARED TO PROCESS MILLED MATERIAL TO MEET CDOT CLASS 6 AGGREGATE BASE COURSE MAXIMUM AGGREGATE SIZE OF ¾". PROCESSING WILL NOT BE MEASURED OR PAID FOR SEPARATELY , BUT SHALL BE INCLUDED IN THE WORK.



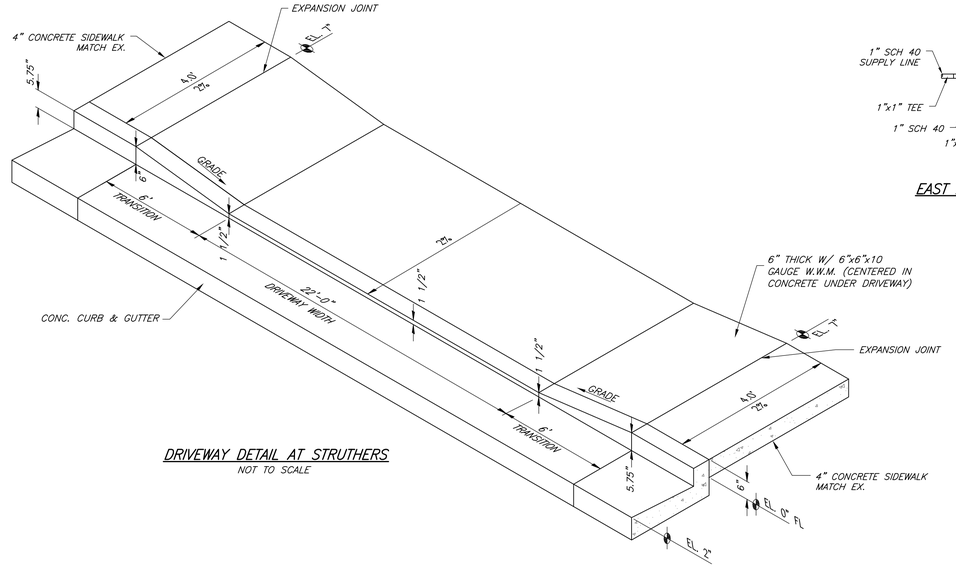
SECTION A–A

NOTE:

STEEL/DUCTILE CASING PIPE OR CONCRETE ENCASEMENT REQUIRED IN ALL CASES WHERE SEWER LINE IS ABOVE WATER LINE OR IS UNDER WATERWAY CROSSING.



WATER LINE ABOVE SEWER LINE
NOT TO SCALE



DRIVEWAY DETAIL AT STRUTHERS
NOT TO SCALE

Bid Set

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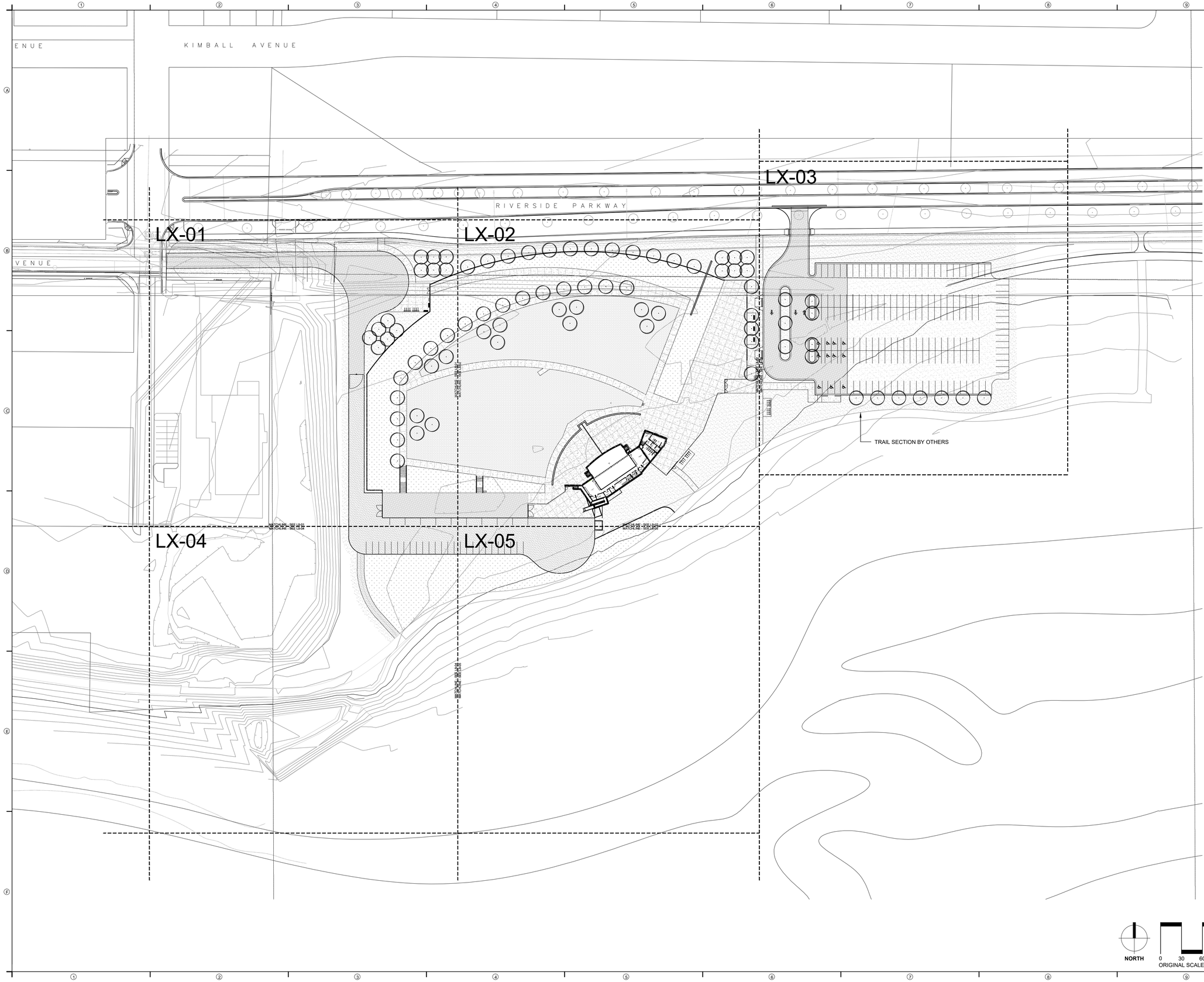
Design Workshop
Las Colonias Park Amphitheater

#	Revision	Date	By
1			

Standard Details

Job No.	2014-504.001		
Drawn by:	FB		
Date:	8/11/16		
QC: DK	PE: BT		
File:	Details		

C19
Of 19



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LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

MICHAEL JOE ALBERT
0000829
08/07/2009
Original Date of Licensure
STATE OF COLORADO
LICENSED LANDSCAPE ARCHITECT

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: AA REVIEWED: PS

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE REFERENCE PLAN

SHEET NUMBER
L0-01

NORTH
0 30 60 120
ORIGINAL SCALE: 1"=60'-00"

GENERAL NOTES

1. Contractor is responsible for determining means and methods for construction. These drawings may indicate a limit of proposed improvements, limits of site demolition, etc. for delineation of expected extents of disturbance, however, final impact shall be determined in the field. Should limits of disturbance exceed boundaries defined in drawings, contractor shall contact landscape architect for resolution.
2. Contractor is responsible for repairing all work disturbed by construction outside of limit lines defined on drawings or through his/her means and methods to a condition better than or equal to the existing conditions prior to commencement of construction at no additional cost to the owner.
3. Contractor is responsible for maintaining a complete up-to-date set of drawings and specifications at the construction site and ensuring the documents are readily available for review by the landscape architect and governing agency.
4. The drawings and specifications are complementary to one another and implied to correspond with one another. Any discrepancies should be brought to the attention of the landscape architect for resolution immediately.

LANDSCAPE DEMOLITION

1. Items shall remain unless designated for removal. Remove designated items shown on the plan to the full depth of their construction unless otherwise noted.
2. Verify the location of items prior to commencement of the work.
3. Items encountered below grade and not shown on the drawings shall be brought to the attention of the Landscape Architect.
4. The current Uranium Mill Tailings Management Plan shall be adhered to during all construction activities. The most current version can be found at the State of Colorado's website https://www.colorado.gov/pacific/sites/default/files/HM_umilltail-mgt-plan.pdf . All contractors and trades working on this project shall be familiar with this and related documents.
5. Demolished materials will be directed by the City of Grand Junction as to disposal means such as direct burial or removal from the site. Prior to any materials that the City of Grand Junction may direct to be removed from the site, materials must first undergo testing for radioactivity. Materials that are found to be under the limits as defined in the Uranium Mill Tailings Management Plan (UMTMP) may then be removed, but not before. A log of these actions must be kept. If materials are not under the radioactivity limits, then they may leave the site to a licensed disposal facility or to the interim storage facility to be defined by the City of Grand Junction and as described in the UMTMP.
6. Contact the local underground service update for utility location and identification prior to demolition.
7. The location of existing utilities as shown on the plans may vary in relation to actual existing conditions; additional utilities not shown on the drawings may exist. Verify in the field the data shown and call any discrepancies to the attention of the Landscape Architect or Site Representative before starting work.
8. Perform excavation in the vicinity of existing utilities by hand where applicable. The Contractor is responsible for damage to existing utilities caused by any person, vehicle, equipment or tool related to the execution of the contract.

LAYOUT NOTES

1. Layout and verify dimensions prior to construction. Bring discrepancies to the attention of the Landscape Architect.
2. For dimensions of buildings, garages, trash enclosures, patios and related work, refer to the architectural drawings.
3. Written dimensions take precedence over scale. Do not scale drawings.
4. Where dimensions are called as "equal," space referenced items equally, measured to their center lines unless otherwise noted.
5. Measurements are to face of building, wall or the fixed site improvement. Dimensions to center lines is indicated.
6. Install intersecting elements at 90 degree angles to each other unless otherwise noted.

GRADING AND DRAINAGE

1. Existing underground utilities are shown per available records. Verify the actual location and elevation in the field prior to beginning construction of the new facilities. Protect existing utilities and be responsible for damage to utilities encountered during construction.
2. Request inspection as required 48 hours in advance of performing any work unless otherwise noted on this sheet.
3. Debris created by removal operations become the property of the Contractor and is to be legally disposed of away from the job site.
4. Notify local underground service companies for utility finds 48 hours prior to any excavation.
5. Refer to structural drawings for connections to drains over structure.
6. Refer to architectural drawings for waterproofing of slab penetrations.
7. Refer to Civil Engineer's drawings for connections to drains.

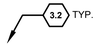
LANDSCAPE PLANTING NOTES

1. Refer to Civil Engineer's utility and precise grading plans for utility location and final grading. If actual site conditions vary from what is shown on the plans, contact the Landscape Architect for direction as to how to proceed.
2. Verify locations of pertinent site improvements installed under other sections. If any part of this plan cannot be followed due to site conditions, contact Landscape Architect for instructions prior to commencing work.
3. Exact locations of plant materials to be approved by the Landscape Architect in the field prior to installation. Landscape Architect reserves the right to adjust plants to exact location in field.
4. Verify plant counts and square footages: quantities are provided as Owner information only. If quantities on plant list differ from graphic indications, then graphics shall prevail.
5. Contact the local underground utility services for utility location and identification.
6. Perform excavation in the vicinity of underground utilities with care and if necessary, by hand. The Contractor bears full responsibility for this work and disruption or damage to utilities shall be repaired immediately at no expense to the Owner.
7. Trees shall bear same relation to finished grade as it bore to existing.
8. Trees to be planted a minimum of 4 feet from face of building, or pavement, except as approved by Landscape Architect.
9. Provide matching forms and sizes for plant materials within each species and size designated on the drawings.
10. Prune newly planted trees only as directed by Landscape Architect.
11. Align and equally space in all directions shrubs as designated per these notes and drawings.
12. Finish grades of shrub areas and lawns shall be 1 1/2 inches below adjacent paving or header. (Check mulch depth and if seeded or sodded lawns).
13. Provide burlap wrapping to second branch with 30% overlap.
14. Cut and remove all burlap from rootball.
15. Landscape Architect to review plant materials at source or by photographs prior to digging or shipping of plant materials.

TABLE OF ABBREVIATIONS

APPROX	APPROXIMATE	MH	MANHOLE
ARCH	ARCHITECT	MIN	MINIMUM
AVG	AVERAGE	MISC	MISCELLANEOUS
B&B	BALLED AND BURLAPPED	N	NORTH
BC	BOTTOM OF CURB	NIC	NOT IN CONTRACT
BLDG	BUILDING	NO	NUMBER
BM	BENCHMARK	NOM	NOMINAL
BOC	BACK OF CURB	NTS	NOT TO SCALE
BR	BOTTOM OF RAMP	OC	ON CENTER
BS	BOTTOM OF STEP	OD	OUTSIDE DIAMETER
BW	BOTTOM OF WALL	PC	POINT OF CURVATURE
CAL	CALIPER	PE	POLYURETHANE
CB	CATCH BASIN	PI	POINT OF INTERSECTION
CF	CUBIC FEET	PL	PROPERTY LINE
CIP	CAST IN PLACE	PT	POINT, POINT OF TANGENCY
CL	CENTER LINE	PVC	POLYVINYL CHLORIDE
CLR	CLEARANCE	QTY	QUANTITY
CM	CENTIMETER	R	RADIUS
CO	CLEAN OUT	REF	REFERENCE
CONT	CONTINUOUS	REINF	REINFORCE(D)
CY	CUBIC YARD	REQ'D	REQUIRED
DEG	DEGREE	REV	REVISION, REVISED
DEMO	DEMOLISH, DEMOLITION	ROW	RIGHT OF WAY
DIA	DIAMETER	S	SOUTH
DIM	DIMENSION	SAN	SANITARY
DTL	DETAIL	SD	STORM DRAIN
DWG	DRAWING	SF	SQUARE FOOT (FEET)
E	EAST	SHT	SHEET
EA	EACH	SIM	SIMILAR
EL	ELEVATION	SPECS	SPECIFICATIONS
ENG	ENGINEER	ST	STORM SEWER
EQ	EQUAL	SY	SQUARE YARD
EST	ESTIMATE	STA	STATION
E.W.	EACH WAY	STD	STANDARD
EXIST	EXISTING	SYM	SYMMETRICAL
EXP	EXPANSION, EXPOSED	T&B	TOP AND BOTTOM
FFE	FINISHED FLOOR ELEVATION	TBC	TOP OF BACK CURB
FG	FINISHED GRADE	TC	TOP OF CURB
FL	FLOW LINE	TF	TOP OF FOOTING
FOC	FACE OF CURB	TH	THICK
FT	FOOT (FEET)	TOPO	TOPOGRAPHY
FTG	FOOTING	TR	TOP OF RAMP
GA	GAUGE	TS	TOP OF STEP
GEN	GENERAL	TW	TOP OF WALL
GR	GRADE ELEVATION	TYP	TYPICAL
HORIZ	HORIZONTAL	VAR	VARIES
HP	HIGH POINT	VOL	VOLUME
HT	HEIGHT	W/	WITH
ID	INSIDE DIAMETER	W/O	WITHOUT
INV	INVERT ELEVATION	WT	WEIGHT
IN	INCH(ES)	WL	WATER LEVEL
INCL	INCLUDE(D)	WWF	WELDED WIRE FABRIC
JT	JOINT	YD	YARD
LF	LINEAR FEET	@	AT
LP	LOW POINT		
MAX	MAXIMUM		

SAMPLE KEYNOTE DRAWING CALLOUT:



SITE DETAIL KEYNOTES:

	DETAIL/ SHEET	RELATED DETAIL(S)	SPEC. SECTION(S)
1.0 PAVEMENTS, RAMPS, CURBS			
1.1 STONE PAVING TYPE 1 - Sand Set w/ Planting Joints	x/ Lx-01	x/ Lx-0x, x/ Lx-0x, x/ Lx-0x	321400

KEYNOTE HEADING (PROPOSED IMPROVEMENT SYSTEM)

KEYNOTE CALL-OUT

KEYNOTE (SYSTEM) ITEM AND BRIEF DESCRIPTION

PRIMARY KEYNOTE DETAIL REFERENCE (NUMBER AND SHEET)

ADDITIONAL DETAIL REFERENCES (COMPOSITE SECTIONS/ELEVATIONS, OTHER SECTIONS, ELEVATIONS OR 3D DRAWINGS, AND/OR TRANSITION OR CONNECTION DETAILS)
NOTE: MULTIPLE DETAILS MAY BE REFERENCED

SPECIFICATION REFERENCE (CSI SECTION NUMBER MASTER FORMAT 2004 OR OTHER JURISDICTIONAL REQUIREMENT)
NOTE: MULTIPLE SPECIFICATIONS MAY BE REFERENCED

SAMPLE REFERENCE NOTE DRAWING CALLOUT:

"x" REFERENCE NOTES

NOTE CALL-OUT

1 Final Location of Path to be Determined in Field Under Direction of Landscape Architect

SERIES SPECIFIC REFERENCE NOTE (SUPPLEMENTAL TO KEYNOTES. TYPICALLY DESCRIBES ITEMS TO BE CONSIDERED DURING CONSTRUCTION. MAY REFERENCE A DETAIL OR SPECIFICATION OR BOTH.)

NOTE: "x" Refers to Drawing Series (i.e. SITE DEMOLITION REFERENCE NOTES). THERE SHOULD BE SPECIFIC REFERENCE NOTES FOR EACH DRAWING SERIES. HOWEVER, SOME NOTES MAY APPEAR ON MULTIPLE SERIES.

PLANTING LIST

ABBR.	BOTANICAL NAME	COMMON NAME	SIZE	QTY
TREES				
AT	*Acer truncatum x Acer platanoides 'Keithsform'*	Norwegian Sunset Maple	2.5" cal	5
GD	*Gymnocladus dioicus*	Kentucky Coffeetree	2.5" cal	3
PA	*Platanus x acerifolia 'Morton Circle*	Exclamation! Planetree	2.5" cal	6
PR	*Prunus cerasifera 'Newport'*	Newport Plum	2.5" cal	23
PC	*Pyrus calleryana*	Redspire Callery Pear	2.5" cal	12
TC	*Tilia cordata*	Littleleaf Linden	2.5" cal	31

ANNUALS, GRASSES, SEED MIXES AND EDGING

Native Seed Mix			64,670 SF
	Blue Grama	*Bouteloua gracilis*	15%
	Mexican Feathergrass	*Nassella tenuissima*	70%
	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*	15
Turf (Seed)			62,865 SF

SOILS LEGEND

- 18" CLEAN FILL TOPSOIL - PLANTING 87,530 SF/ 2 AC
- 12" CLEAN FILL TOPSOIL 25,165 SF/ .57 AC
- NO CLEAN FILL REQ., TOP W/ DECOMPOSED STONE SURFACE 57,450 SF/ 1.31 AC
- 6" CLEAN FILL TOPSOIL - PLANTING 65,182 SF/ 1.5 AC

MATERIAL SYSTEMS LEGEND

- Hot Mix Asphalt Vehicular Surface
- Concrete Paving
- Concrete Paving Vehicular
- Asphalt Millings
- Asphalt Millings and Chip and Seal
- Decomposed Stone Surface
- Fence

BID ADD ALTERNATES

#6	5.1 Benches The base bid excludes bench procurement and installation. The Add Alternate #6 is for the contractor to procure and install benches in the project.
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LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

MICHAEL JOE ALBERT 0000829 08/07/2009 Original Date of Licensure STATE OF COLORADO LICENSED LANDSCAPE ARCHITECT

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: AA REVIEWED: PS

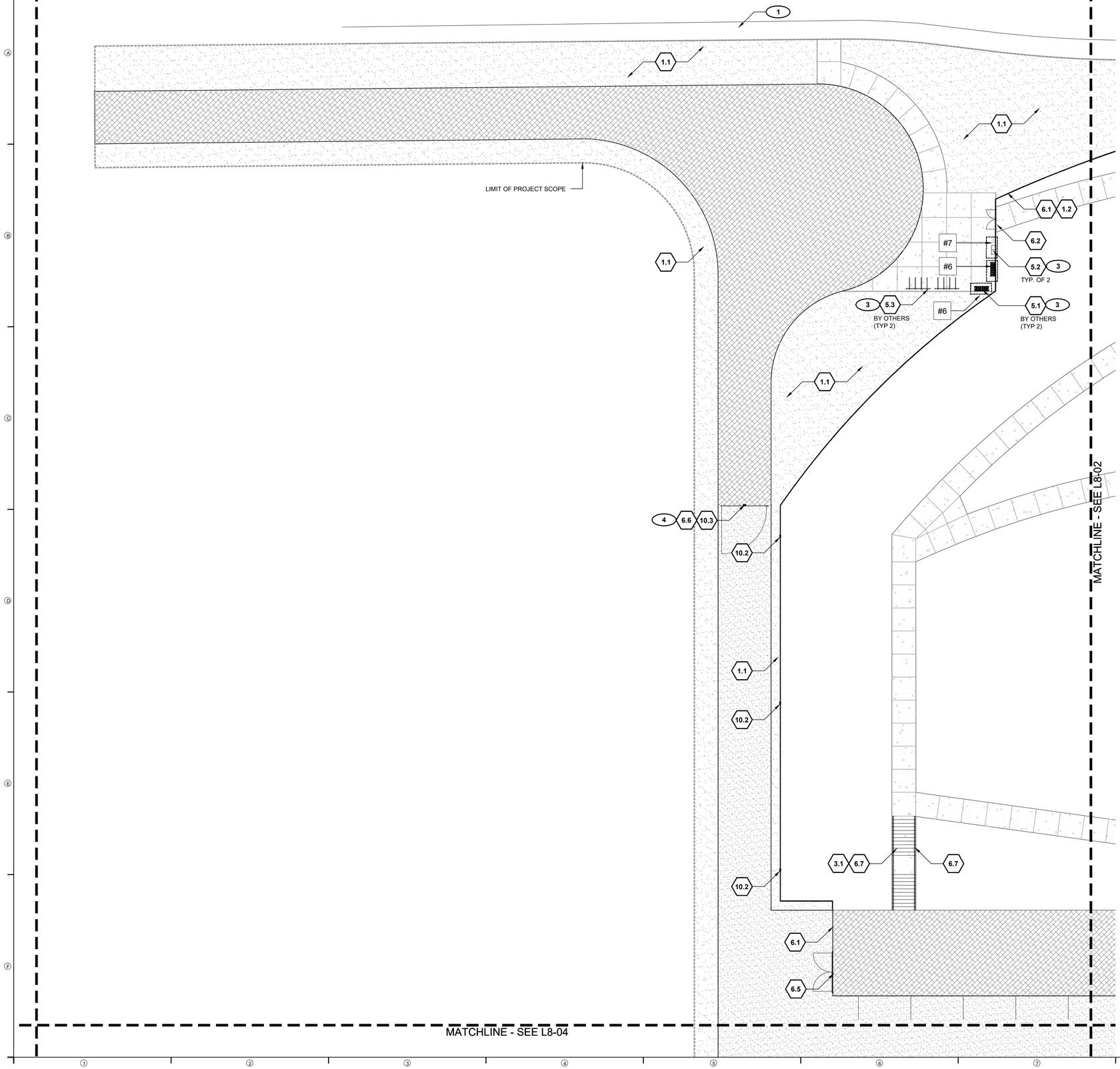
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

GENERAL INFORMATION

SHEET NUMBER

L0-02



SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
1.1	Decomposed Stone Surface	1 / L7-01		321540
1.2	Metal Edger	2 / L7-01		329300
2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
6.1	Site Fence	1 / L7-02		323116
6.2	Pedestrian Gate - Type 1 (Double)	2 / L7-02		323116
6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
6.4	Vehicular Gate - Type 1 (Slide)	2 / L7-03		323116
6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
10.3	Sign- Event Staff Only	4 / L7-05		101426

SITE MATERIALS REFERENCE NOTES

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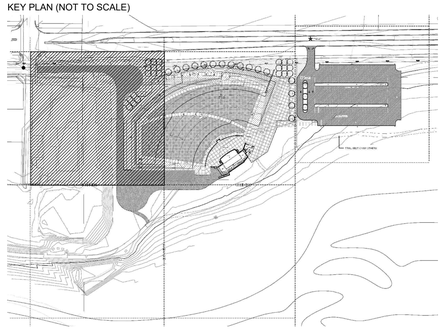

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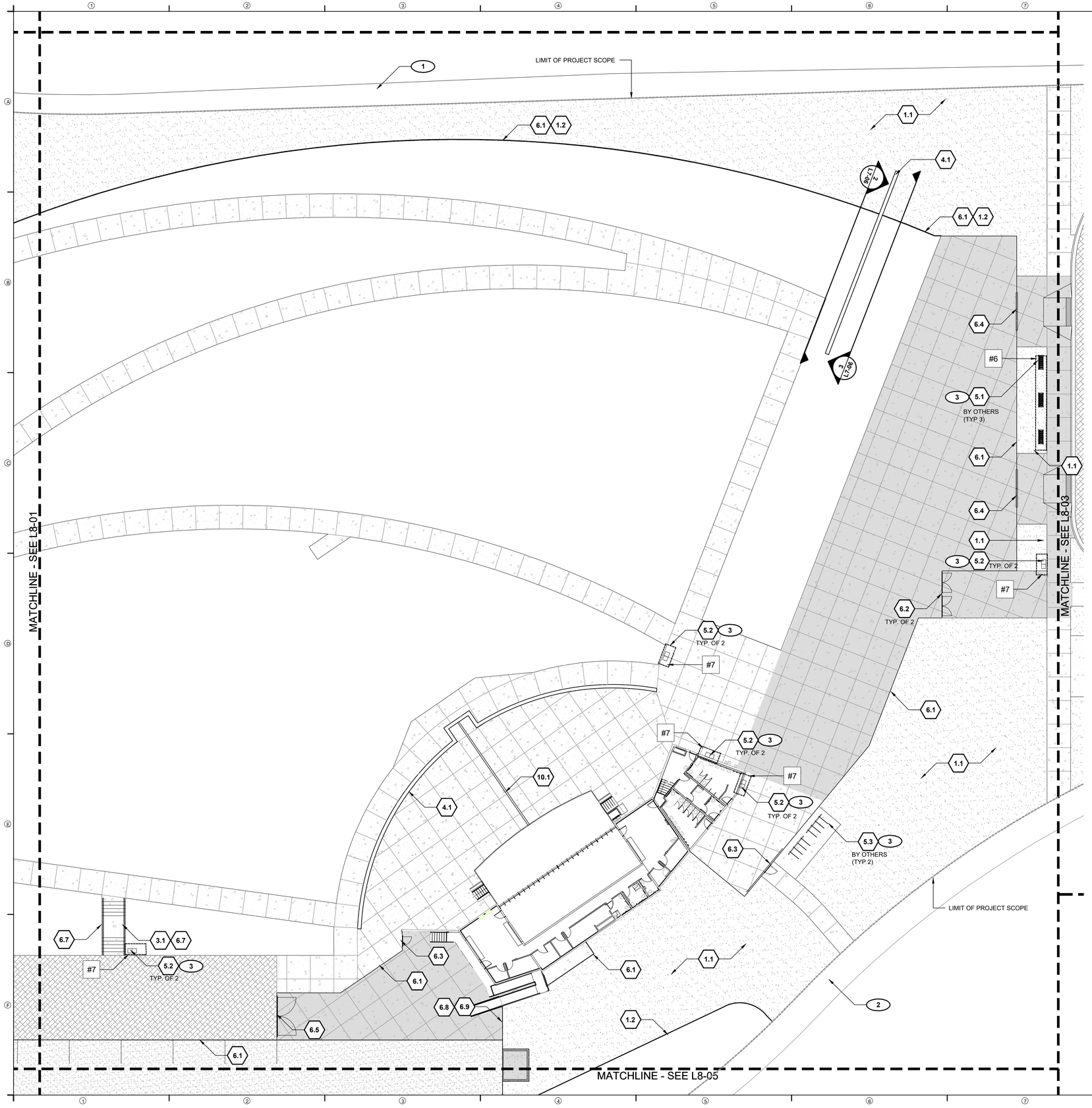
SITE MATERIALS SERIES

SHEET NUMBER
L3-01



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2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
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3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
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6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
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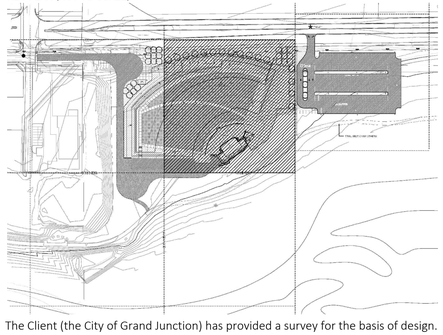

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REVISIONS

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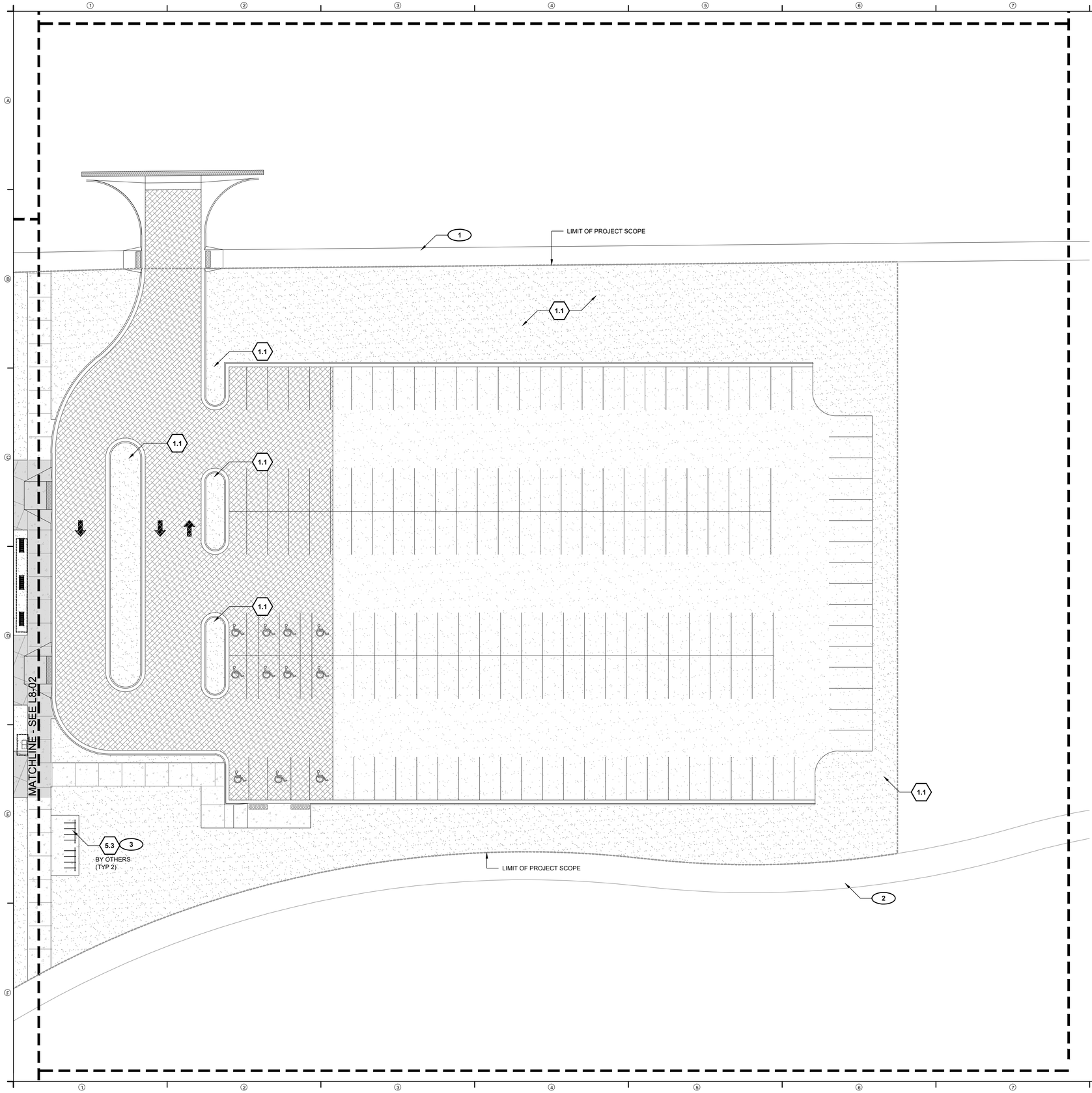
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE MATERIALS SERIES

SHEET NUMBER
L3-02



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2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
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5.3	Bicycle Rack - By City			
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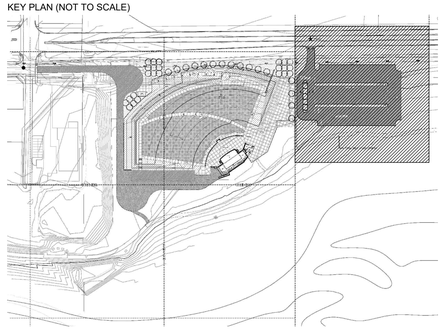

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DRAWN: AA REVIEWED: PS

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE MATERIALS SERIES

SHEET NUMBER

L3-03

MATCHLINE - SEE L8-01

1.1

LIMIT OF PROJECT SCOPE

2

MATCHLINE - SEE L8-05

SITE KEYNOTES:

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1.0	**PAVEMENTS, RAMPS, CURBS**			
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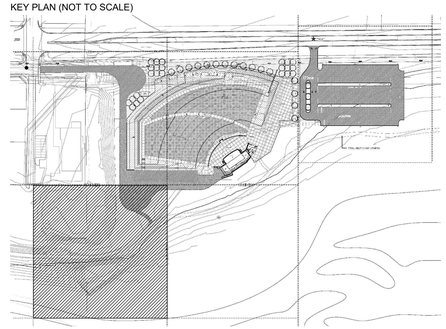

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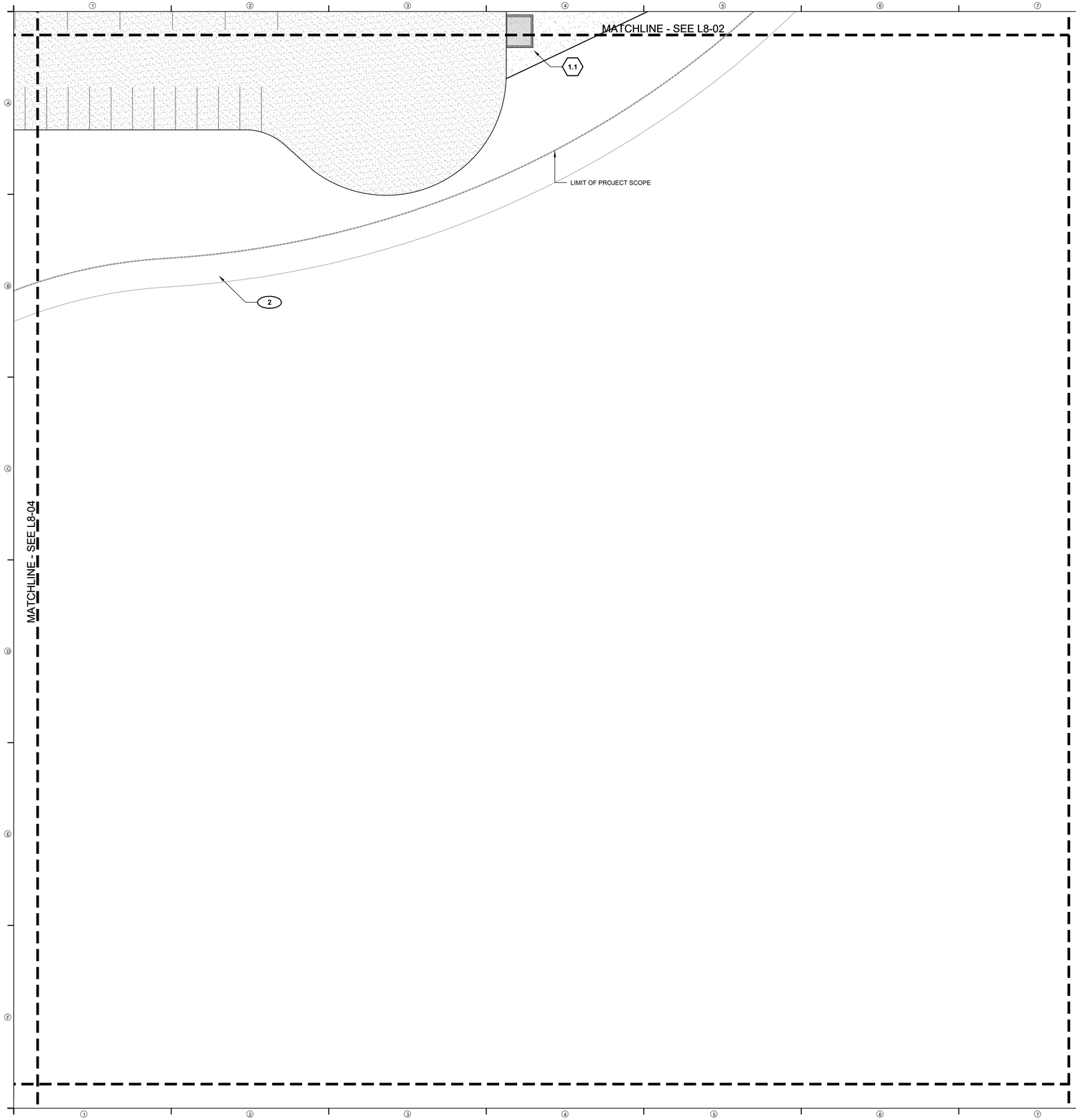
SHEET NUMBER

L3-04



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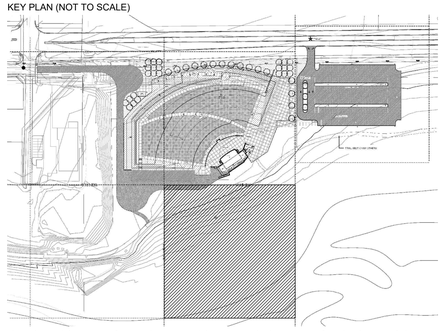

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LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

MICHAEL JOE ALBERT 0000829 08/07/2009 Oregon Date of Licensure STATE OF COLORADO LICENSED LANDSCAPE ARCHITECT

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

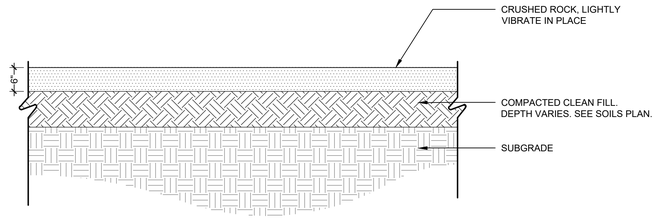
DRAWN: AA REVIEWED: PS

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE MATERIALS SERIES

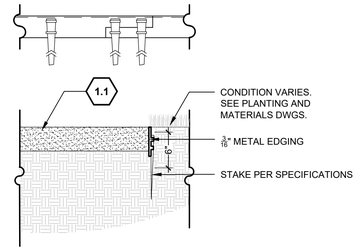
SHEET NUMBER
L3-05



1 DECOMPOSED STONE SURFACE

1" = 1'-0"

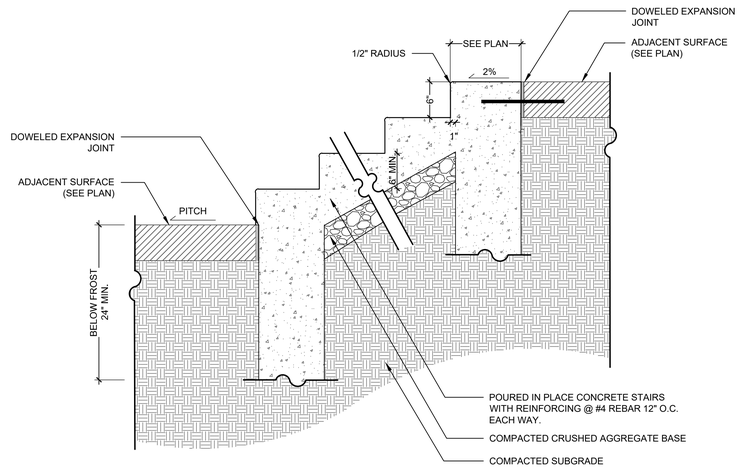
1.1



2 METAL EDGER

1" = 1'-0"

1.2

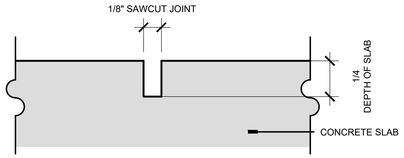


NOTE: NUMBER OF STAIRS VARIES. SEE PLANS.

3 STAIRS

1" = 1'-0"

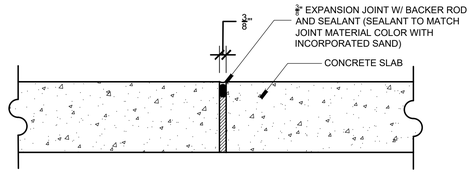
3.1



5 CONTROL JOINT

NTS

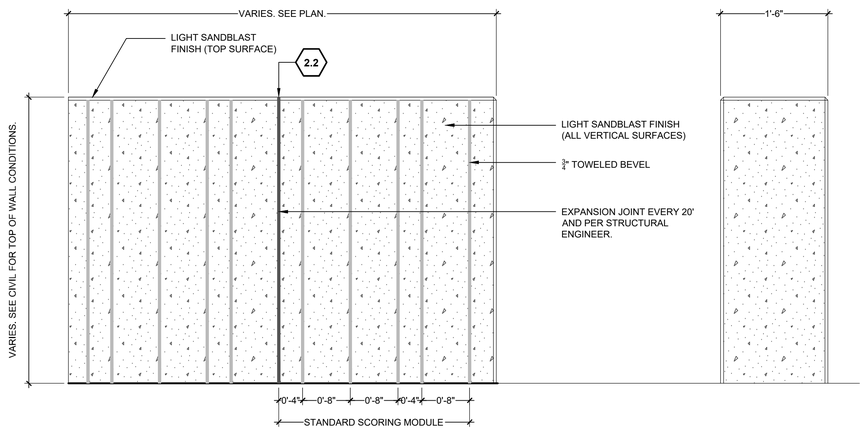
2.1



6 EXPANSION JOINT

NTS

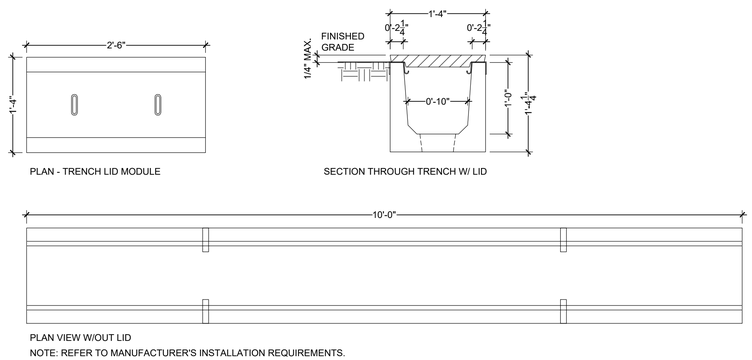
2.2



4 SITE WALL

1" = 1'-0"

4.1



7 SOUNDBOARD TRENCH GRATE

1"=1'-0"

10.1

SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
1.1	Decomposed Stone Surface	1 / L7-01		321540
1.2	Metal Edger	2 / L7-01		329300
2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
6.1	Site Fence	1 / L7-02		323116
6.2	Pedestrian Gate - Type 1 (Double)	2 / L7-02		323116
6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
6.4	Vehicular Gate - Type 1 (Slide)	2 / L7-03		323116
6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
10.3	Sign- Event Staff Only	4 / L7-05		101426

BID ADD ALTERNATES

#6 5.1 Benches
The base bid excludes bench procurement and installation. The Add Alternate #6 is for the contractor to procure and install benches in the project.

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The base bid excludes the procurement and installation of trash and recycling receptacles. The Add Alternate #7 is for the contractor to procure and install trash and recycling receptacles in the project.

#8 9.3 Turf (Sod)
The base bid is for sodded turf. The Add Alternate #8 is to replace sod with lawn seeding.

#9 9.1 and 9.2 Deciduous Tree Planting
The base bid excludes the procurement and installation of trees. The Add Alternate #9 is for the contractor to procure and install all trees in the project.

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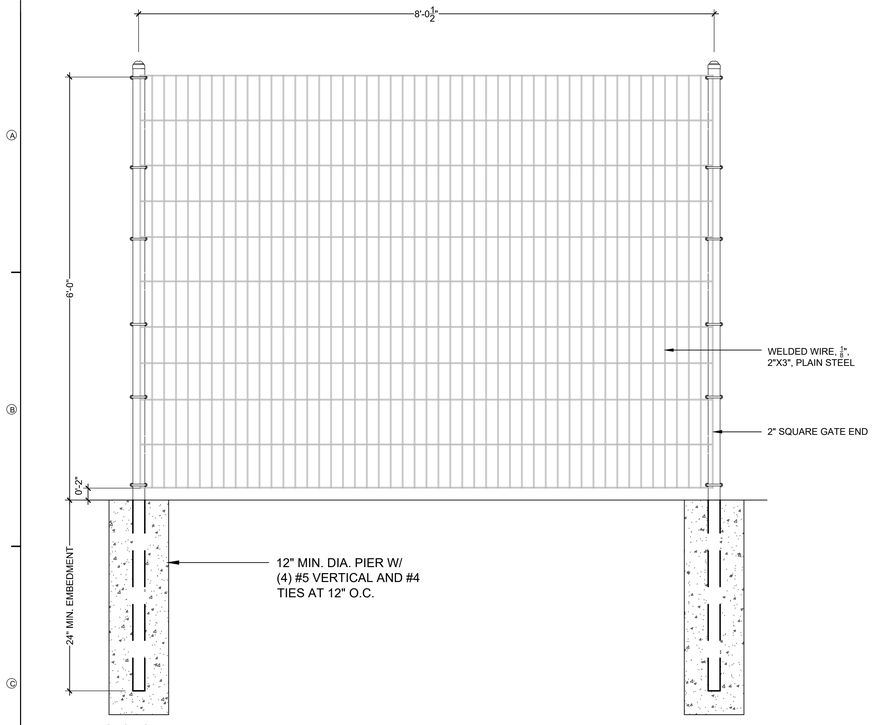
PROJECT NUMBER: 5272

SITE DETAILS

SHEET NUMBER

L7-01

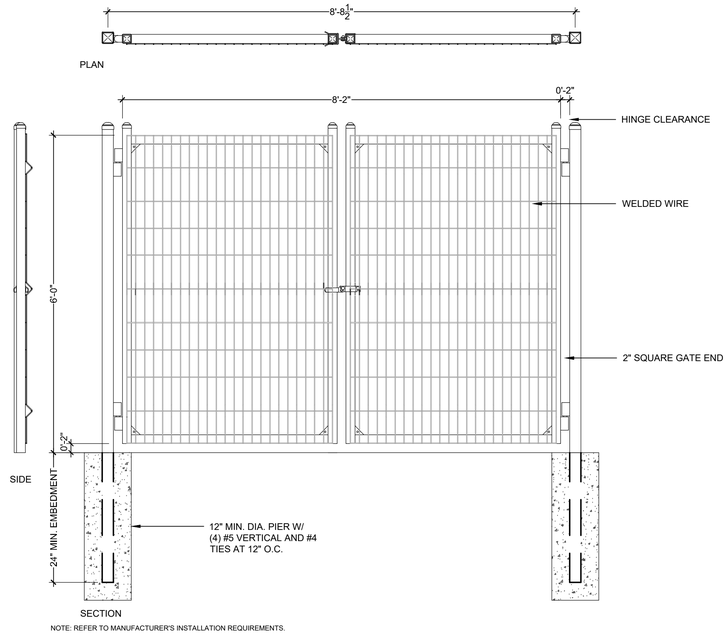


NOTE: REFER TO MANUFACTURER'S INSTALLATION REQUIREMENTS.

1 SITE FENCE

1" = 1'-0"

6.1



NOTE: REFER TO MANUFACTURER'S INSTALLATION REQUIREMENTS.

2 PEDESTRIAN GATE - TYPE 1 (DOUBLE)

3/4" = 1'-0"

6.2

SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
1.1	Decomposed Stone Surface	1 / L7-01		321540
1.2	Metal Edger	2 / L7-01		329300
2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
6.1	Site Fence	1 / L7-02		323116
6.2	Pedestrian Gate - Type 1 (Double)	2 / L7-02		323116
6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
6.4	Vehicular Gate - Type 1 (Slide)	2 / L7-03		323116
6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
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BID ADD ALTERNATES

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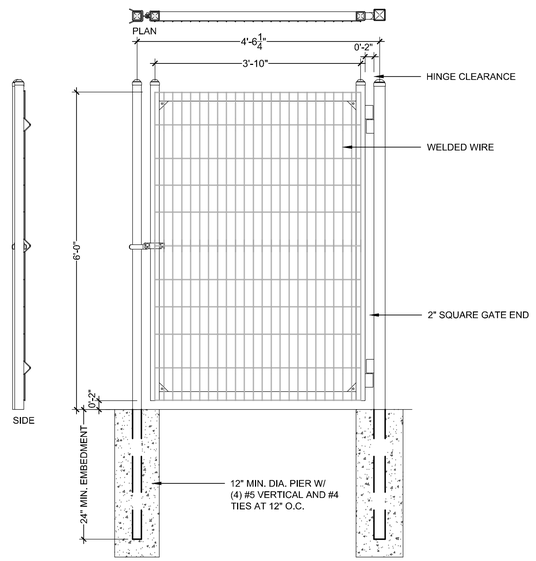
#9 9.1 and 9.2 Deciduous Tree Planting
The base bid excludes the procurement and installation of trees. The Add Alternate #9 is for the contractor to procure and install all trees in the project.

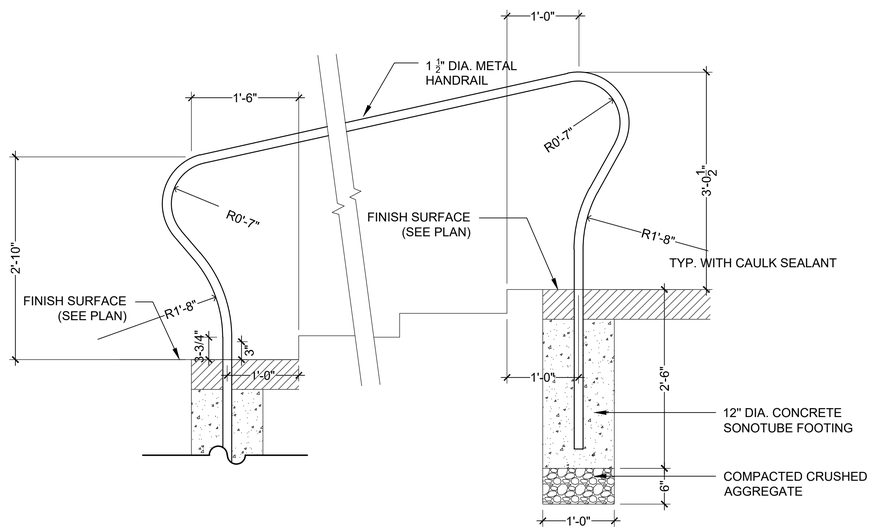


NOTE: REFER TO MANUFACTURER'S INSTALLATION REQUIREMENTS.

3 PEDESTRIAN GATE - TYPE 2 (SINGLE)

3/4" = 1'-0"

6.3



4 HANDRAIL

1" = 1'-0"

6.7

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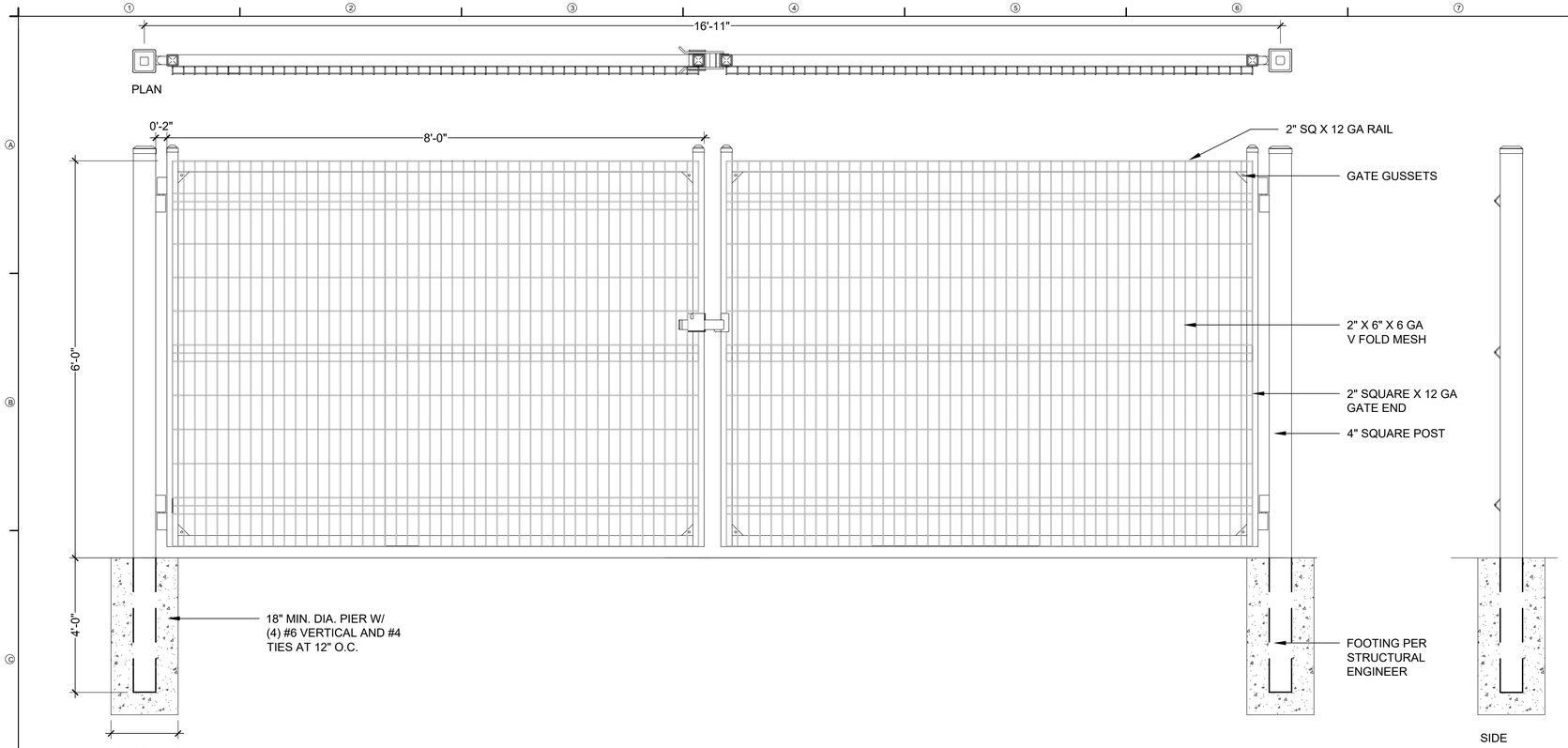
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE DETAILS

SHEET NUMBER

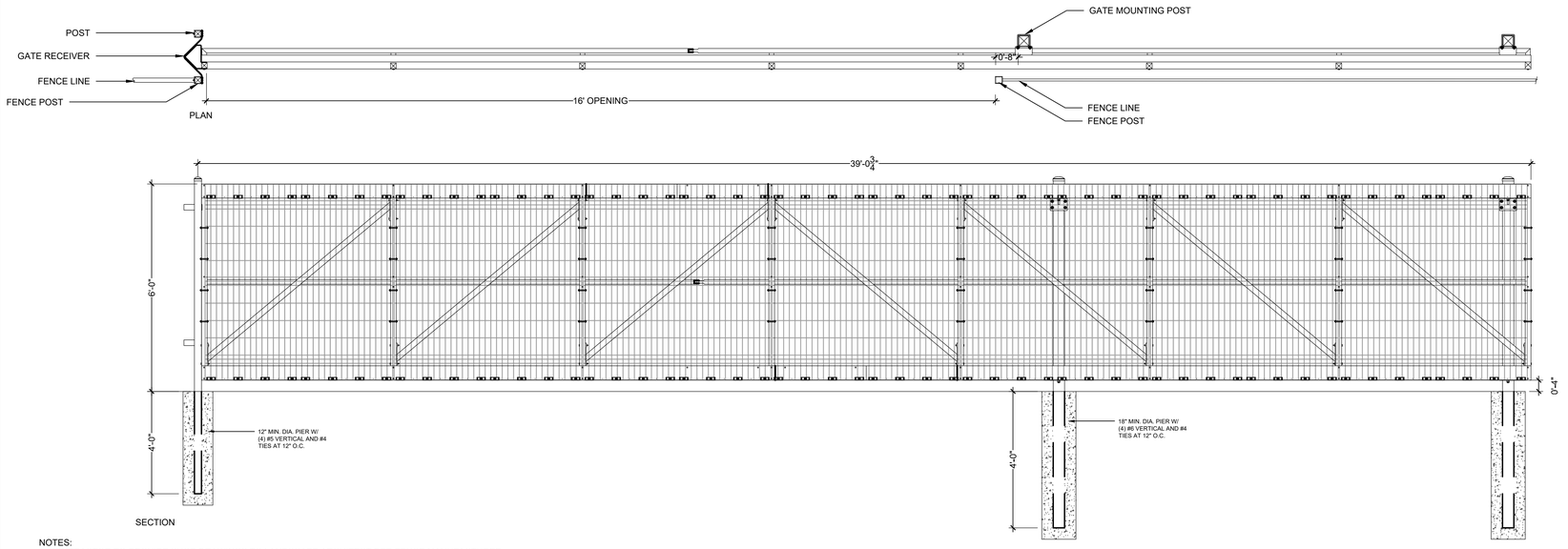
L7-02



NOTES:
1. MESH TO BE CUT AROUND LATCH AFTER INSTALL BY CONTRACTOR.
2. REFER TO MANUFACTURER'S INSTALLATION REQUIREMENTS.

1 VEHICULAR GATE - TYPE 2 (DOUBLE SWING)

1"=1'-0"



NOTES:
1. CONTRACTOR TO PROVIDE SHOP DRAWINGS TO LANDSCAPE ARCHITECT PER FENCE MANUFACTURER.
2. REFER TO MANUFACTURER'S INSTALLATION REQUIREMENTS.
3. WHERE STEEL GATE POSTS ARE LARGER THAN 4" SQUARE OR DIAMETER, 18" DIA. CONCRETE PIERS ARE TO BE USED W/ MIN. REINFORCING AT (4) #6 BAR VERTICAL W/ #4 TIES AT 12" O.C.

2 VEHICULAR GATE - TYPE 1 (SLIDE)

1/2"=1'-0"

SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
1.1	Decomposed Stone Surface	1 / L7-01		321540
1.2	Metal Edger	2 / L7-01		329300
2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
6.1	Site Fence	1 / L7-02		323116
6.2	Pedestrian Gate - Type 1 (Double)	2 / L7-02		323116
6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
6.4	Vehicular Gate - Type 1 (Slide)	2 / L7-03		323116
6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
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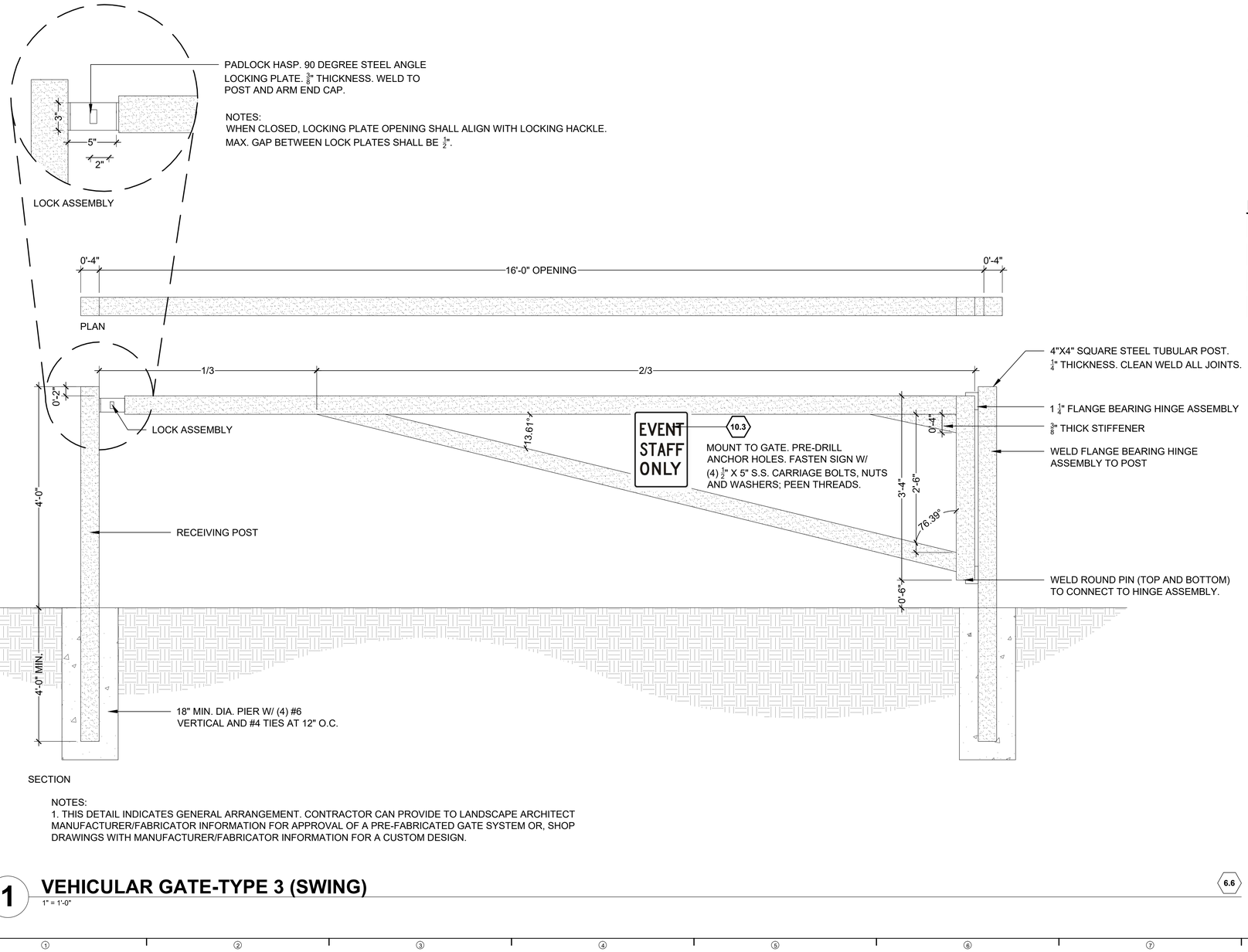
SITE DETAILS

SHEET NUMBER
L7-03



NOTES:
1. THIS DETAIL INDICATES GENERAL ARRANGEMENT. CONTRACTOR CAN PROVIDE TO LANDSCAPE ARCHITECT MANUFACTURER/FABRICATOR INFORMATION FOR APPROVAL OF A PRE-FABRICATED GATE SYSTEM OR, SHOP DRAWINGS WITH MANUFACTURER/FABRICATOR INFORMATION FOR A CUSTOM DESIGN.

1 VEHICULAR GATE-TYPE 3 (SWING)

1" = 1'-0"

6.6

SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
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5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
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7.0	**SITE LIGHTING**			
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10.0	**MISCELLANEOUS ELEMENTS**			
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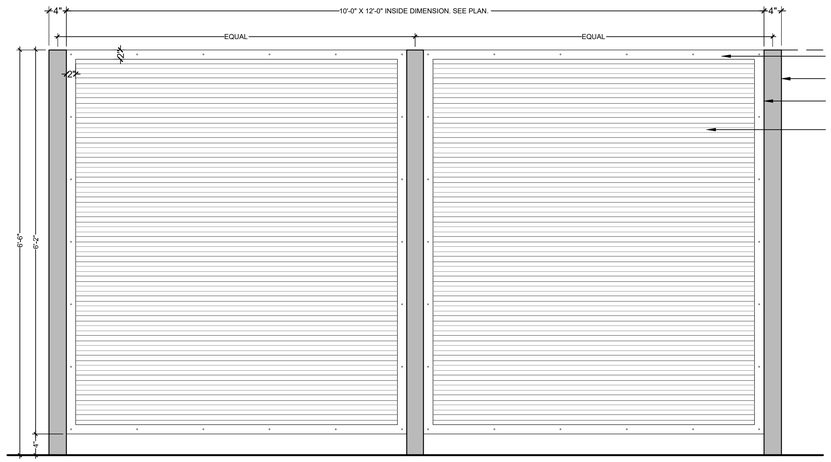
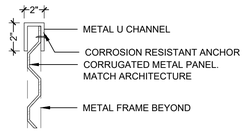
SITE DETAILS

SHEET NUMBER
L7-04

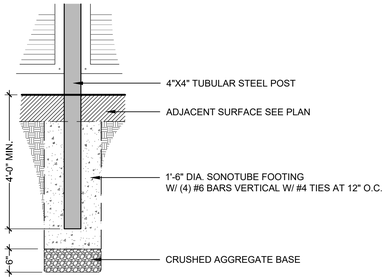


ELEVATION

NOTE:
1. INCLUDE ONE CROSS BRACE ON INSIDE FACE OF EACH FENCE PANEL. 2" WIDE X $\frac{1}{4}$" THICK METAL BAR. WELD TO STEEL U CHANNEL..
2. CONTRACTOR TO PROVIDE SHOP DRAWINGS.



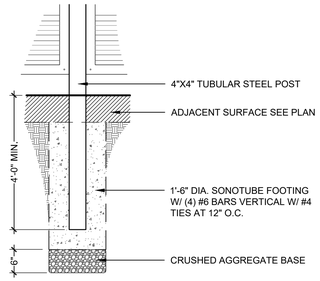
CROSS SECTION FRAME ENLARGEMENT

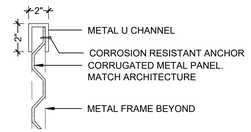


TYPICAL POST FOOTING DETAIL

1 DUMPSTER ENCLOSURE

3/4" = 1'-0"



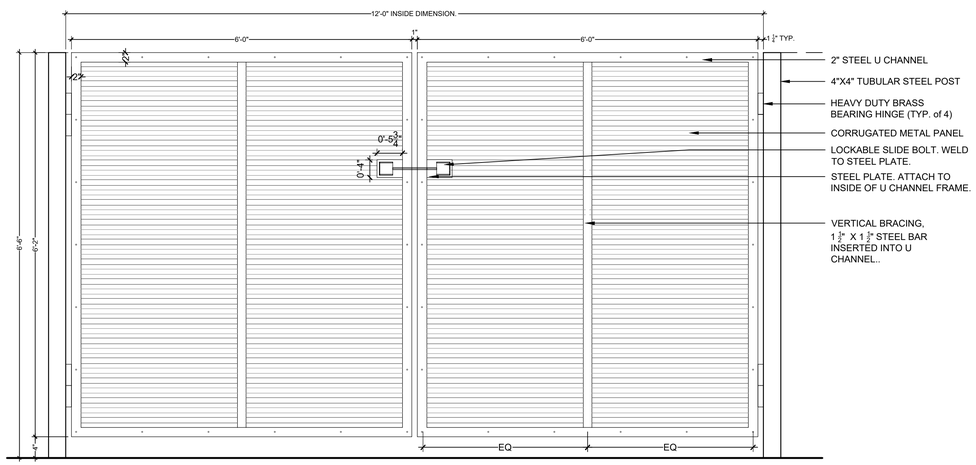


CROSS SECTION FRAME ENLARGEMENT

HINGE ENLARGEMENT

SLIDE BOLT

TYPICAL POST FOOTING DETAIL



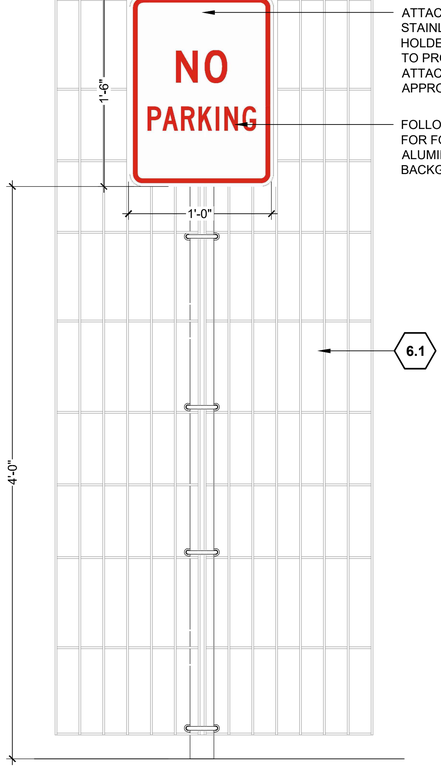
ELEVATION

NOTE:
1. INCLUDE ONE CROSS BRACE ON INSIDE FACE OF EACH GATE DOOR. 2" WIDE X $\frac{1}{4}$" THICK METAL BAR. WELD TO STEEL U CHANNEL..
2. CONTRACTOR TO PROVIDE SHOP DRAWINGS.

2 DUMPSTER ENCLOSURE GATE

3/4" = 1'-0"

6.9



3 SIGN- NO PARKING

NTS

10.2

4 SIGN- EVENT STAFF ONLY

NTS

10.3

SITE KEYNOTES:

		DETAIL / SHEET	RELATED DETAILS	SPEC. SECTION
1.0	**PAVEMENTS, RAMPS, CURBS**			
1.1	Decomposed Stone Surface	1 / L7-01		321540
1.2	Metal Edger	2 / L7-01		329300
2.0	**JOINTING**			
2.1	Control Joint	5 / L7-01		
2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
6.1	Site Fence	1 / L7-02		323116
6.2	Pedestrian Gate - Type 1 (Double)	2 / L7-02		323116
6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
6.4	Vehicular Gate - Type 1 (Slide)	2 / L7-03		323116
6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
10.3	Sign- Event Staff Only	4 / L7-05		101426

BID ADD ALTERNATES

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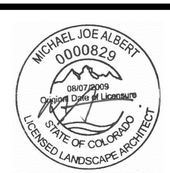
GRAND JUNCTION, COLORADO



ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: AA REVIEWED: PS

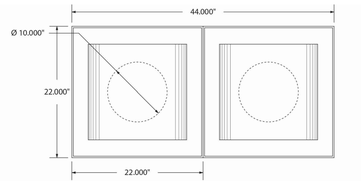
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE DETAILS

SHEET NUMBER

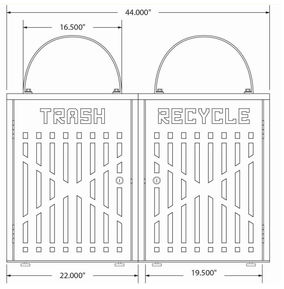
L7-05



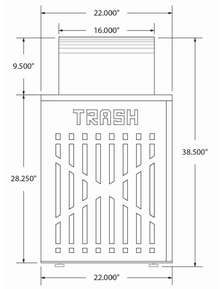
PLAN

NOTE: SURFACE MOUNT PER MANUFACTURER.

#7



FRONT

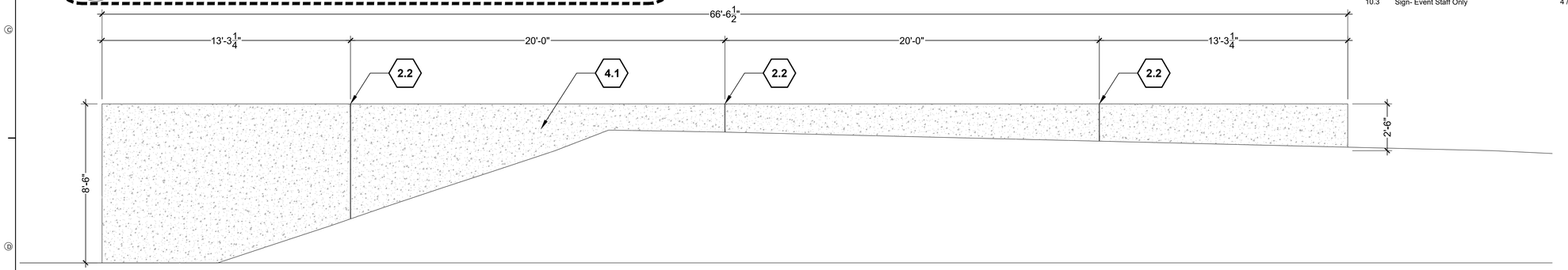


SIDE

1 TRASH/RECYCLING

1"=1'-0"

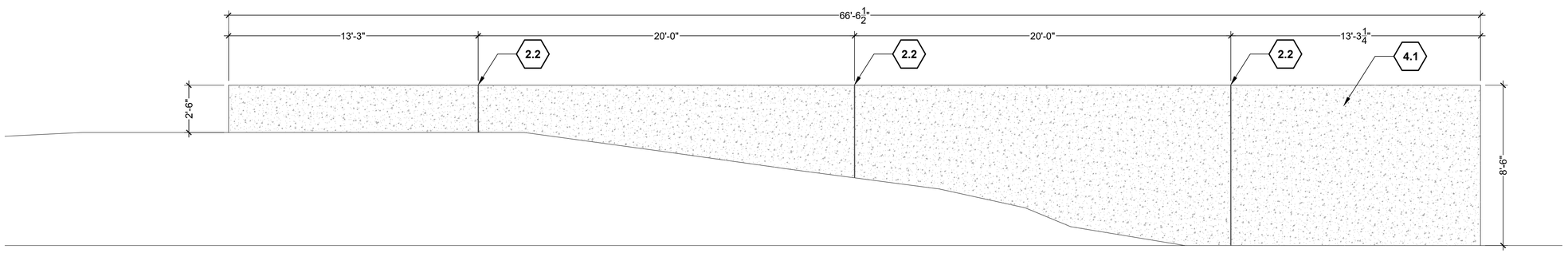
5.2



2 WALL LOOKING EAST

1"=1'-0"

4.1



3 WALL LOOKING WEST

1"=1'-0"

4.1

BID ADD ALTERNATES

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SITE KEYNOTES:

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2.0	**JOINTING**			
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2.2	Expansion Joint	6 / L7-01		
3.0	**STEPS**			
3.1	Stairs	3 / L7-01		033000
4.0	**SITE WALLS/ EMBANKMENTS**			
4.1	Site Wall	4 / L7-01	1&2 / L7-07	033000
5.0	**SITE FURNITURE**			
5.1	Bench - By City (Add Alt #1)			
5.2	Trash/Recycling (Add Alt #2)	1 / L7-06		129300
5.3	Bicycle Rack - By City			
6.0	**RAILINGS, BARRIERS, FENCING**			
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6.3	Pedestrian Gate - Type 2 (Single)	3 / L7-02		323116
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6.5	Vehicular Gate - Type 2 (Double Swing)	1 / L7-03		323116
6.6	Vehicular Gate - Type 3 (Swing)	1 / L7-04		323116
6.7	Handrail	4 / L7-02		055213
6.8	Dumpster Enclosure	1 / L7-05		323116
6.9	Dumpster Enclosure Gate	2 / L7-05		323116
7.0	**SITE LIGHTING**			
	SEE LIGHTING/ELECTRICAL DRAWINGS			
8.0	**DRAINAGE**			
	SEE CIVIL DRAWINGS			
9.0	**PLANTING AND LANDSCAPE**			
	SEE PLANTING SERIES			
10.0	**MISCELLANEOUS ELEMENTS**			
10.1	Soundboard Trench Grate	7 / L7-01		334600
10.2	Sign- No Parking	3 / L7-05		101426
10.3	Sign- Event Staff Only	4 / L7-05		101426

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LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: AA REVIEWED: PS

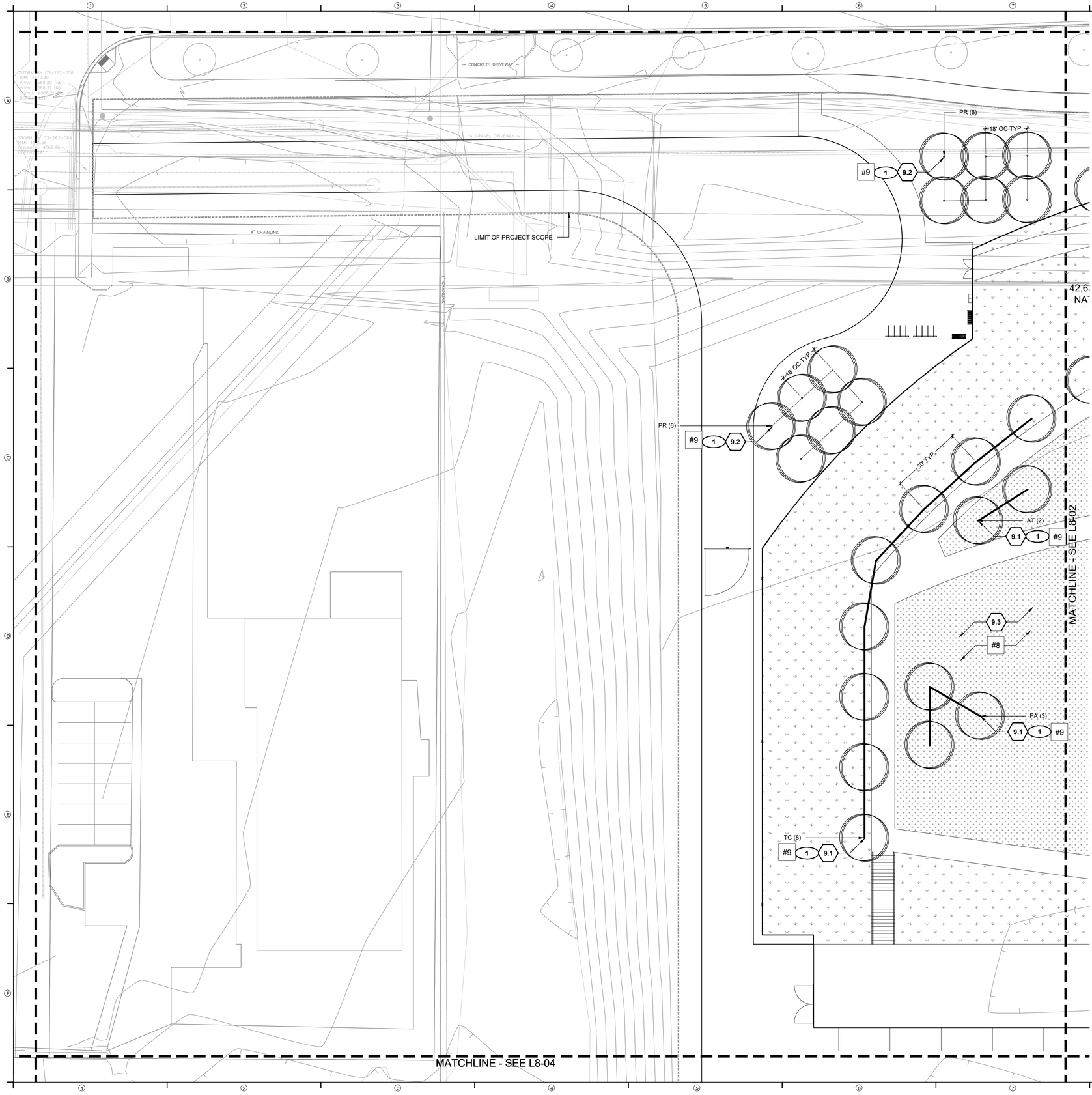
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE DETAILS

SHEET NUMBER

L7-06



SITE KEYNOTES:

		DETAIL / SHEET	SPEC. SECTION
9.0	**PLANTING AND LANDSCAPE**		
9.1	Deciduous Tree Planting (Add Alt #4)	1 / L9-01	329300
9.2	Deciduous Tree Planting in Decomposed Gravel - Type 1 (Add Alt #4)	2 / L9-01	329300
9.3	Sod (Add Alt #3)	3 / L9-01	329200
9.4	Soil Type 1 - Planting (Enriched)		329113
9.5	Soil Type 2 - Planting (Native Grass)		329113
9.6	Soil Type 3		329113

PLANTING LIST

ABBR.	BOTANICAL NAME	COMMON NAME	SIZE	QTY
TREES				
AT	*Acer truncatum x Acer platanoides 'Keithsform'*	Norwegian Sunset Maple	2.5" cal	5
GD	*Gymnocladus dioicus*	Kentucky Coffeetree	2.5" cal	3
PA	*Platanus x acerifolia 'Morton Circle*	Exclamation! Planetree	2.5" cal	6
PR	*Prunus cerasifera 'Newport'*	Newport Plum	2.5" cal	23
PC	*Pyrus calleryana*	Redspire Callery Pear	2.5" cal	12
TC	*Tilia cordata*	Littleleaf Linden	2.5" cal	31
ANNUALS, GRASSES, SEED MIXES AND EDGING				
	Native Seed Mix		64,670 SF	
	Blue Grama	*Bouteloua gracilis*	15%	
	Mexican Feathergrass	*Nassella tenuissima*	*70%*	
	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*	*15*	
	Turf (Seed)		62,865 SF	

SITE PLANTING REERENCE NOTES

1 Trees to be located in field by Landscape Architect.

BID ADD ALTERNATES

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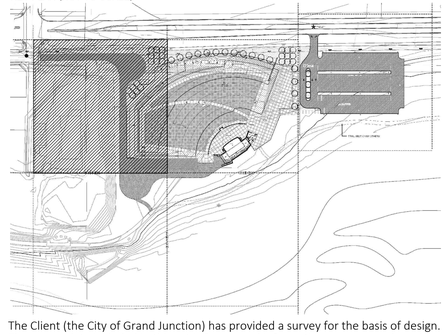

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NORTH

0 10 20 40
ORIGINAL SCALE: 1"=20'-0"

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LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

MICHAEL JOE ALBERT 0000829 08/07/2009 Colorado State of Licensure STATE OF COLORADO LICENSED LANDSCAPE ARCHITECT

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

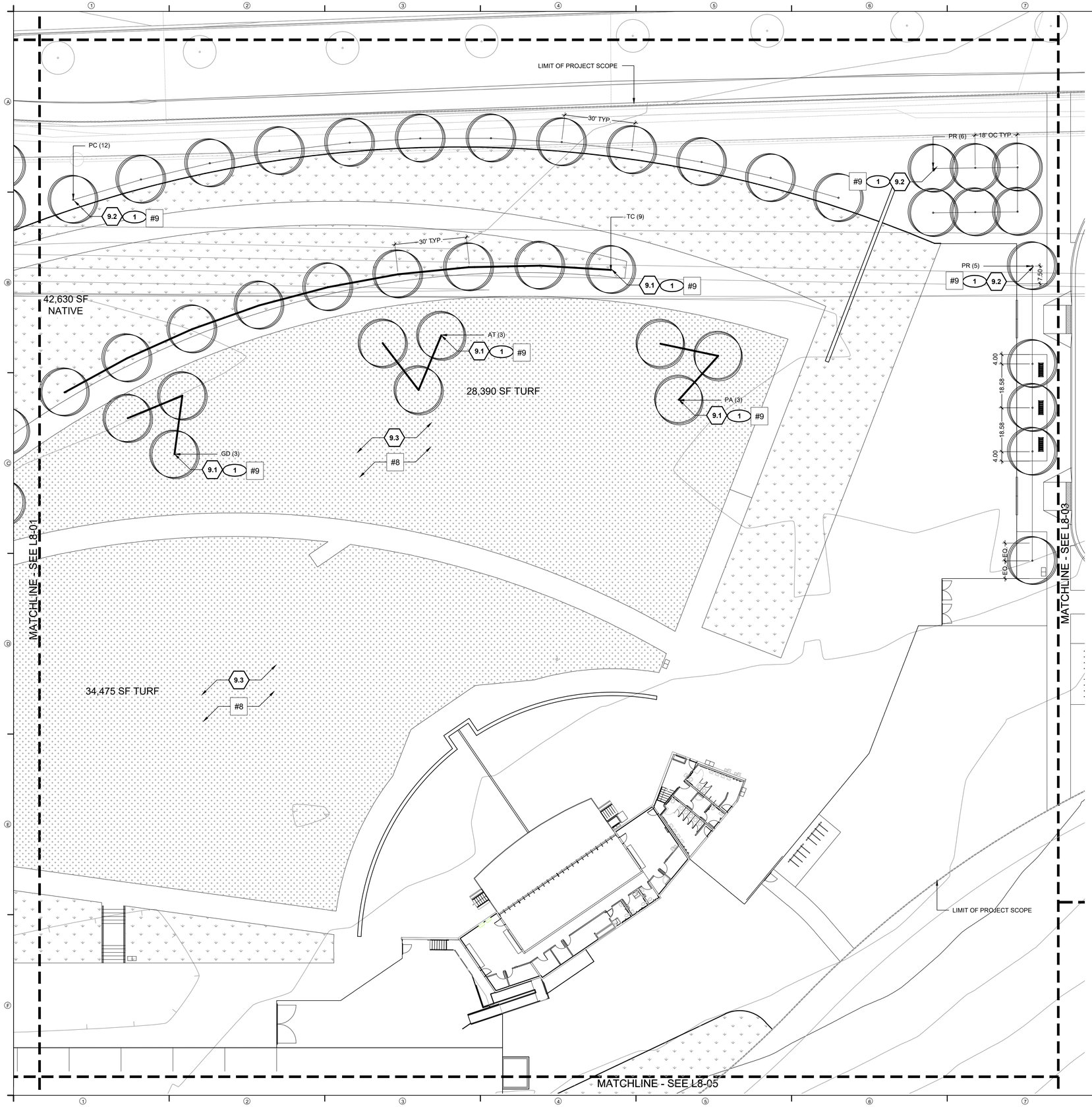
DRAWN: AA REVIEWED: PS

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE PLANTING SERIES

SHEET NUMBER
L8-01



SITE KEYNOTES:

		DETAIL / SHEET	SPEC. SECTION
9.0	**PLANTING AND LANDSCAPE**		
9.1	Deciduous Tree Planting (Add Alt #4)	1 / L9-01	329300
9.2	Deciduous Tree Planting in Decomposed Gravel - Type 1 (Add Alt #4)	2 / L9-01	329300
9.3	Sod (Add Alt #3)	3 / L9-01	329200
9.4	Soil Type 1 - Planting (Enriched)		329113
9.5	Soil Type 2 - Planting (Native Grass)		329113
9.6	Soil Type 3		329113

PLANTING LIST

ABBR.	BOTANICAL NAME	COMMON NAME	SIZE	QTY
TREES				
AT	*Acer truncatum x Acer platanoides 'Keithsform'*	Norwegian Sunset Maple	2.5" cal	5
GD	*Gymnocladus dioicus*	Kentucky Coffeetree	2.5" cal	3
PA	*Platanus x acerifolia 'Morton Circle*	Exclamation! Planetree	2.5" cal	6
PR	*Prunus cerasifera 'Newport'*	Newport Plum	2.5" cal	23
PC	*Pyrus calleryana*	Redspire Callery Pear	2.5" cal	12
TC	*Tilia cordata*	Littleleaf Linden	2.5" cal	31
ANNUALS, GRASSES, SEED MIXES AND EDGING				
	Native Seed Mix			64,670 SF
	Blue Grama	*Bouteloua gracilis*		15%
	Mexican Feathergrass	*Nassella tenuissima*		*70%*
	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*		*15*
	Turf (Seed)			62,865 SF

SITE PLANTING REERENCE NOTES

1 Trees to be located in field by Landscape Architect.

BID ADD ALTERNATES

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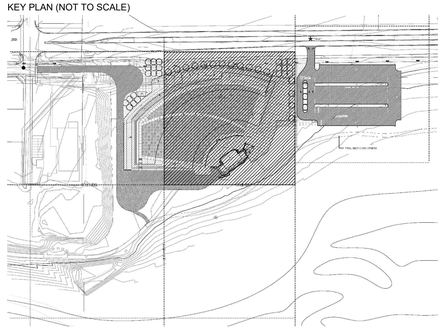

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NORTH

0 10 20 40
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MICHAEL JOE ALBERT 0000829 08/07/2009 Original Date of Licensure STATE OF COLORADO LICENSED LANDSCAPE ARCHITECT

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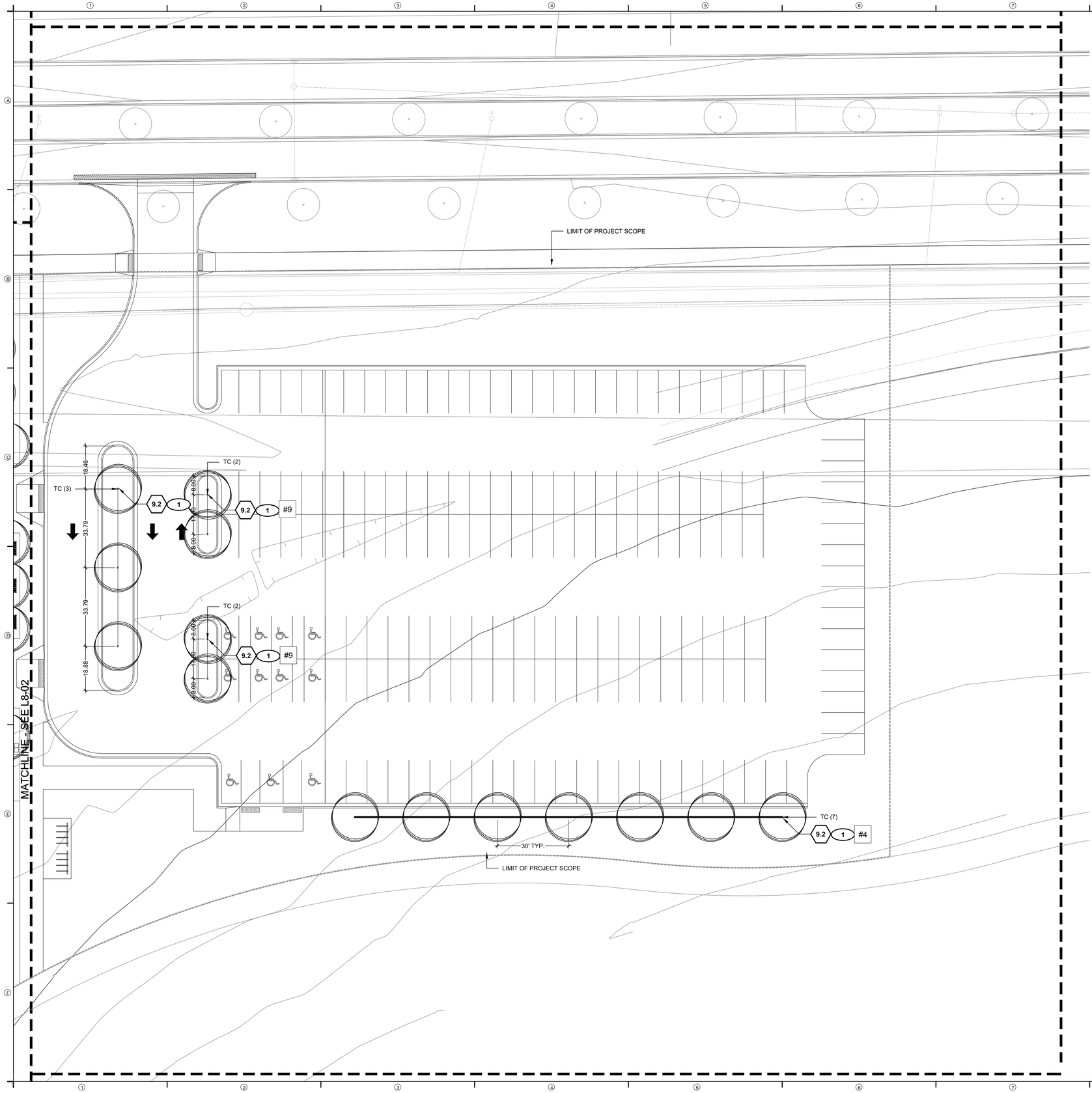
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE PLANTING SERIES

SHEET NUMBER

L8-02



SITE KEYNOTES:

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9.2	Deciduous Tree Planting in Decomposed Gravel - Type 1 (Add Alt #4)	2 / L9-01	329300
9.3	Sod (Add Alt #3)	3 / L9-01	329200
9.4	Soil Type 1 - Planting (Enriched)		329113
9.5	Soil Type 2 - Planting (Native Grass)		329113
9.6	Soil Type 3		329113

PLANTING LIST

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GD	*Gymnocladus dioicus*	Kentucky Coffeetree	2.5" cal	3
PA	*Platanus x acerifolia 'Morton Circle*	Exclamation! Planetree	2.5" cal	6
PR	*Prunus cerasifera 'Newport'*	Newport Plum	2.5" cal	23
PC	*Pyrus calleryana*	Redspire Callery Pear	2.5" cal	12
TC	*Tilia cordata*	Littleleaf Linden	2.5" cal	31
ANNUALS, GRASSES, SEED MIXES AND EDGING				
	Native Seed Mix			64,670 SF
	Blue Grama	*Bouteloua gracilis*		15%
	Mexican Feathergrass	*Nassella tenuissima*		*70%*
	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*		*15*
	Turf (Seed)			62,865 SF

SITE PLANTING REERENCE NOTES

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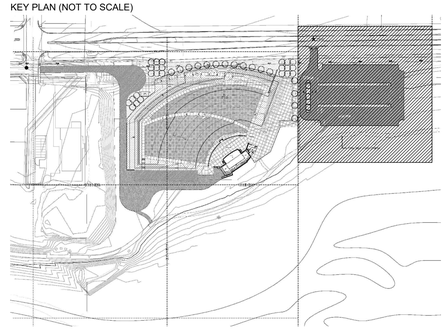

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DRAWN: AA REVIEWED: PS

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 5272

SITE PLANTING SERIES

SHEET NUMBER

L8-03

MATCHLINE - SEE L8-01

22,040 SF
NATIVE

LIMIT OF PROJECT SCOPE

MATCHLINE - SEE L8-05

SITE KEYNOTES:

		DETAIL / SHEET	SPEC. SECTION
9.0	**PLANTING AND LANDSCAPE**		
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9.3	Sod (Add Alt #3)	3 / L9-01	329200
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	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*		*15*
	Turf (Seed)			62,865 SF

SITE PLANTING REERENCE NOTES

1 Trees to be located in field by Landscape Architect.

BID ADD ALTERNATES

#6 5.1 Benches
The base bid excludes bench procurement and installation. The Add Alternate #6 is for the contractor to procure and install benches in the project.

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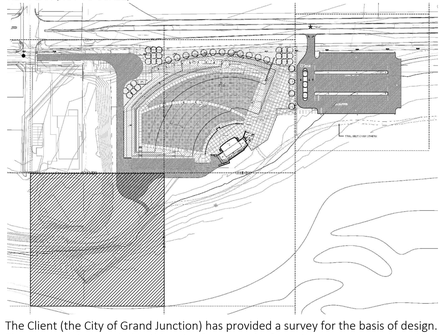

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NORTH

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MICHAEL JOE ALBERT
0000829
08/07/2009
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ISSUE DATE: July 15, 2016

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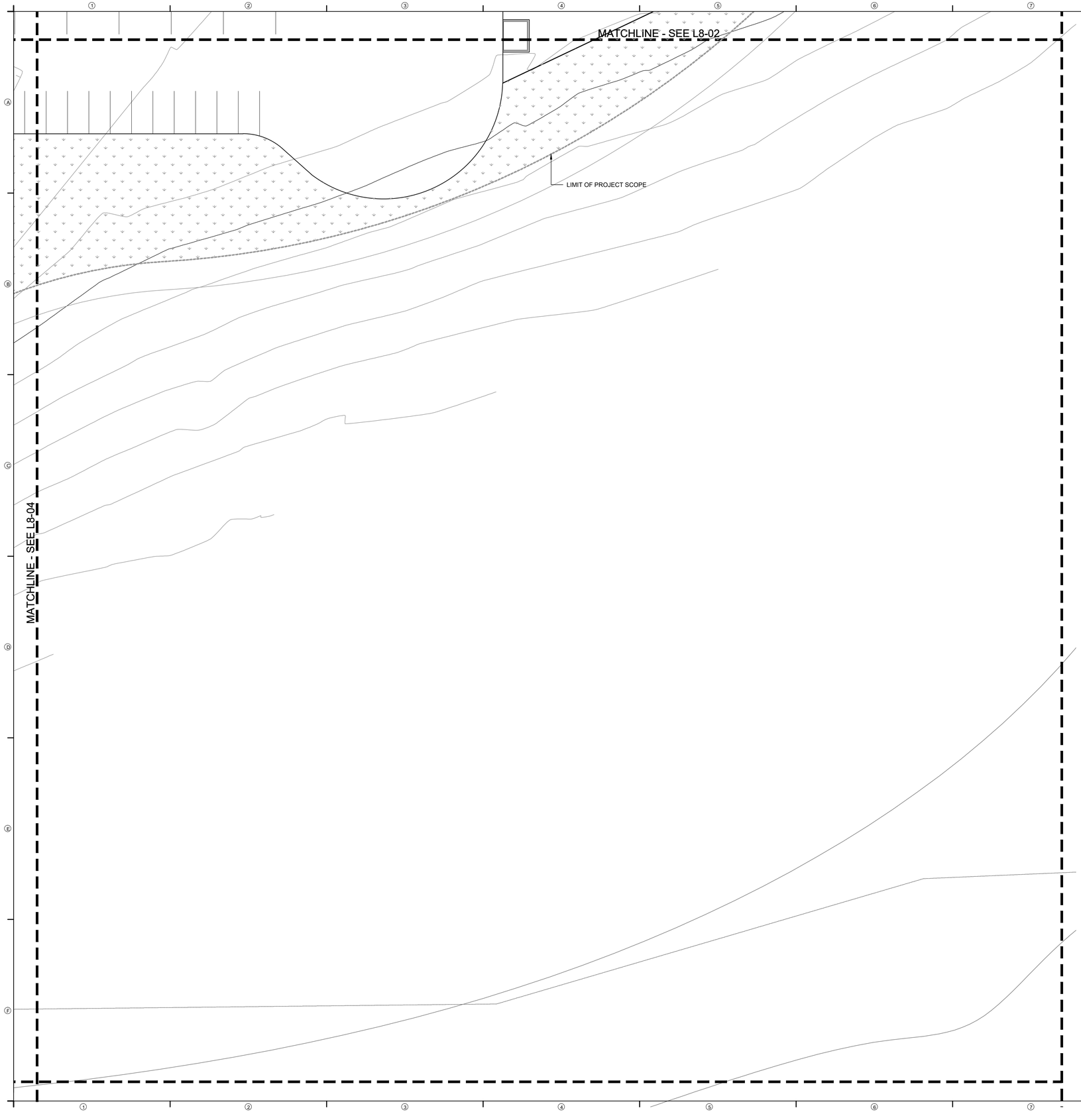
PROJECT NUMBER: 5272

SITE PLANTING SERIES

SHEET NUMBER
L8-04



SITE KEYNOTES:

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9.4	Soil Type 1 - Planting (Enriched)		329113
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9.6	Soil Type 3		329113

PLANTING LIST

ABBR.	BOTANICAL NAME	COMMON NAME	SIZE	QTY
TREES				
AT	*Acer truncatum x Acer platanoides 'Keithsform'*	Norwegian Sunset Maple	2.5" cal	5
GD	*Gymnocladus dioicus*	Kentucky Coffeetree	2.5" cal	3
PA	*Platanus x acerifolia 'Morton Circle*	Exclamation! Planetree	2.5" cal	6
PR	*Prunus cerasifera 'Newport'*	Newport Plum	2.5" cal	23
PC	*Pyrus calleryana*	Redspire Callery Pear	2.5" cal	12
TC	*Tilia cordata*	Littleleaf Linden	2.5" cal	31
ANNUALS, GRASSES, SEED MIXES AND EDGING				
	Native Seed Mix		64,670 SF	
	Blue Grama	*Bouteloua gracilis*	15%	
	Mexican Feathergrass	*Nassella tenuissima*	*70%*	
	'Arriba' Western Wheatgrass	*Pascopyrum smithii 'Arriba'*	*15*	
	Turf (Seed)		62,865 SF	

SITE PLANTING REERENCE NOTES

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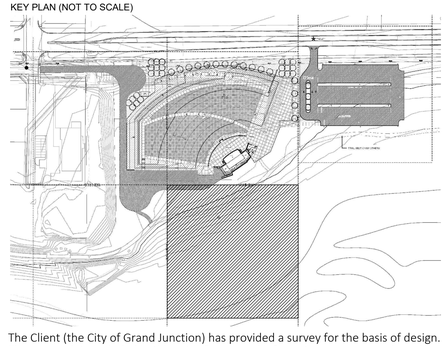

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SITE PLANTING SERIES

SHEET NUMBER
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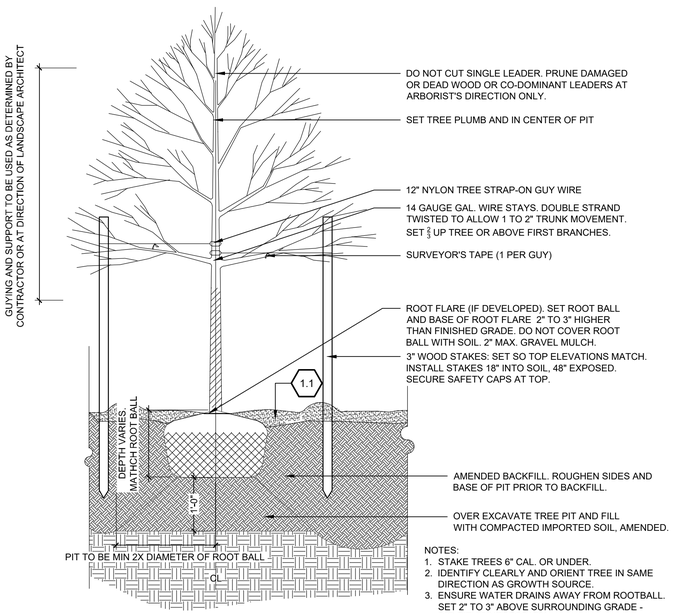
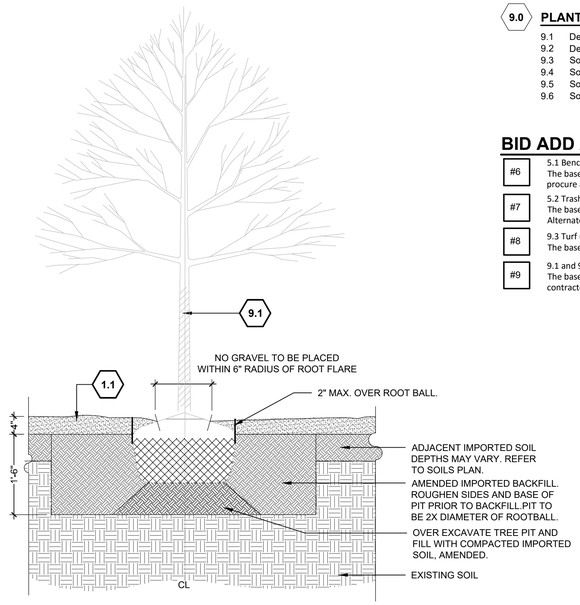


NOTES:
1. STAKE TREES 6" CAL. OR UNDER.
2. IDENTIFY CLEARLY AND ORIENT TREE IN SAME DIRECTION AS GROWTH SOURCE.
3. ENSURE WATER DRAINS AWAY FROM ROOTBALL. SET 2" TO 3" ABOVE SURROUNDING GRADE - DIG PIT AS NECESSARY
4. ALIGN TRUNKS WHEN PLANTED IN ROWS.
5. REMOVE ALL WIRE BASKETS AND BURLAP.

1 DECIDUOUS TREE PLANTING

3/4"=1'-0"

9.1

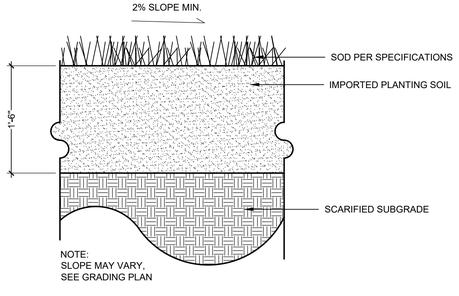


2 DECIDUOUS TREE PLANTING IN DECOMPOSED GRAVEL - TYPE 1

3/4"=1'-0"

9.2

#8



3 LAWN / SOD

1"=1'-0"

9.3

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PLANTING DETAILS

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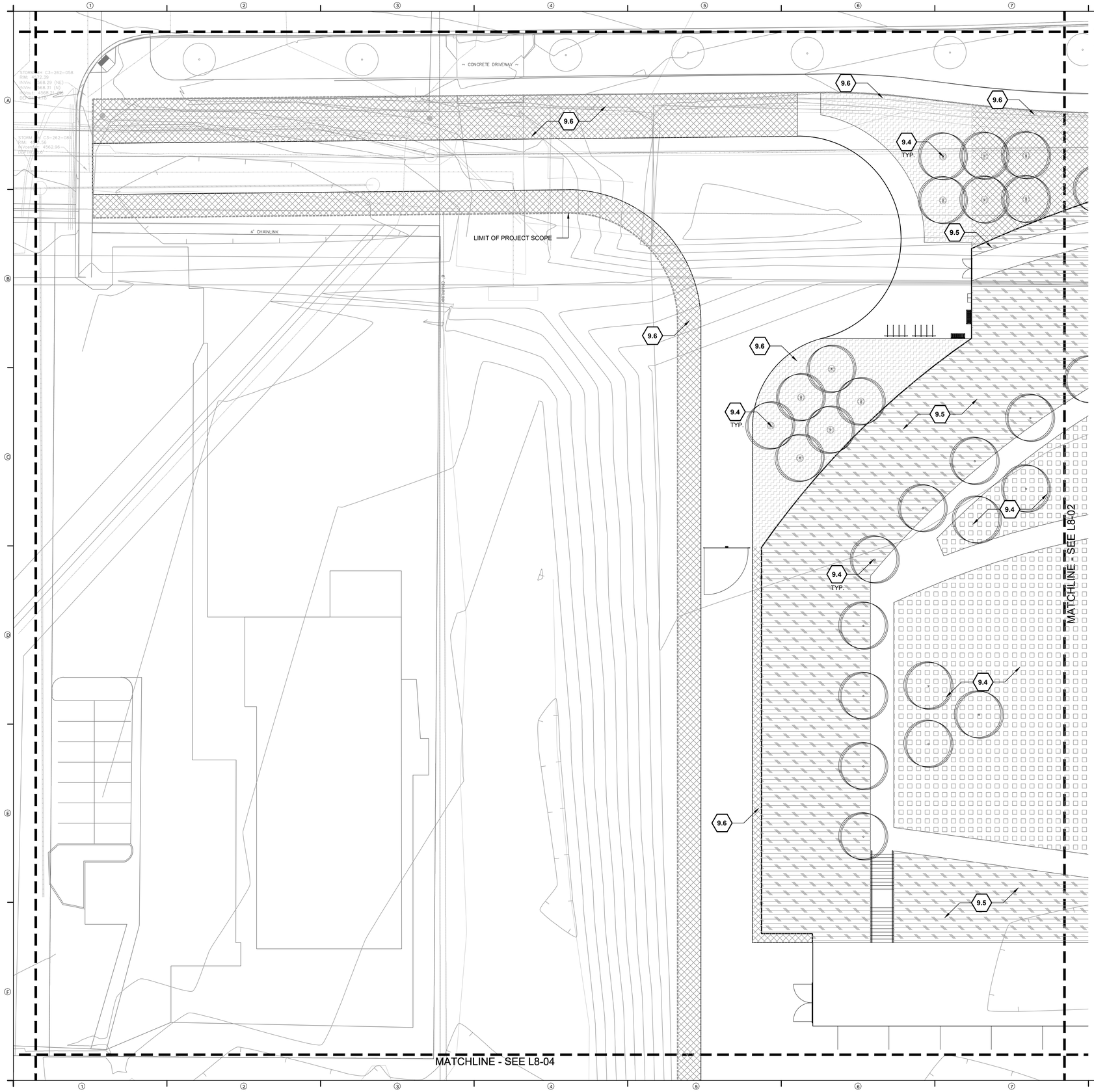

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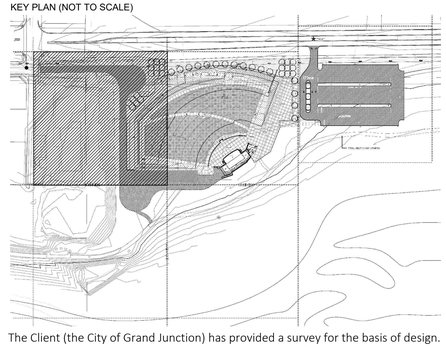

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SITE SOILS SERIES

SHEET NUMBER
L10-01

LIMIT OF PROJECT SCOPE

9.6
9.4 TYP.
9.4 TYP.
9.5
9.5
9.4 TYP.
9.4
9.4 TYP.
9.6
9.5
9.6
9.4
9.5
9.5
9.6
9.5
9.6
LIMIT OF PROJECT SCOPE
9.5

MATCHLINE - SEE L8-01

MATCHLINE - SEE L8-03

MATCHLINE - SEE L8-05

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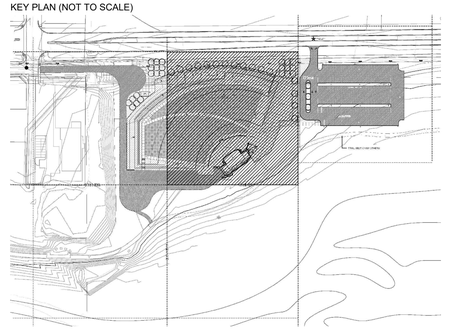

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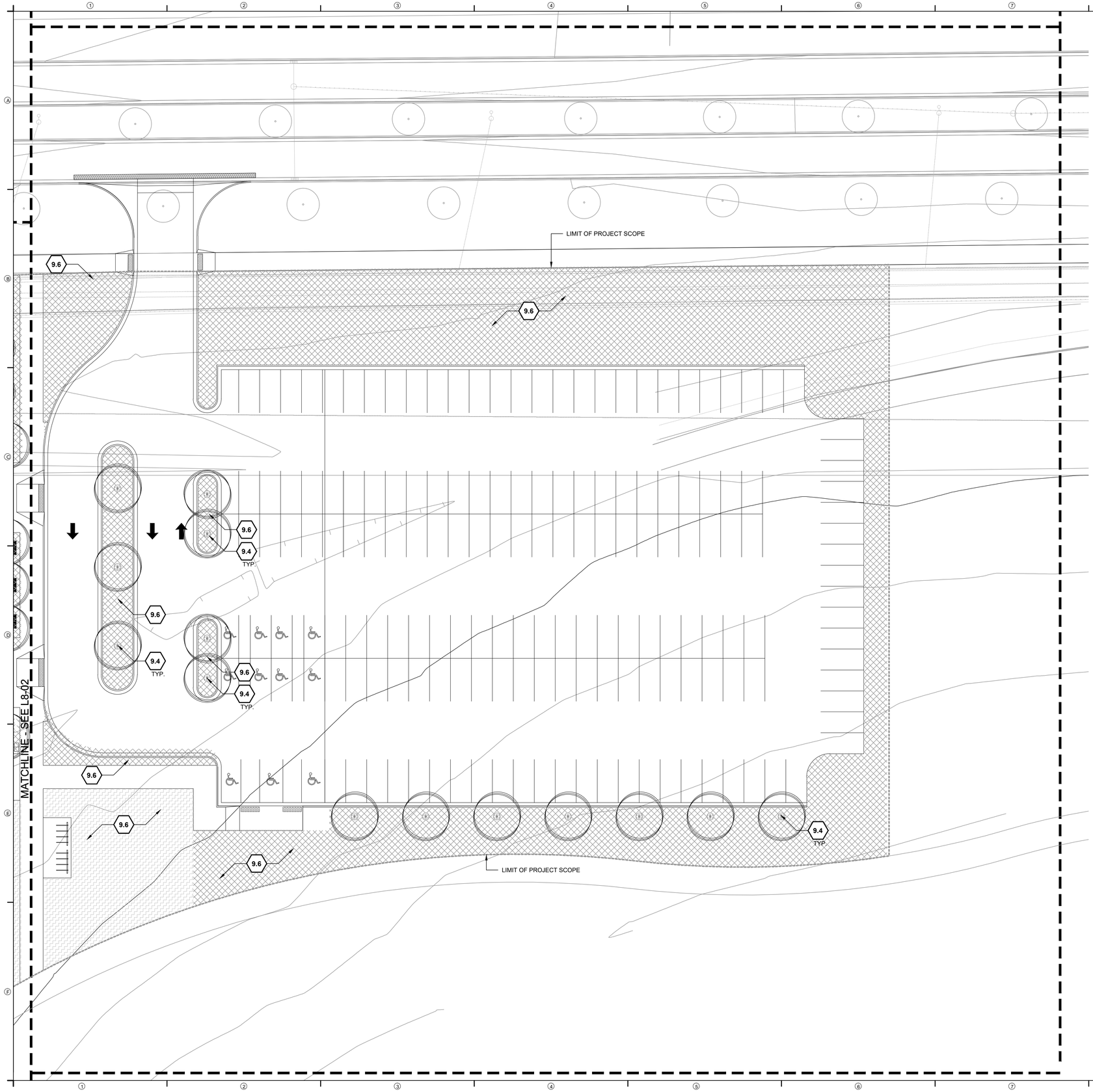
SITE SOILS SERIES

SHEET NUMBER
L10-02



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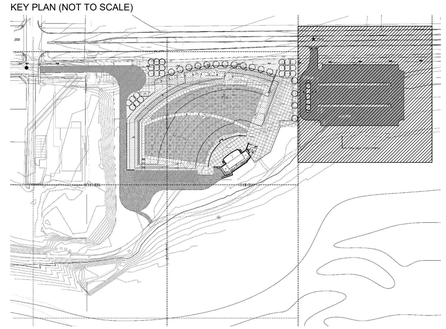

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SITE SOILS SERIES

SHEET NUMBER
L10-03

MATCHLINE - SEE L8-01

MATCHLINE - SEE L8-05

9.6

9.5

LIMIT OF PROJECT SCOPE

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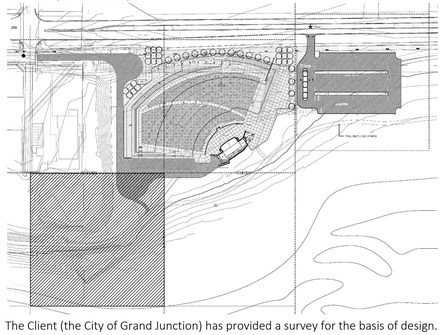

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SHEET NUMBER

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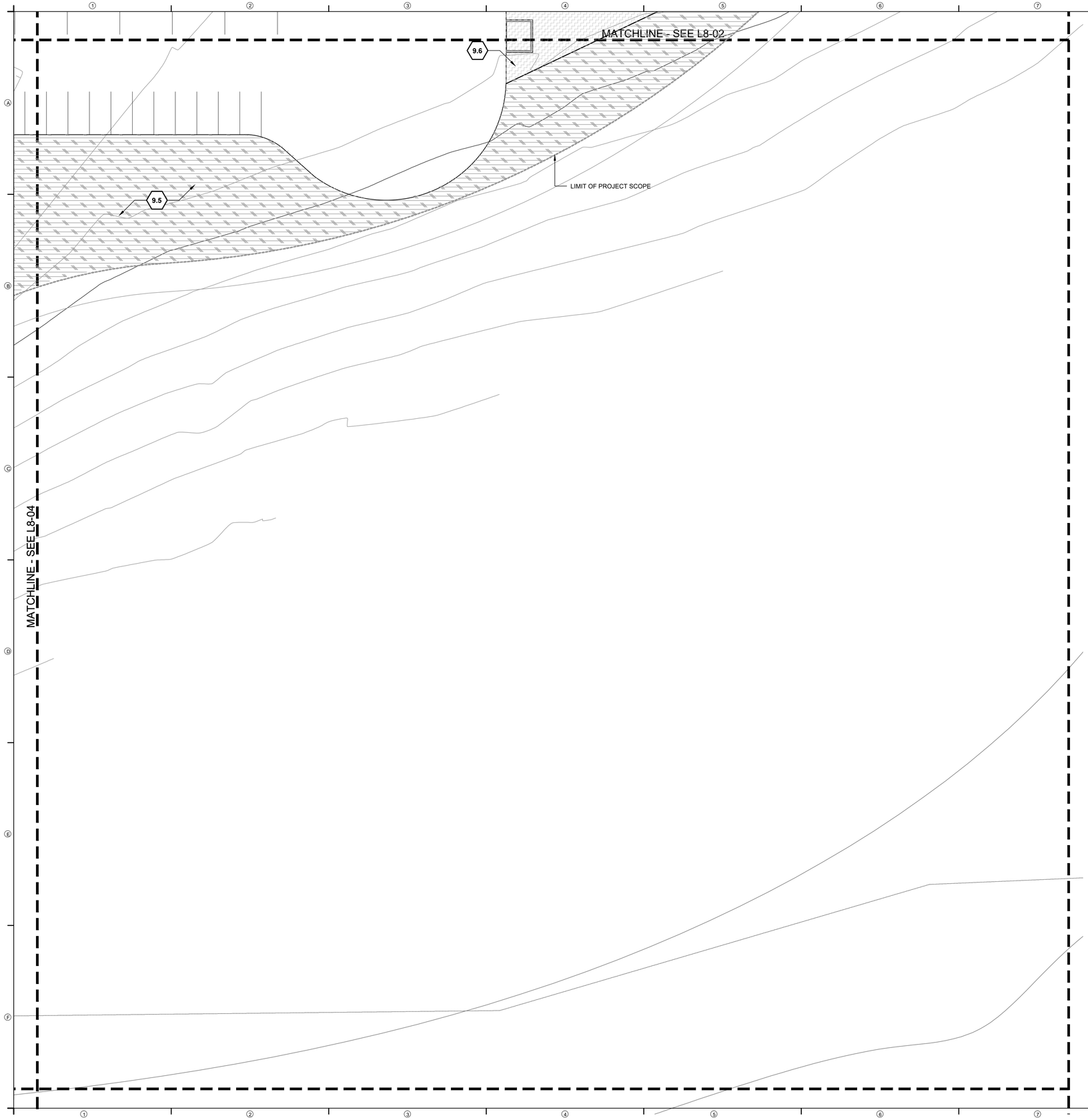

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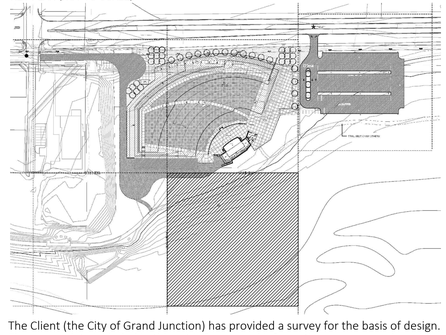

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SITE SOILS SERIES

SHEET NUMBER
L10-05

INSTALL SLEEVES BEFORE PAVING AND SURFACING
FOR FUTURE IRRIGATION EXPANSION

COORDINATE WITH CIVIL SITE DEVELOPMENT
ASBUILT SURVEY- LOCATION AND TOP ELEVATION

INSTALL BACKFLOW PREVENTER,
MASTER VALVE & FLOW SENSOR

CONNECT TO DOMESTIC WATER SUPPLY 2" TAP & METER
REFERENCE CIVIL WATER PLANS

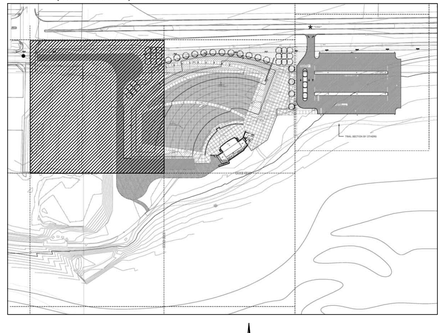
INSTALL IRRIGATION
CONTROLLER RAIN BIRD
ESP40SATLS
COORDINATE WITH MECHANICAL
& ELECTRICAL FOR POWER
SUPPLY

INSTALL SLEEVES BEFORE PAVING AND SURFACING
FOR IRRIGATION

COORDINATE WITH CIVIL SITE DEVELOPMENT
ASBUILT SURVEY- LOCATION AND TOP ELEVATION

WEST
PLAZA

KEY PLAN (NOT TO SCALE)



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Western Heritage
Consulting & Engineering
307.215.7430
www.westernhce.com
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Mills, WY 82644

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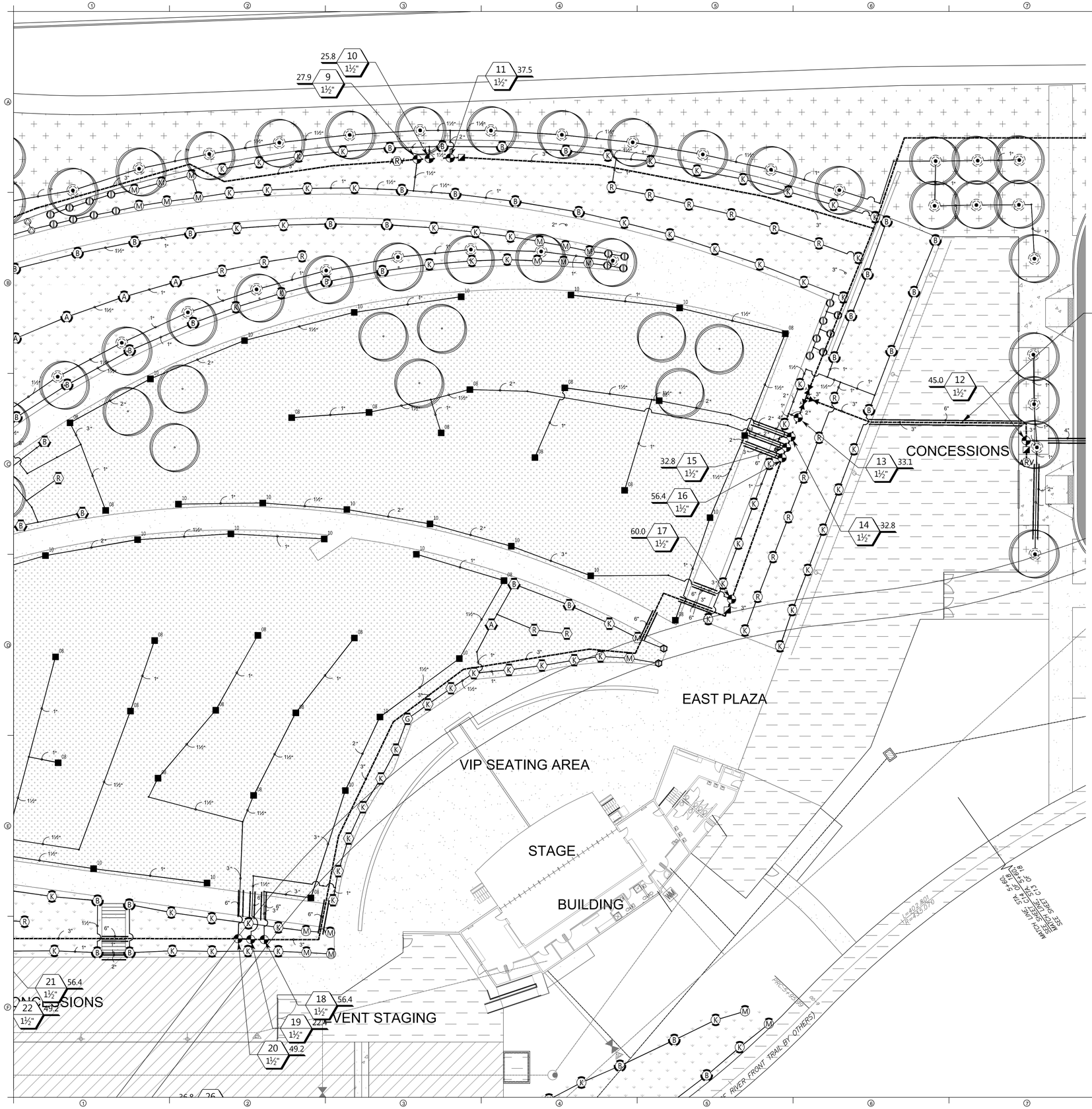
PROJECT NUMBER: 15WHC001

LANDSCAPE IRRIGATION PLAN

SHEET NUMBER

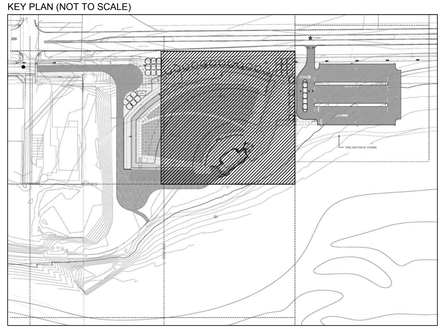
IR-01



INSTALL SLEEVES BEFORE PAVING, CONCRETE AND ALL HARDSCAPE SURFACING FOR IRRIGATION

COORDINATE WITH CIVIL SITE DEVELOPMENT ASBUILT SURVEY- LOCATION AND TOP ELEVATION

KEY PLAN (NOT TO SCALE)



NORTH

0 10 20 40

ORIGINAL SCALE: 1"=20'-00"

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Mills, WY 82644

LAS COLONIAS AMPHITHEATER

GRAND JUNCTION, COLORADO

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: JSS REVIEWED: RLA

100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 15WHC001

LANDSCAPE IRRIGATION PLAN

SHEET NUMBER

IR-02

CONTRACTOR SHALL REPAIR DAMAGE TO ALL EXISTING
IRRIGATION DAMAGED DURING CONSTRUCTION
ADD ADDITIONAL SLEEVING AS NECESSARY

INSTALL SLEEVES BEFORE PAVING AND SURFACING
FOR FUTURE & EXISTING IRRIGATION EXPANSION

COORDINATE WITH CIVIL SITE DEVELOPMENT
ASBUILT SURVEY- LOCATION AND TOP ELEVATION

EXTEND 2 EXTRA ZONE WIRES
& COMMON WIRE FOR FUTURE EXPANSION
INSTALL STANDARD VALVE BOX AT END OF PIPE
WITH AIR VENT & QUICK COUPLER

INSTALL SLEEVES BEFORE SURFACING
FOR FUTURE IRRIGATION & FUTURE PARKING ISLANDS

COORDINATE WITH CIVIL SITE DEVELOPMENT
ASBUILT SURVEY- LOCATION AND TOP ELEVATION

INSTALL SLEEVES BEFORE PAVING AND SURFACING
FOR IRRIGATION

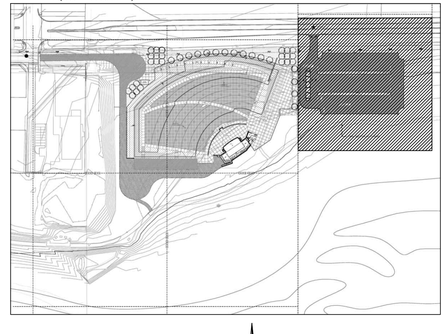
COORDINATE WITH CIVIL SITE DEVELOPMENT
ASBUILT SURVEY- LOCATION AND TOP ELEVATION

SPACES

TRAIL SECTION BY OTHERS

TRAIL 1
(FUTURE RIVER FRONT TRAIL BY OTHERS)

KEY PLAN (NOT TO SCALE)



NORTH

0 10 20 40
ORIGINAL SCALE: 1"=20'-00"

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LANDSCAPE IRRIGATION PLAN

SHEET NUMBER

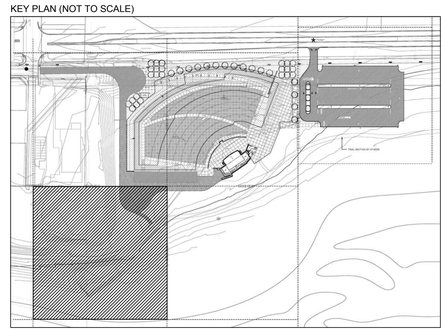
IR-03

INSTALL SLEEVES BEFORE PAVING AND SURFACING FOR IRRIGATION

COORDINATE WITH CIVIL SITE DEVELOPMENT ASBUILT SURVEY- LOCATION AND TOP ELEVATION

22,040 SF NATIVE

KEY PLAN (NOT TO SCALE)



NORTH

0 10 20 40

ORIGINAL SCALE: 1"=20'-00"

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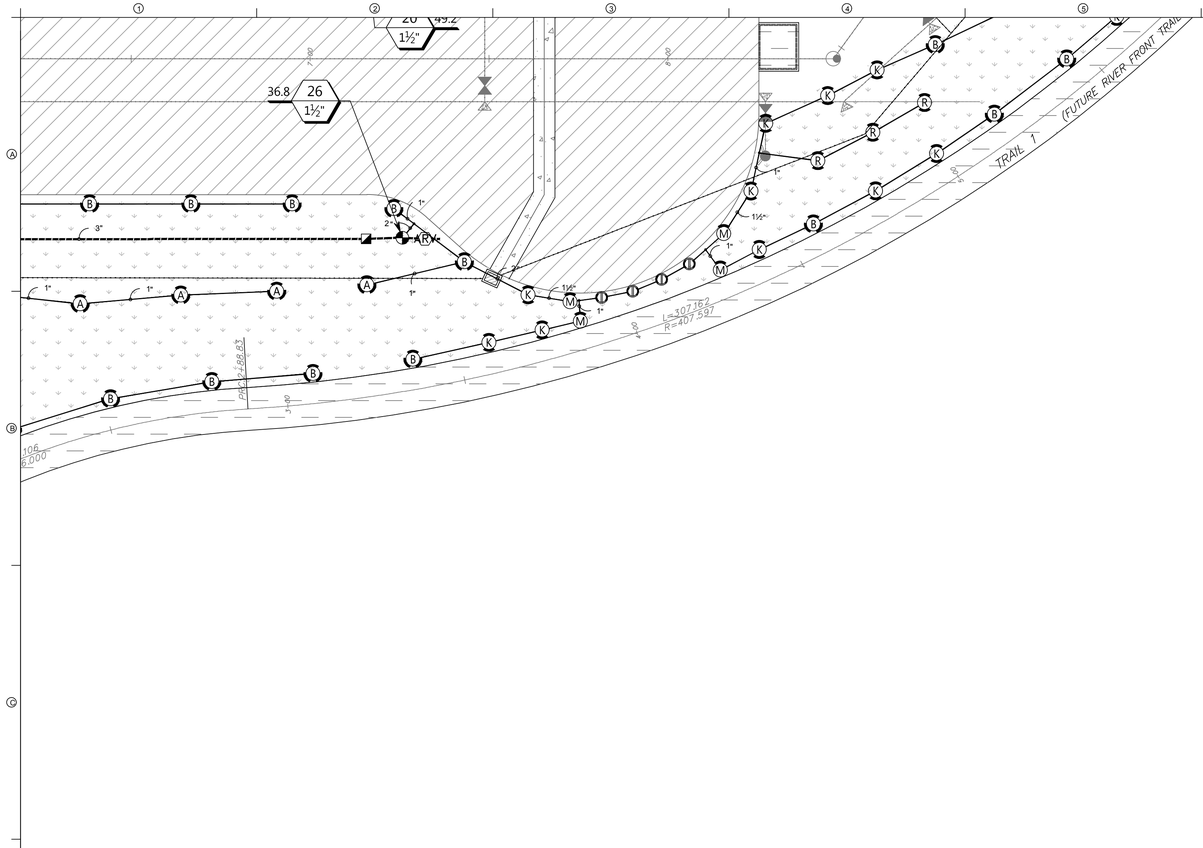
LANDSCAPE IRRIGATION PLAN

SHEET NUMBER

IR-04



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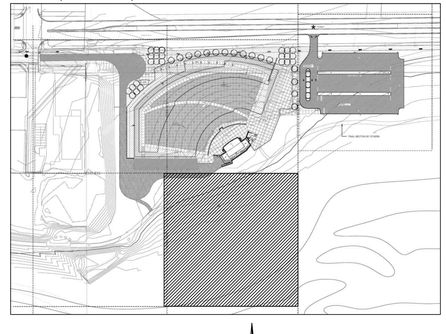

NORTH

0 10 20 40

ORIGINAL SCALE: 1"=20'-00"

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GRAND JUNCTION, COLORADO

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LANDSCAPE IRRIGATION PLAN

SHEET NUMBER

IR-05

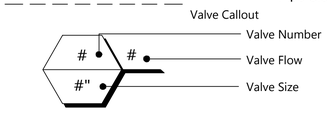
IRRIGATION SCHEDULE

SYMBOL	MANUFACTURER/MODEL	QTY
M	Hunter MP1000 w/ Rain Bird 1804-SAMP45	4
G	Hunter MP2000 w/ Rain Bird 1804-SAMP45	1
K	Hunter MP2000 w/ Rain Bird 1804-SAMP45	16
R	Hunter MP2000 w/ Rain Bird 1804-SAMP45	3
A	Hunter MP3000 w/ Rain Bird 1804-SAMP45	1
B	Hunter MP3000 w/ Rain Bird 1804-SAMP45	6
	Hunter MP800SR w/ Rain Bird 1804-SAMP45	4
M	Hunter MP1000 w/ Rain Bird 1812-SAMP45	22
K	Hunter MP2000 w/ Rain Bird 1812-SAMP45	78
R	Hunter MP2000 w/ Rain Bird 1812-SAMP45	22
A	Hunter MP3000 w/ Rain Bird 1812-SAMP45	30
B	Hunter MP3000 w/ Rain Bird 1812-SAMP45	83
Y	Hunter MP3000 w/ Rain Bird 1812-SAMP45	2
	Hunter MP800SR w/ Rain Bird 1812-SAMP45	23
	Hunter MP Strip w/ Rain Bird 1812-SAMP45	1
	Hunter MP Strip w/ Rain Bird 1812-SAMP45	1
	Hunter MP Strip w/ Rain Bird 1812-SAMP45	6

SYMBOL	MANUFACTURER/MODEL	QTY
08 / 10	Rain Bird F4-PC, FC-SS	28
	Rain Bird F4-PC, FC-SS	27

SYMBOL	MANUFACTURER/MODEL	QTY
X X	Rain Bird 1400 Bubbler Assembly	66
	Cap for future use	2

SYMBOL	MANUFACTURER/MODEL	QTY
	Rain Bird PESB 1-1/2"	25
	Rain Bird PESB 1"	1
	Rain Bird 33-DLRC 3/4"	8
	CI Gate Valve	8
ARV	1" Air Relief Valve-Netadim #65ARIB1	5
BF	Febco 825YA 2" RPA, With GS-4 Guard Shack Enclosure & Polar Parka Insulated PK440	1
CC	Rain Bird ESP40SATLS 40 Station, Controller Stainless Steel Pedistal-Link Communicatoin	1
TAP	2" POC w/ 2" Muller H10283L	1
	Irrigation Lateral Line: PVC Schedule 40 1"	6,240 l.f.
	Irrigation Lateral Line: PVC Schedule 40 1 1/2"	2,520 l.f.
	Irrigation Lateral Line: PVC Schedule 40 2"	1,000 l.f.
	Irrigation Lateral Line: PVC Schedule 40 3"	540 l.f.
3	Irrigation Mainline: PVC Schedule 40 3"	2,060 l.f.
2"	Pipe Sleeve: PVC Schedule 40 2"	300 l.f.
4"	Pipe Sleeve: PVC Schedule 40 4"	220 l.f.
6"	Pipe Sleeve: PVC Schedule 40 6"	440 l.f.



IRRIGATION NOTES:

1. All work shall be per existing City, County and State code and is subject to inspection and approval by appropriate inspectors and/or owner representative. Installer to be responsible for all installation standards, practices and all permit requirements.

2. DESIGN WORKSHOP has provided all base and planting information. Any discrepancies between the Civil, Utility, or Landscaping plans and these Irrigation plans shall be reported by contractor to owner or owner's representative. Contractor assumes all costs and liabilities associated with any field changes to the system design that are made without written consent of owner. See specifications for additional project requirements.

3. The system is designed to operate from the source with a flow of 100 gallons per minute (GPM) at 85 pounds per square inch (PSI) at the point of connection. Irrigation system is designed to operate at manufacturer recommended pressure for the sprinkler heads and drip emittes after the valve. flow control valves shall be adjusted for drip & spray zones and small rotors.

4. All pipe to be sleeved wherever concrete, asphalt, or any hard surfaces or boulders are to be overlaid. All sleeves to be 2 times the diameter of the pipe to be sleeved. Main line sleeves to have an additional 4" inch sleeve in parallel for control wires.

5. Irrigation plan is a diagrammatic single line drawing. All equipment and materials must be installed within property limits, easements, and landscaped areas unless otherwise specifically noted. Equipment and materials shown outside of these limits are for clarity only. Multiple pipes may be installed in the same trench when proper pipe spacing can be maintained.

6. Main line to be buried 24" (inch) to top of pipe.

7. Control wires to be routed with main line and attached at 24" increments with plastic wire ties or duct tape. Wire splices to be located in a 10" (inch) round or larger valve box at least.

8. Swing pipe to be used on all sprinkler heads under 5 GPM and swing joints on all heads over 5 GPM. Maximum length of swing pipe to be 5' (foot).

9. Isolation valves to be located in 10" (inch) round valve box or larger, or per details shown on drawings.

10. For obstructions (Electrical Transformers, Trees, Fire Hydrants, etc...), that will interfere with proper coverage of sprinkler heads, will require the addition of properly patterned heads around obstruction as to provide head to head coverage to all irrigated areas. All sprinklers shall be adjusted by contractor for maximum uniformity following installation.

11. Sprinkler heads to be set perpendicular to finished grade and adjusted to prevent over spray onto non irrigated areas.

12. Laterals are sized at transitions only, segments that are not noted will be the same size as adjacent segments. Upstream segments will never be smaller than any down stream segments on the same lateral.

14. Zone schedule and watering times are based on 100% ET. Weather and microclimate conditions may vary across the site and the zone run times may need to be adjusted. The zone schedule does not take into account soil types and infiltration rate. Soil absorption rates in this area may be low enough to require multiple start times to apply water without runoff, i.e. wasting water.

15. Quick coupler valves to be field located per plans. Minimum one every 200 lf on main line, requiring additional quick couplers beyond that shown on the plans. Owner shall be coordinated with for placemetn of additional quick couplers, contractor shall provide seven days notice to owner for location of quick couplers.

16. Exact flow configuration may need to be adjusted based on water requirements from plant supplier. As plants become more established, flows and run times will need to be readjusted.

VALVE SCHEDULE

NUMBER	MODEL	SIZE	TYPE	PSI	PSI @ POC	GPM	PRECIP
1	Rain Bird PESB	1-1/2"	Native Rotary	50.08	62.18	32.63	0.34 in/h
2	Rain Bird PESB	1-1/2"	Turf Rotor	66.18	78.46	50.00	0.90 in/h
3	Rain Bird PESB	1-1/2"	Native Rotary	52.36	64.50	42.29	0.30 in/h
4	Rain Bird PESB	1-1/2"	Bubbler Asmb	47.15	59.29	34.50	5.11 in/h
5	Rain Bird PESB	1"	Turf Rotary	44.47	56.79	11.43	0.39 in/h
6	Rain Bird PESB	1-1/2"	Native Rotary	52.26	64.36	38.47	0.29 in/h
7	Rain Bird PESB	1-1/2"	Turf Rotor	66.98	79.66	56.40	1.11 in/h
8	Rain Bird PESB	1-1/2"	Native Rotary	49.96	62.11	35.56	0.30 in/h
9	Rain Bird PESB	1-1/2"	Native Rotary	51.73	64.09	27.93	0.36 in/h
10	Rain Bird PESB	1-1/2"	Native Rotary	50.76	63.13	25.83	0.31 in/h
11	Rain Bird PESB	1-1/2"	Bubbler Asmb	47.84	60.18	37.50	5.11 in/h
12	Rain Bird PESB	1-1/2"	Bubbler Asmb	47.46	60.28	45.00	5.11 in/h
13	Rain Bird PESB	1-1/2"	Native Rotary	50.23	62.59	33.06	0.51 in/h
14	Rain Bird PESB	1-1/2"	Turf Rotor	65.03	77.39	32.80	0.50 in/h
15	Rain Bird PESB	1-1/2"	Turf Rotor	65.89	78.25	32.80	0.58 in/h
16	Rain Bird PESB	1-1/2"	Turf Rotor	67.02	80.19	56.40	1.15 in/h
17	Rain Bird PESB	1-1/2"	Turf Rotor	66.74	80.06	60.00	0.73 in/h
18	Rain Bird PESB	1-1/2"	Turf Rotor	67.10	79.92	56.40	1.13 in/h
19	Rain Bird PESB	1-1/2"	Turf Rotary	46.98	59.32	22.35	0.46 in/h
20	Rain Bird PESB	1-1/2"	Turf Rotor	65.58	78.10	49.20	0.52 in/h
21	Rain Bird PESB	1-1/2"	Turf Rotor	66.54	79.23	56.40	0.97 in/h
22	Rain Bird PESB	1-1/2"	Turf Rotor	65.19	77.60	49.20	0.48 in/h
23	Rain Bird PESB	1-1/2"	Native Rotary	50.24	62.52	25.43	0.50 in/h
24	Rain Bird PESB	1-1/2"	Native Rotary	50.57	62.97	41.46	0.36 in/h
25	Rain Bird PESB	1-1/2"	Native Rotary	50.77	63.27	43.27	0.34 in/h
26	Rain Bird PESB	1-1/2"	Native Rotary	51.21	63.88	36.85	0.49 in/h

WATERING SCHEDULE

NUMBER	MODEL	TYPE	PRECIP	IN./WEEK	MIN./WEEK	GAL./WEEK	GAL./DAY
1	Rain Bird PESB	Shrub Rotary	0.34 in/h	2	350	11,419	3,806
2	Rain Bird PESB	Turf Rotor	0.90 in/h	2.50	167	8,350	2,783
3	Rain Bird PESB	Shrub Rotary	0.30 in/h	2	395	16,704	5,568
4	Rain Bird PESB	Bubbler Asmb	5.11 in/h	2.50	29	1,000	333
5	Rain Bird PESB	Turf Rotary	0.39 in/h	2.50	382	4,367	1,456
6	Rain Bird PESB	Shrub Rotary	0.29 in/h	2	412	15,850	5,283
7	Rain Bird PESB	Turf Rotor	1.11 in/h	2.50	135	7,614	2,538
8	Rain Bird PESB	Shrub Rotary	0.30 in/h	2	398	14,153	4,718
9	Rain Bird PESB	Shrub Rotary	0.36 in/h	2	331	9,245	3,082
10	Rain Bird PESB	Shrub Rotary	0.31 in/h	2	389	10,050	3,350
11	Rain Bird PESB	Bubbler Asmb	5.11 in/h	2.50	29	1,088	363
12	Rain Bird PESB	Bubbler Asmb	5.11 in/h	2.50	29	1,305	435
13	Rain Bird PESB	Shrub Rotary	0.51 in/h	2	234	7,737	2,579
14	Rain Bird PESB	Turf Rotor	0.50 in/h	2.50	298	9,774	3,258
15	Rain Bird PESB	Turf Rotor	0.58 in/h	2.50	257	8,430	2,810
16	Rain Bird PESB	Turf Rotor	1.15 in/h	2.50	131	7,388	2,463
17	Rain Bird PESB	Turf Rotor	0.73 in/h	2.50	206	12,360	4,120
18	Rain Bird PESB	Turf Rotor	1.13 in/h	2.50	133	7,501	2,500
19	Rain Bird PESB	Turf Rotary	0.46 in/h	2.50	328	7,331	2,444
20	Rain Bird PESB	Turf Rotor	0.52 in/h	2.50	291	14,317	4,772
21	Rain Bird PESB	Turf Rotor	0.97 in/h	2.50	155	8,742	2,914
22	Rain Bird PESB	Turf Rotor	0.48 in/h	2.50	311	15,301	5,100
23	Rain Bird PESB	Shrub Rotary	0.50 in/h	2	242	6,153	2,051
24	Rain Bird PESB	Shrub Rotary	0.36 in/h	2	330	13,683	4,561
25	Rain Bird PESB	Shrub Rotary	0.34 in/h	2	352	15,233	5,078
26	Rain Bird PESB	Shrub Rotary	0.49 in/h	2	247	9,101	3,034
TOTALS:					6,561	244,196	81,399

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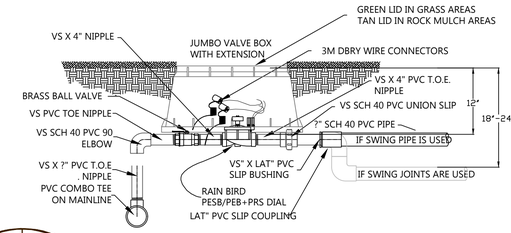
IRRIGATION SCHEDULE & LEGEND

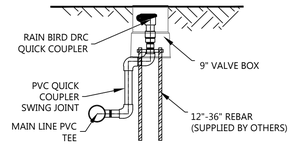
SHEET NUMBER

IR-06



W.f 1 RAINBIRD PESB/PEB ELECTRIC VALVE W/ BALL VALVE AND UNION

VS=VALVE SIZE (NTS)

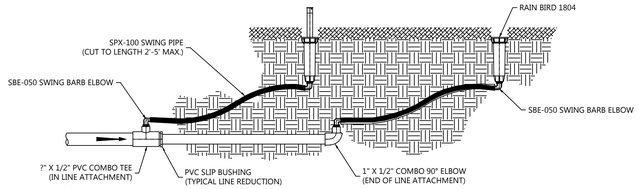


W.f 2 QUICK COUPLER ON SWING JOINT

NTS

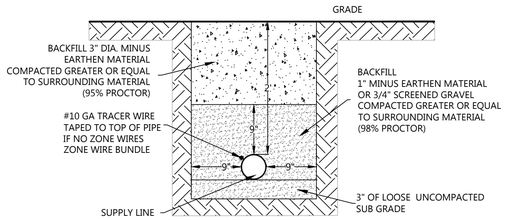
W.f 3 BLANK

NTS



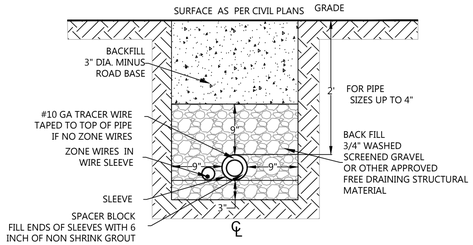
W.f 4 RAINBIRD 1804 ON SWING PIPE

NTS



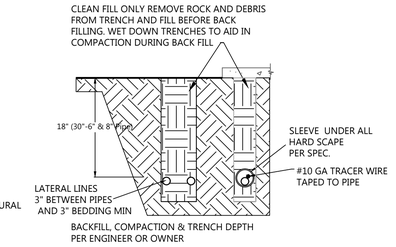
W.f 5 TRENCH DETAIL

N.T.S.



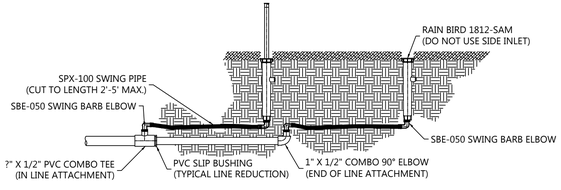
W.f 6 TRENCH DETAIL - SLEEVED PIPE

N.T.S.



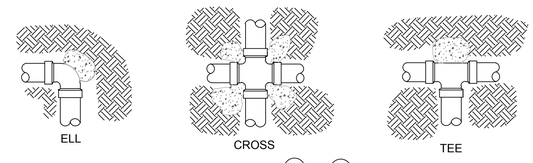
W.f 7 LATERAL TRENCH RECOMMENDATION

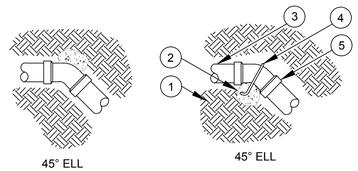
N.T.S.

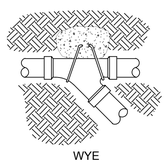


W.f 8 RAINBIRD 1812 ON SWING PIPE

NTS



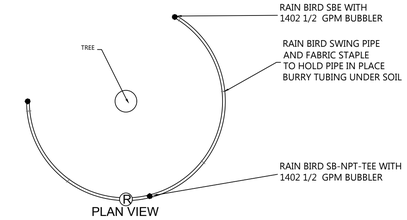


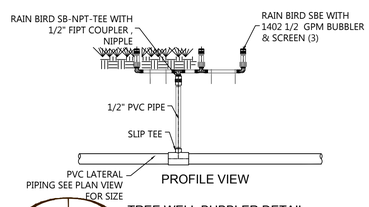


NOTES:
1. SUPPLY LINES 3-INCHES IN DIAMETER AND LARGER SHALL RECEIVE CONCRETE THRUST BLOCKS.
2. MIN 3 FT^2 BEARING AREA OF 3000 PSI CONCRETE.
3. SEE SPECIFICATIONS FOR AMOUNT OF CONCRETE TO BE USED FOR THRUST BLOCK.

W.f 9 THRUST BLOCK DETAILS

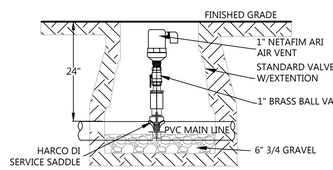
N.T.S.





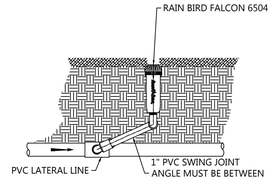
W.f 10 TREE WELL BUBBLER DETAIL

N.T.S.



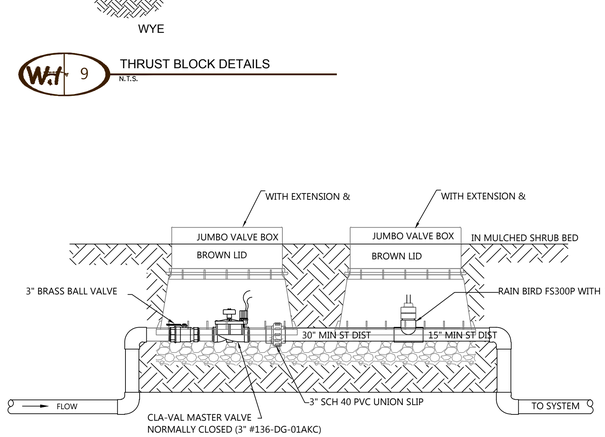
W.f 11 1" AIR VENT

N.T.S.



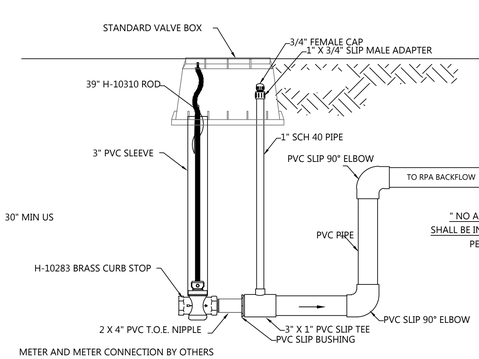
W.f 12 RAIN BIRD 6504 FALCON ON SWING JOINT

NTS



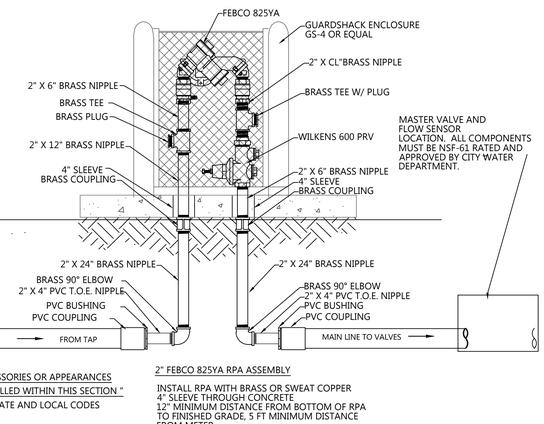
W.f 13 MASTER VALVE & FLOW SENSOR

NTS



W.f 14 CURB STOP & BLOWOUT TAP CONNECTION-IN LANDSCAPE AREA

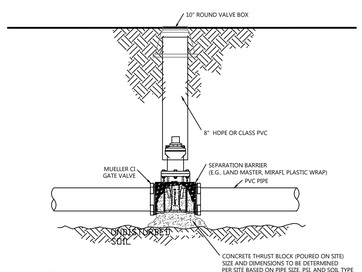
NTS



" NO ACCESSORIES OR APPEARANCES SHALL BE INSTALLED WITHIN THIS SECTION " PER STATE AND LOCAL CODES

2" FEBCO 825YA RPA ASSEMBLY

INSTALL RPA WITH BRASS OR SWEAT COPPER
4" SLEEVE THROUGH CONCRETE
12" MINIMUM DISTANCE FROM BOTTOM OF RPA
TO FINISHED GRADE, 5 FT MINIMUM DISTANCE
FROM METER



W.f 15 CAST IRON MUELLER VALVE WITH PVC VALVE BOX

NTS

Western Heritage
Consulting & Engineering
307.215.7430
www.westernhce.com
PO BOX 2117
Mills, WY 82644

LAS COLONIAS AMPHITHEATER
GRAND JUNCTION, COLORADO

ISSUE DATE: July 15, 2016

REVISIONS

#	DATE	DESCRIPTION

DRAWN: JSS REVIEWED: RLA

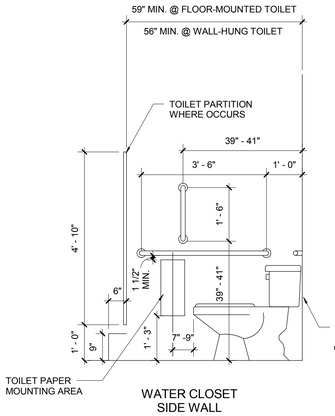
100% CONSTRUCTION DOCUMENTS

PROJECT NUMBER: 15WHC001

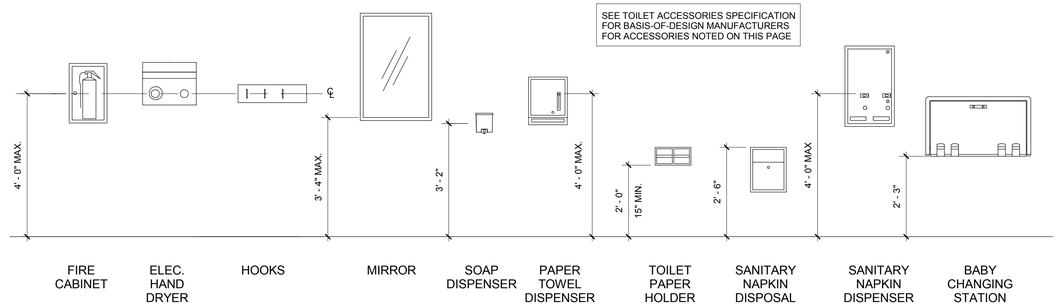
LANDSCAPE IRRIGATION DETAILS

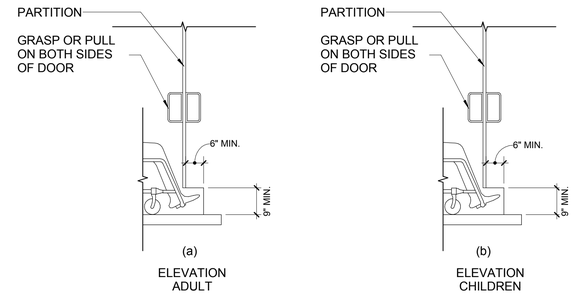
SHEET NUMBER

IR-07



WATER CLOSET SIDE WALL

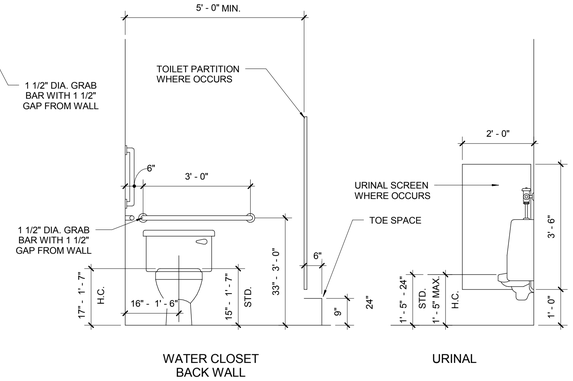




MISC MOUNTING HEIGHTS

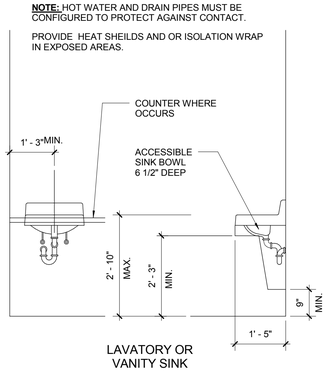
TYPICAL TOILET ACCESSORIES MOUNTING HEIGHTS

TOE CLEARANCE

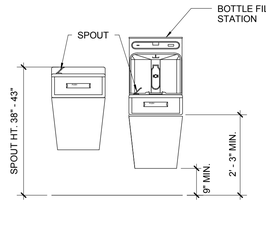


WATER CLOSET BACK WALL

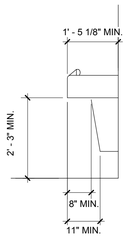
URINAL



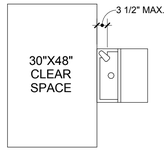
LAVATORY OR VANITY SINK



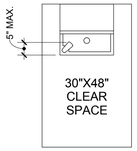
FRONT VIEW



SIDE VIEW



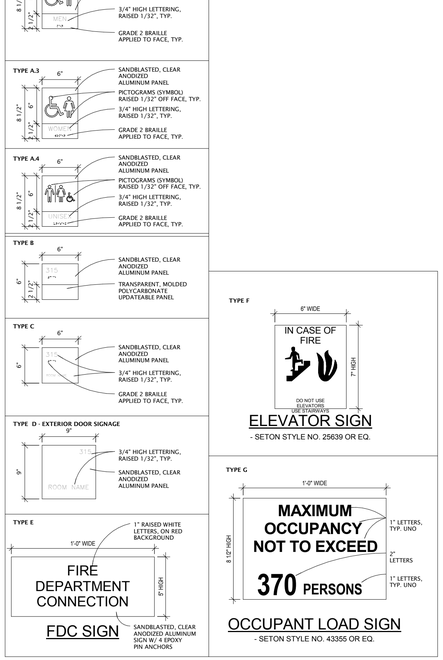
PARALLEL APPROACH



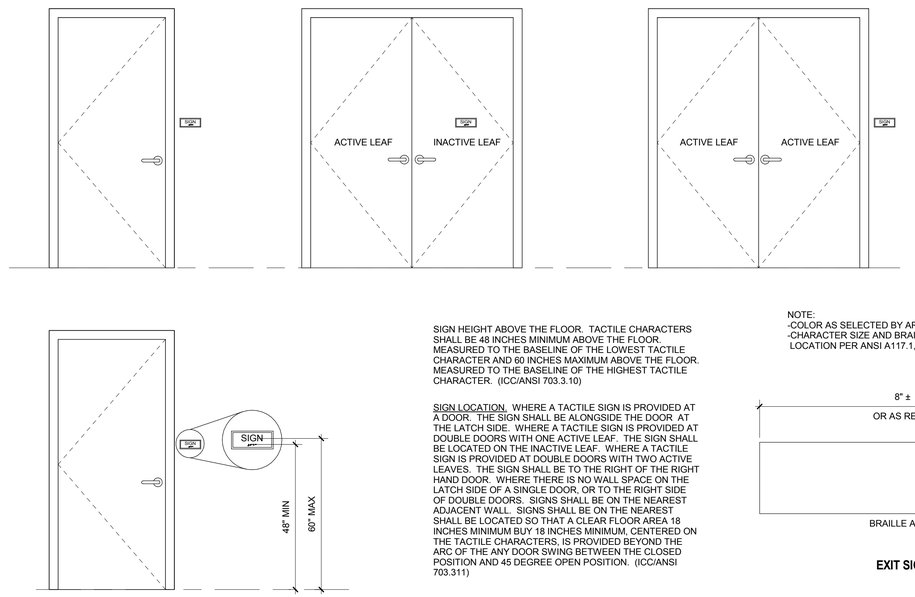
FORWARD APPROACH

PLAN

TYPICAL PLUMBING FIXTURES AND ACCESSORIES MOUNTING HEIGHTS



SIGNAGE

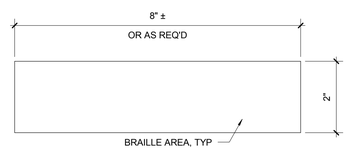


SIGN HEIGHT ABOVE THE FLOOR. TACTILE CHARACTERS SHALL BE 48 INCHES MINIMUM ABOVE THE FLOOR. MEASURED TO THE BASELINE OF THE LOWEST TACTILE CHARACTER AND 60 INCHES MAXIMUM ABOVE THE FLOOR. MEASURED TO THE BASELINE OF THE HIGHEST TACTILE CHARACTER. (ICC/ANSI 703.3.10)

SIGN LOCATION. WHERE A TACTILE SIGN IS PROVIDED AT A DOOR, THE SIGN SHALL BE ALONGSIDE THE DOOR AT THE LATCH SIDE. WHERE A TACTILE SIGN IS PROVIDED AT DOUBLE DOORS WITH ONE ACTIVE LEAF, THE SIGN SHALL BE LOCATED ON THE INACTIVE LEAF. WHERE A TACTILE SIGN IS PROVIDED AT DOUBLE DOORS WITH TWO ACTIVE LEAVES, THE SIGN SHALL BE TO THE RIGHT OF THE RIGHT HAND DOOR. WHERE THERE IS NO WALL SPACE ON THE LATCH SIDE OF A SINGLE DOOR, OR TO THE RIGHT SIDE OF DOUBLE DOORS, SIGNS SHALL BE ON THE NEAREST ADJACENT WALL. SIGNS SHALL BE ON THE NEAREST SHALL BE LOCATED SO THAT A CLEAR FLOOR AREA 18 INCHES MINIMUM BUY 18 INCHES MINIMUM, CENTERED ON THE TACTILE CHARACTERS, IS PROVIDED BEYOND THE ARC OF THE ANY DOOR SWING BETWEEN THE CLOSED POSITION AND 45 DEGREE OPEN POSITION. (ICC/ANSI 703.311)

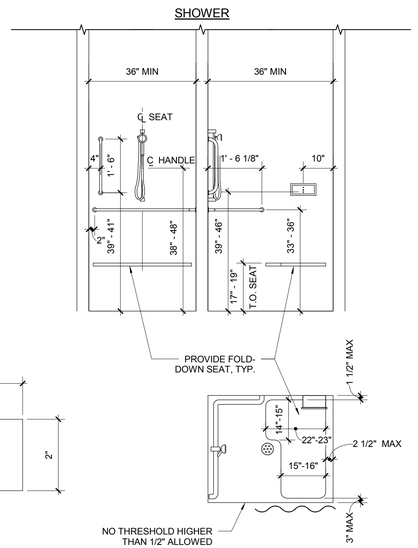
SIGNAGE LOCATIONS

NOTE:
-COLOR AS SELECTED BY ARCHITECT
-CHARACTER SIZE AND BRAILLE LOCATION PER ANSI A117.1, CH. 7



EXIT SIGN

EXIT SIGN



TRANSFER ADA SHOWER PLAN & ELEVATIONS

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project:
LAS COLONIAS AMPHITHEATER

Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Accessory Mounting Heights

sheet:
G003

100% CONSTRUCTION DOCUMENTS

PARTITION WALLS

WALL TYPES GENERAL NOTES -

1. REFER TO FLOOR PLAN "AE" SERIES FOR LOCATION OF WALL TYPES. ALL WALLS ARE TYPE "P2" UNLESS NOTED OTHERWISE.

2. REFER TO SCHEDULES & DETAILS FOR FINISHES. WALL TYPES REVER TO BASE WALL ONLY.

3. "LINE OF STRUCTURE" AS SHOWN AT THE HEAD CONDITIONS OF EACH WALL TYPE IS DIAGRAMMATIC ONLY AND DOES NOT INDICATE THE EXACT CONSTRUCTION CONDITION. RATED WALLS ARE TO TERMINATE AT STRUCTURAL MEMBERS WITH A FIRE RESISTANT RATING. WHERE REQ'D APPROPRIATE FRAMING AND GYP BOARD IS TO BE INSTALLED AND OFFSET AROUND STRUCTURAL MEMBERS OR OTHER OBSTRUCTIONS SUCH AS PIPING OR DUCTWORK, TO MAINTAIN THE FIRE RESISTANCE RATING. NON-RATED WALLS THAT CONTINUE TO STRUCTURE ARE TO TERMINATE AT PROPER LOCATIONS TO MAINTAIN THE INTENT OF THE CONTINUOUS PLANE OF ONE LAYER OF GYP BOARD AS A NOISE, SMOKE OR OTHER TYPE OF BARRIER.

4. ALL GYP BOARD SHALL BE 5/8", UNLESS NOTED OTHERWISE.

5. ALL RATED WALLS SHALL BE CONSTRUCTED FIRST. SECONDARY WALLS TO ABUTT, BUT NOT PENETRATION RATED WALLS.

6. APPROPRIATE SUBMITTAL INFORMATION MUST BE PROVIDED TO SUBSTANTIATE THAT THE MATERIALS AND ASSEMBLY USED BY THE CONTRACTOR HAVE BEEN TESTED BY A RECOGNIZED TESTING AGENCY TO MEET THE FIRE RESISTANCE RATING SCHEDULED ON THESE WALL TYPES.

7. FIRESTOPPING TO BE PROVIDED AT PENETRATIONS THROUGH RATED WALLS AS SPECIFIED.

8. ALL GYPSUM WALL BOARD MUST BE MOISTURE RESISTANT AT THE FOLLOWING LOCATIONS:
   a. TOILET ROOMS
   b. WET WALLS
   c. SHOWERS
   d. JANITOR'S CLOSETS

9. SOUND ATTENUATION BLANKETS SHALL EXTEND THE FULL HEIGHT IF THE WALLS.

10. SPACING OF THE METAL STUDS HAS NOT BEEN INDICATED ON THE WALL TYPOES OR DETAILS. STUD SPACING IS TO BE DETERMINED BY THE HEIGHT OF THE PARTITION AS SHOWN IN THE TABLE BELOW. EACH STUD GOING TO STRUCTURE AND EXCEEDING ALLOWABLE HEIGHTS SHALL BE BRACED 45 DEGREES DIAGONALLY 12" ABOVE CEILING WITH EQUAL SIZE 20 GA. METAL STUDS. THIS TABLE IS TO BE USED FOR THE INTERIOR WALL TYPES ONLY AND DOES NOT APPLY TO EXTERIOR STUDS. USE 20 GA STUDS AT ALL HEAD AND JAMB LOCATIONS.

11. REFER TO INTERIOR DETAILS FOR ADDITIONAL INFORMATION.

12. UL DESIGN NUMBERS REFER TO FIRE RESISTANCE IN MOST CURRENT EDITION OF THE UL DIRECTORY.

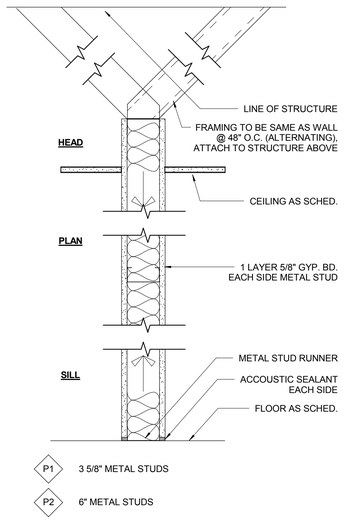
13. SUPPORT INSULATION WITH CHICKEN WIRE IN PARTITIONS WITHOUT GYP BOARD ON BOTH SIDES TO STRUCTURE.

14. MAINTAIN 1/2" SPACE BETWEEN FLOOR SLAB AND BOTTOM OF GYP BOARD ON ALL WALLS.

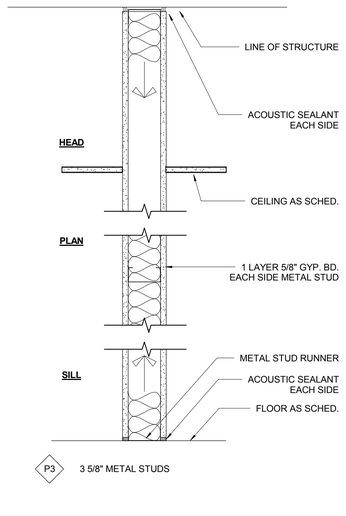
15. STOP STUD 1" BELOW METAL RUNNER (TOP TRACK) TO ALLOW FOR VERTICAL EXPANSION DO NOT ATTACH STUDS OR GYP BOARD TO TOP TRACK.

FACING ON SIDES OF STUDS	STUD SPAC'G ON CENTER	STUD DEPTH 2 1/2" MAX. HT.	STUD DEPTH 3 5/8" MAX. HT.	STUD DEPTH 6" MAX. HT.
1 LAYER 5/8" GYP BD - 1 SIDE ONLY	16 24	11'-0" 9'-9"	14'-6" 12'-9"	14'-6" 12'-9"
1 LAYER 5/8" GYP BD - EACH SIDE	16 24	12'-0" 10'-9"	16'-0" 13'-6"	16'-0" 13'-6"
2 LAYER 5/8" GYP BD - EACH SIDE	16 24		16'-9" 13'-6"	20'-0" 15'-0"

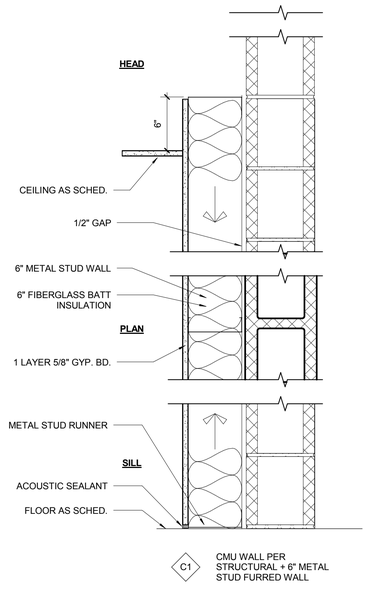
- HEIGHT IS DISTANCE FROM THE FLOOR TO THE STRUCTURE, NOT FLOOR TO CEILING
- BRACING AT MIDPOINT PREQUIRED FOR ALL WALLS OVER 12'-0" HIGH
- ALL WALLS GO TO DECK



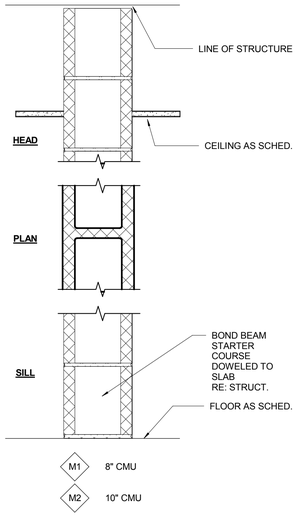
PARTITION WALL -
NON RATED
WALL ABOVE CEILING



PARTITION WALL -
NON RATED
WALL TO STRUCTURE



COMBINATION WALL



MASONRY WALL

STATE OF COLORADO
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CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Wall Types

sheet:
G004

100% CONSTRUCTION DOCUMENTS

HEALTH DEPARTMENT NOTE:

THIS PROJECT SHALL ADHERE TO THE CURRENT VERSION OF THE "URANIUM MILL TAILINGS MANAGEMENT PLAN" (UMTMP)

https://www.colorado.gov/pacific/sites/default/files/HM_umilltail-mgt-plan.pdf

PER THE DOCUMENT MENTIONED ABOVE, IF ANY SITE MATERIAL IS TO BE REMOVED FROM THE SITE, IT MUST BE FIRST CHECKED FOR RADIOACTIVITY. IF IT IS UNDER THE LIMITS FOUND IN THE UMTMP THEN IT MAY BE REMOVED, BUT NOT BEFORE. A LOG OF THIS SHOULD BE KEPT. IF IT IS NOT UNDER THE LIMITS, THEN IT MAY LEAVE THE SITE TO A LICENSED DISPOSAL FACILITY OR TO THE INTERIM STORAGE FACILITY AT THE CITY YARD, AS DESCRIBED IN THE UMTMP.

LEGEND

FEC = FIRE EXTINGUISHER CABINET LOCATION

CODE REFERENCES

ALL CONSTRUCTION SHALL COMPLY WITH THE FOLLOWING CODES:

2012 INTERNATIONAL BUILDING CODE (IBC)
2012 INTERNATIONAL PLUMBING CODE (IPC)
2012 INTERNATIONAL MECHANICAL CODE (IMC)
2012 INTERNATIONAL FIRE CODE (IFC)
2014 NATIONAL ELECTRICAL CODE (NEC)
2009 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
NATIONAL FIRE PROTECTION ASSOCIATION CODES (IN TOTAL)
ASHRAE 90-1-89 AND SUBSEQUENT ADDENDA
IAQ GUIDELINES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION (SMACNA)
AMERICANS WITH DISABILITIES ACT (ADA)
2006 LIFE SAFETY CODE

Chapter 3 Use and Occupancy Classification:
Group A1 - Assembly

Chapter 5 General Building Heights & Areas:

Allowable Height	40 feet	Table 503
Allowable Stories	1	Table 503
Tabular Area per Story (At)	5,500 SF	Table 503

504.2 Sprinkler Increase - Height = 20 Feet, Stories: 1

506.1 General, Area Modification, Allowable area (Aa)
Aa = (At + (At x If) + (At x Is)) Equation 5-1

506.2 Frontage Increase (If)
[F/P – 0.25] W/30 Equation 5-2
[310'/310' -0.25] 30/30 = .75

506.3 Automatic Sprinkler Increase (Is) = 300% (no more than 1 story above grade plane)

Aa = (5,500 + (5,500 x .75) + (5,500 x 300%)
5,500 + 4,125 + 16,500

Allowable Area (Aa) per story = 26,125 sf

Actual Total Building Stories/Height 1 story/32 Feet

Actual Total Building Area

Level 1	4,328 sf
Total	**4,328 sf**

Chapter 6 Types of Construction

602.2 Type V-B

Table 601 Fire-Resistance Rating Req's for Bldg Elements (hrs):

Construction Type V-B

Structural Frame	0
Exterior Bearing Walls	0
Interior Bearing Walls	0
Nonbearing Walls and Interior Partitions	0
Floor Construction (Supporting beams and joists)	0
Roof (Beams and joists)	0

Table 602 Fire-Resistance Rating Req's for Exterior Walls Based on Fire Separation Distance

Fire Separation Distance = x (feet)	X<5	5≤X<10	10≤X<30	X≥30
Type of Construction	All	Others	VB	All
Occupancy A	**1**	**1**	**0**	**0**

Chapter 7 Fire & Smoke Protection Features

Maximum Area of Exterior Wall Openings (Table 705.8)

Fire Separation Distance:	30 or greater
Protection	UP,S
Allowable Area	NR

Fire Partitions (709.3)
Fire partitions shall have a fire-resistance rating of not less than 1 hour.

Horizontal Assemblies (712.3)
The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction

IBC Table 803.9 Interior Wall And Ceiling Finish Requirements By Occupancy:

Occupancy Group A1 (Sprinkled):
Vertical exits and exit passageways - Class B
Exit access corridors and other exitways - Class B,
Rooms and enclosed spaces - Class C

Fire Protection System: NFPA 13
Fully sprinklered with approved system as required by Sec. 903.2.8.
Portable fire extinguishers are required by Sec 906.1.1.

Occupancy Load and Exit Requirements
Occupant Load Calculations (Table 1004.1.1)
Stage Areas: 215 occupants
Back of House: 10 occupants
Total Building Occupancy = 225 occupants

Egress Width (Sec 1005.1)

Stairs -
Balcony Level -
127 occ x 0.3" per occ = 38.1" min. required
Backstage -
98 occ x 0.2" per occ = 29.4" min. required
All other egress components -
752 occ x 0.2" per occ = 150"

Actual stairway width provided -
From Balcony - 60" x (2 stairs) = 120"
All others allowed per code, 36" min

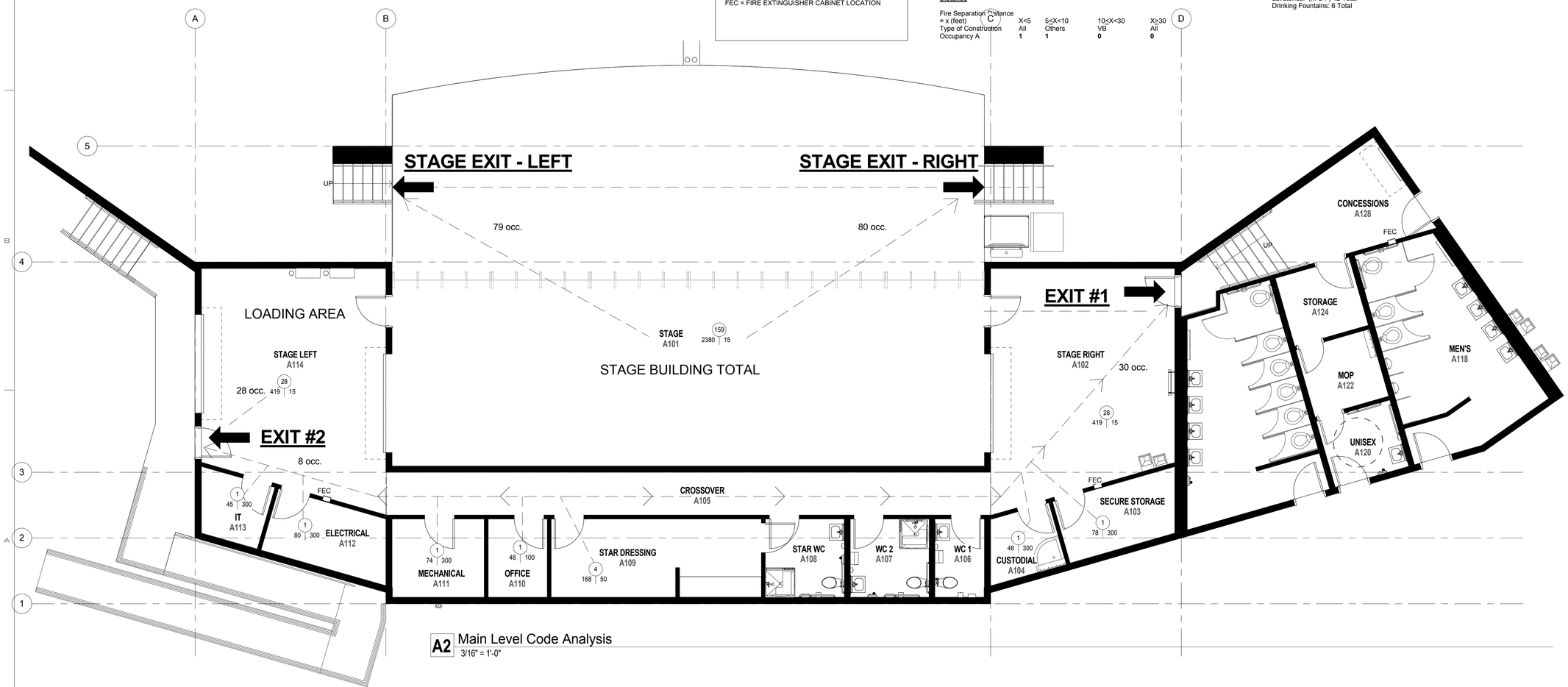
IBC Table 1020 Minimum Number Of Exits For Occupant Load:

Occupant Load: <500
Minimum Number of Required Exits: 2
Number of Exits provided: 2 from Stage
2 from Building

Minimum number of plumbing Fixtures (Table 2902.1)
Group A-1 Occupant Load = 225

Fixtures Required:
Water Closets: (M) 1 per 125, 1 Req'd (F) 1 per 65, 2 Req'd
Lavatories: (M & F) 1 per 200, 2 Req'd
Drinking Fountains: 1 per 500, 1 Req'd

Fixtures Provided:
Water Closets: (M) 8, (F) 8
Lavatories: (M & F) 12 Total
Drinking Fountains: 6 Total



A2 Main Level Code Analysis
3/16" = 1'-0"

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revisions :

title:
Code Plan - Code Analysis

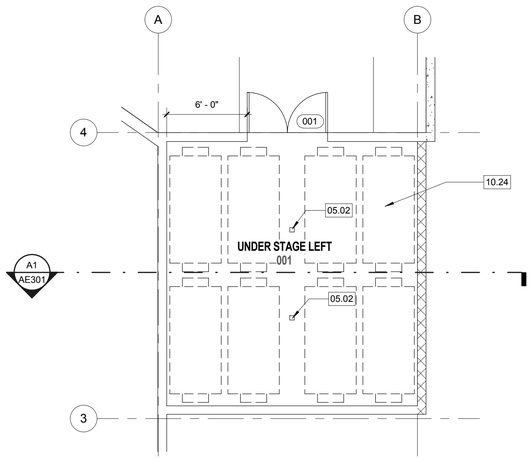
sheet:
G101

100% CONSTRUCTION DOCUMENTS

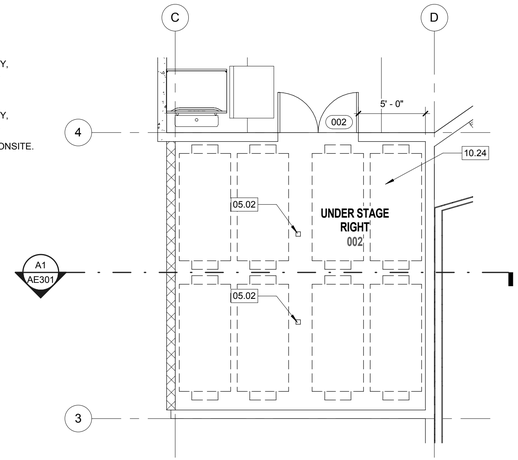
ESTIMATED ONSITE CHAIR STORAGE
OPTION #1 - LESS COMFORTABLE CHAIRS:
512 FOLDING CHAIRS, BASED ON LIFETIME "CONTEMPORARY" MODEL 80142, ARE ESTIMATED TO BE ABLE TO BE STORED UNDER-STAGE, USING BOTH UNDER-STAGE STORAGE AREAS. AN ADDITIONAL 288 CHAIRS, APPROXIMATELY, CAN BE STORED IN THE WINGS OF THE MAIN STAGE LEVEL WHEN THE VENUE IS CLOSED. THIS TOTALS 800 CHAIRS.

OPTION #2 - MORE COMFORTABLE CHAIRS:
256 FOLDING CHAIRS, BASED ON LIFETIME "CONTOURED" MODEL 80376, ARE ESTIMATED TO BE ABLE TO BE STORED UNDER-STAGE, USING BOTH UNDER-STAGE STORAGE AREAS. AN ADDITIONAL 144 CHAIRS, APPROXIMATELY, CAN BE STORED IN THE WINGS OF THE MAIN STAGE LEVEL WHEN THE VENUE IS CLOSED. THIS TOTALS 400 CHAIRS.

IF ONSITE TABLES ARE DESIRED TO BE STORED, THIS WILL REDUCE THE AMOUNT OF CHAIRS ABLE TO BE STORED ONSITE.



D1 Under Stage Storage Left
3/16" = 1'-0"



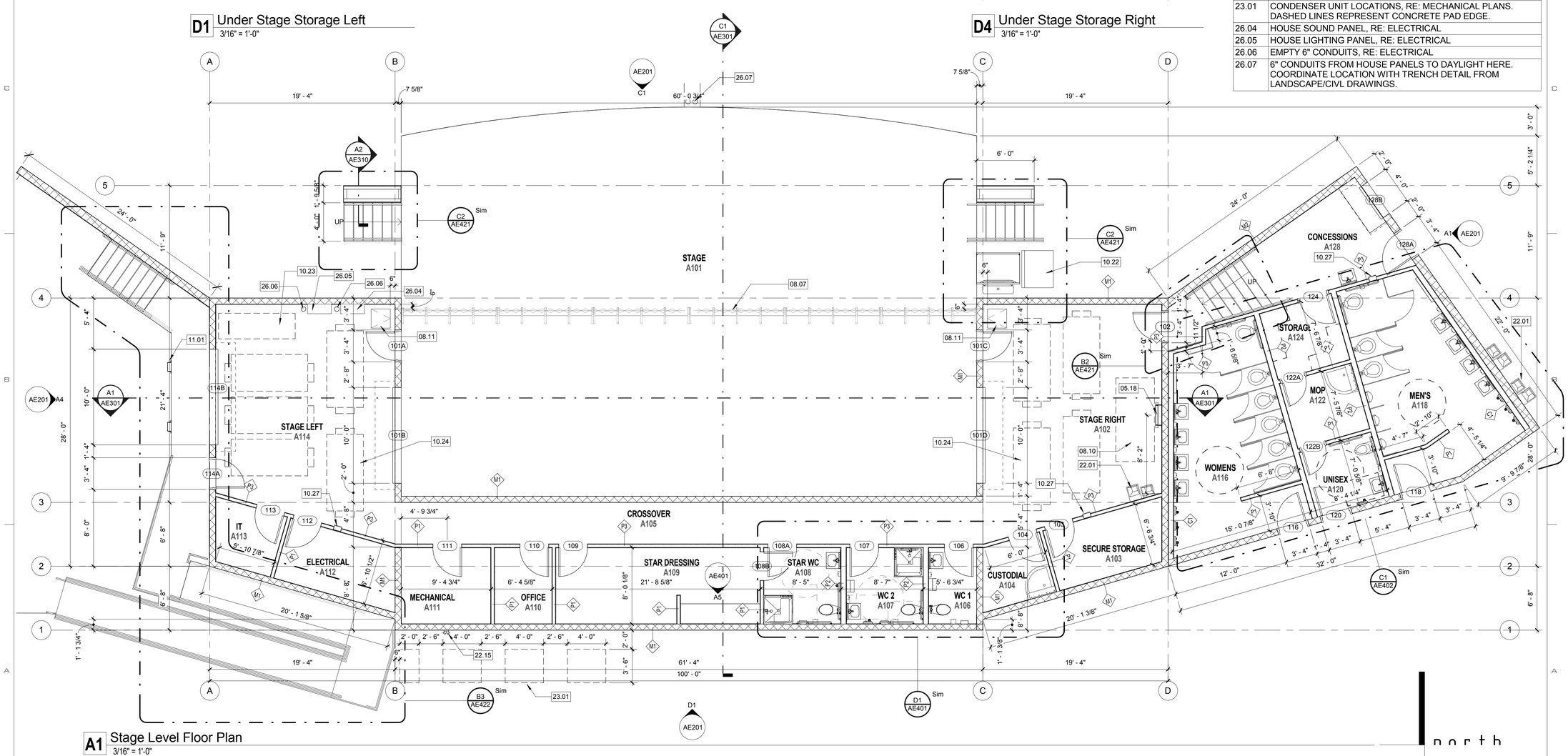
D4 Under Stage Storage Right
3/16" = 1'-0"

GENERAL NOTES - FLOOR PLAN

1	SEE SHEET AE210 FOR TYPICAL MOUNTING HEIGHTS
2	ALL DIMENSIONS ARE TO FACE OF CMU OR STUD, TYP.
3	REFER TO SHEET AE601 FOR DOOR SCHEDULE
4	REFER TO SHEET G004 FOR WALL TYPES

Keynote Legend

05.02	PAINTED STEEL COLUMN, RE: STRUCTURAL
05.18	STEEL ROOF ACCESS LADDER. RE: SPECS
08.07	SCISSOR GATE, DEPLOYED CONDITION, INCLUDE IN BASE BID. BASIS-OF-DESIGN IS "CISCO-EAGLE PORTABLE FOLDING GATE", WWW.CISCO-EAGLE.COM
08.10	STORAGE LOCATION FOR STAGE SCISSOR GATES.
08.11	LOCKABLE 2' X 2'FLOOR ACCESS HATCH, BASIS-OF-DESIGN "ACUDOR FA-300-24-24" CAST-IN-PLACE FLUSH FLOOR DOOR, WWW.ACCESSDOORSANDPANELS.COM. COORDINATE OPENING WITH STRUCTURAL FRAMING.
10.22	OPTIONAL ADA STAGELIFT. SEE ELECTRICAL PLANS FOR POWER REQUIREMENTS.
10.23	STORAGE LOCATION FOR STAGE SCISSOR LIFT.
10.24	TOILET PARTITIONS, TYP. PER PLAN AND SPECIFICATIONS
10.27	FIRE EXTINGUISHER CABINET LOCATION, SEMI-RECESSED INTO WALL, TYP. SEE SPECIFICATIONS
11.01	DOCK BUMPER, SEE SPECIFICATIONS
22.01	DRINKING FOUNTAINS, FOUNTAIN SHOULD ACCOMMODATE WATER BOTTLE FILLER. RE: PLUMBING PLANS
22.15	FIRE DEPARTMENT CONNECTION LOCATION, RE: PLUMBING PLANS
23.01	CONDENSER UNIT LOCATIONS, RE: MECHANICAL PLANS. DASHED LINES REPRESENT CONCRETE PAD EDGE.
26.04	HOUSE SOUND PANEL, RE: ELECTRICAL
26.05	HOUSE LIGHTING PANEL, RE: ELECTRICAL
26.06	EMPTY 6" CONDUITS, RE: ELECTRICAL
26.07	6" CONDUITS FROM HOUSE PANELS TO DAYLIGHT HERE. COORDINATE LOCATION WITH TRENCH DETAIL FROM LANDSCAPE/CIVL DRAWINGS.



A1 Stage Level Floor Plan
3/16" = 1'-0"

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ARC.01258
REGISTERED ARCHITECT
7-15-16

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CITY OF Grand Junction COLORADO

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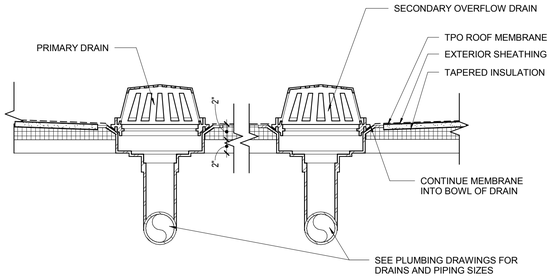
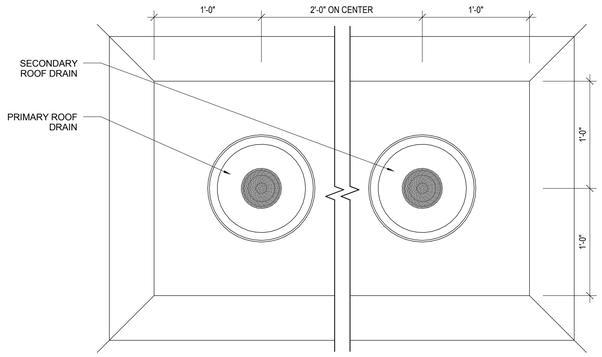
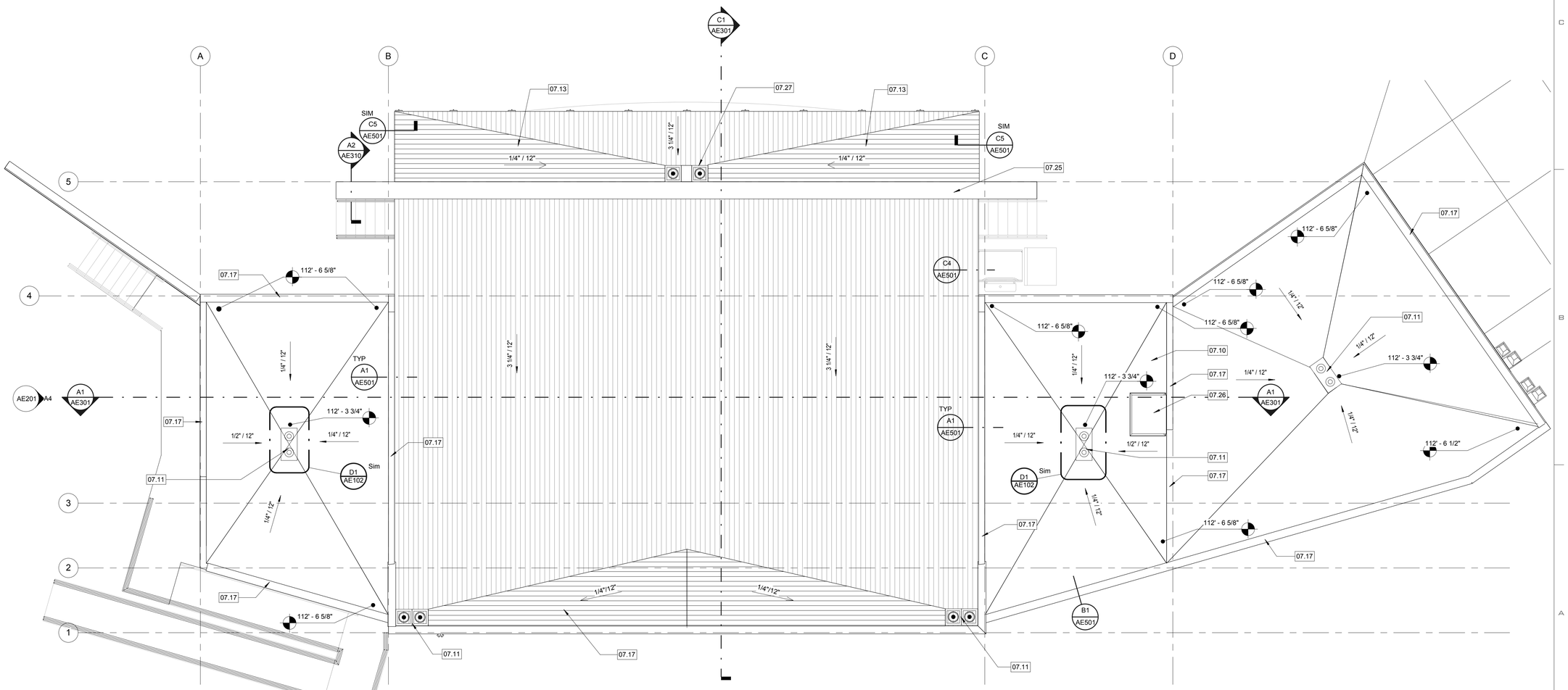




D1 Roof Drain Detail
1 1/2" = 1'-0"

Keynote Legend

07.10	SINGLE-PLY ROOFING MEMBRANE
07.11	ROOF DRAIN AND OVERFLOW, RE: PLUMBING DRAWINGS FOR PIPING DETAILS
07.13	CRICKET 1/4" PER FOOT MIN.
07.17	PARAPET COPING
07.25	18 GA WEATHERED STEEL PANEL, SEE SPECIFICATIONS
07.26	ROOF HATCH, 4' X 4' MIN. CONTRACTOR RESPONSIBLE FOR COORDINATION WITH ROOF FRAMING.
07.27	ROOF DRAIN, RE: PLUMBING DRAWINGS FOR PIPING DETAILS. PLEASE NOTE, PRIMARY AND SECONDARY DRAINS ARE OFFSET TO EITHER SIDE OF CENTER ROOF BEAM.



A1 Roof Plan
3/16" = 1'-0"

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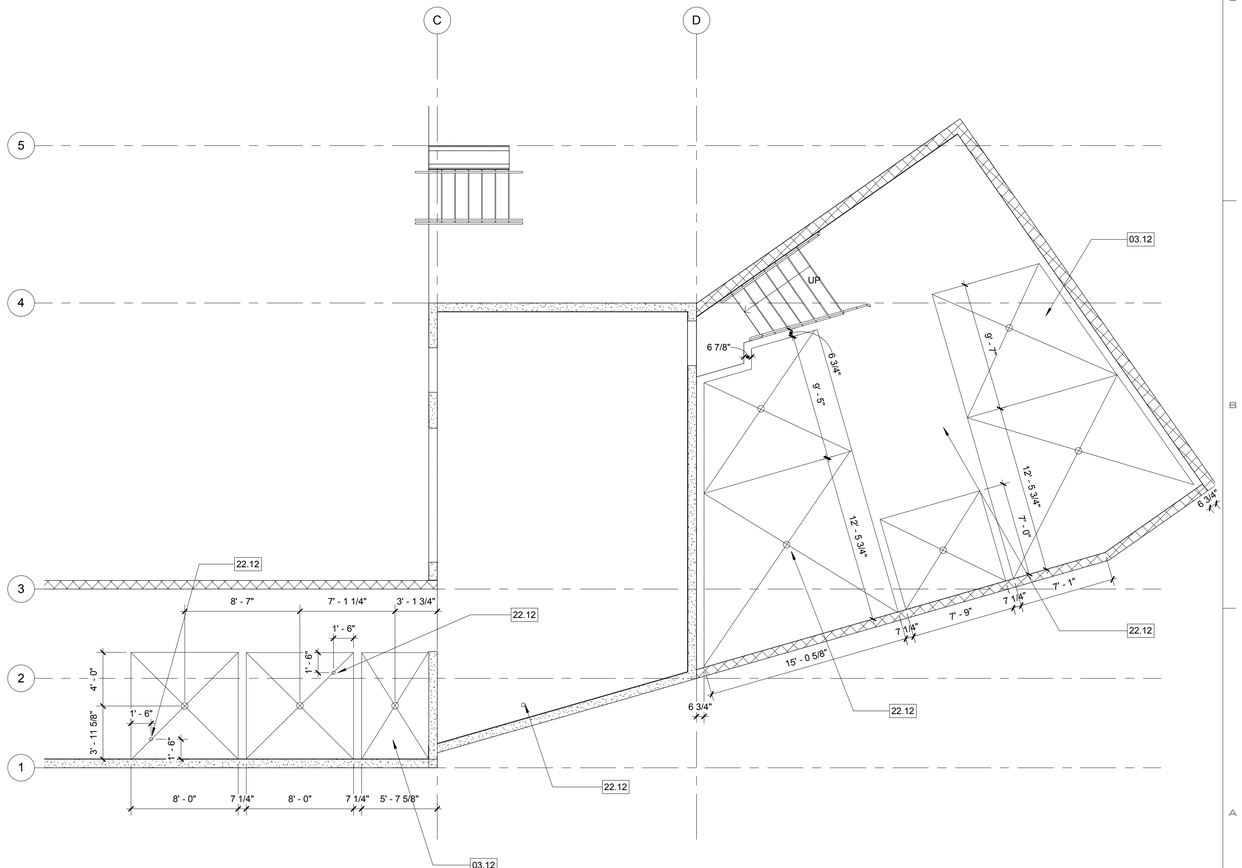
Keynote Legend

03.12	DIMENSIONED AREAS DENOTE 2" RECESSED CONCRETE FOR THICKSET TILE PLACEMENT, TYP. COORDINATE WITH FLOOR PLAN
22.12	FLOOR DRAIN APPROXIMATE LOCATION. COORDINATE WITH PLUMBING DRAWINGS.



A3 Slab Edge Plan
3/16" = 1'-0"

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Slab Edge Plan

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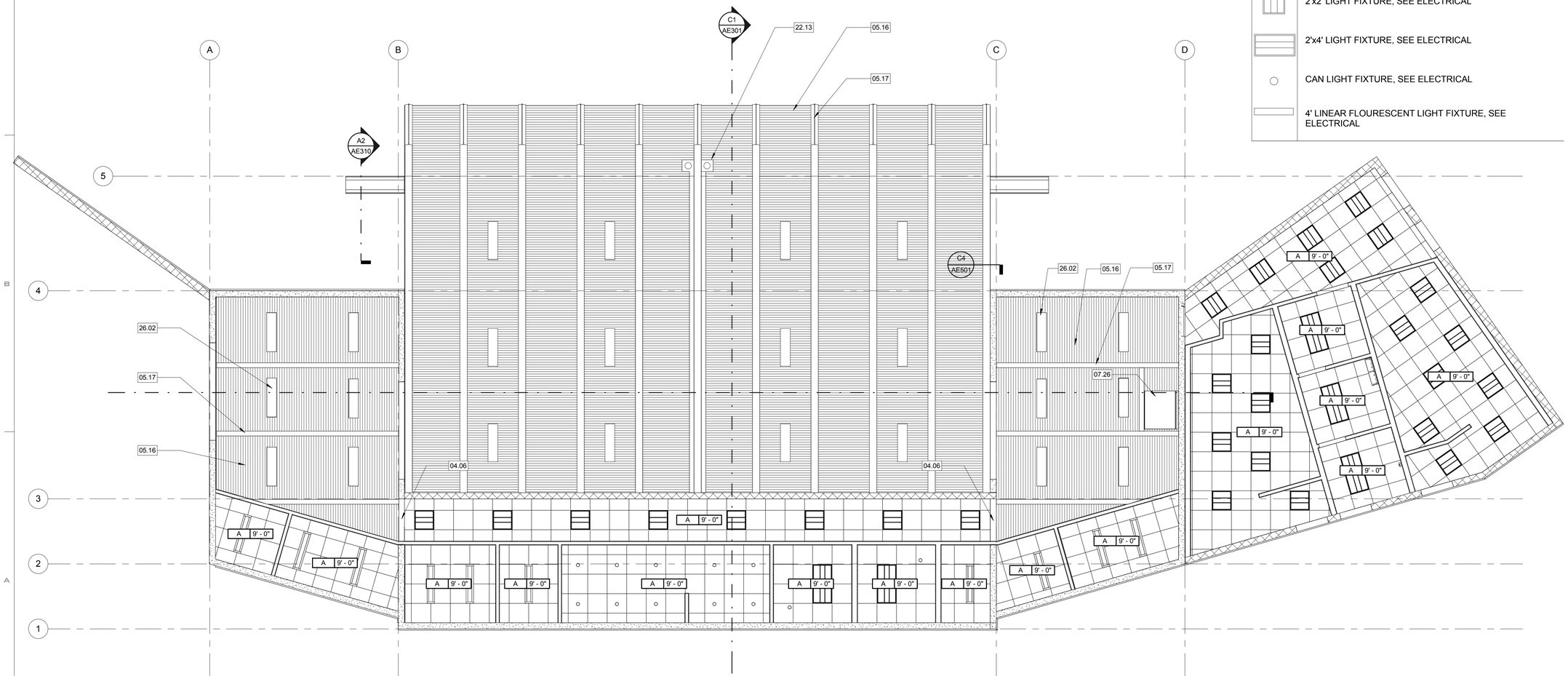

A1 Reflected Ceiling Plan
3/16" = 1'-0"

GENERAL NOTES - CEILING PLAN

1	VERIFY ALL MECHANICAL DUCT, GRILLE, DIFFUSER AND VENT LOCATIONS WITH MECHANICAL DRAWINGS.
2	CEILING GRID SHOWN IS ONLY A GRAPHIC REPRESENTATION OF CEILING. CONTRACTOR SHALL VERIFY ACTUAL GRID LAYOUT/LOCATION.
3	COORDINATE FIXTURE LAYOUT & QUANTITY WITH ELECTRICAL PLANS. REFER TO MECHANICAL DRAWINGS FOR DIFFUSER LOCATIONS.
4	ALL CEILING HEIGHTS SHOWN ARE FROM FINISH FLOOR OF THE ROOM.

Keynote Legend

04.06	CMU HEADER, OPENING AT 8'-4" A.F.F. OF STAGE
05.16	METAL DECK, EPOXY PAINTED, RE: FINISH SCHEDULE AND STRUCTURAL DWGS
05.17	STEEL BEAM, EPOXY PAINTED, RE: FINISH SCHEDULE AND STRUCTURAL DWGS
07.26	ROOF HATCH, 4' X 4' MIN. CONTRACTOR RESPONSIBLE FOR COORDINATION WITH ROOF FRAMING.
22.13	ROOF DRAIN AND LINE EXPOSED AND PAINTED. ROUTE PIPE NEXT TO NEAREST STRUCTURAL BEAM AND TIE INTO DRAIN PER PLUMBING DRAWINGS.
26.02	LIGHT FIXTURE, RE: ELECTRICAL

CEILING LEGEND

TYPE A	2' X 2' LAY-IN ACOUSTICAL TILE IN SUSPENDED GRID
TYPE C	EXPOSED STRUCTURE, PAINTED
	2'x2' LIGHT FIXTURE, SEE ELECTRICAL
	2'x4' LIGHT FIXTURE, SEE ELECTRICAL
	CAN LIGHT FIXTURE, SEE ELECTRICAL
	4' LINEAR FLOURESCENT LIGHT FIXTURE, SEE ELECTRICAL

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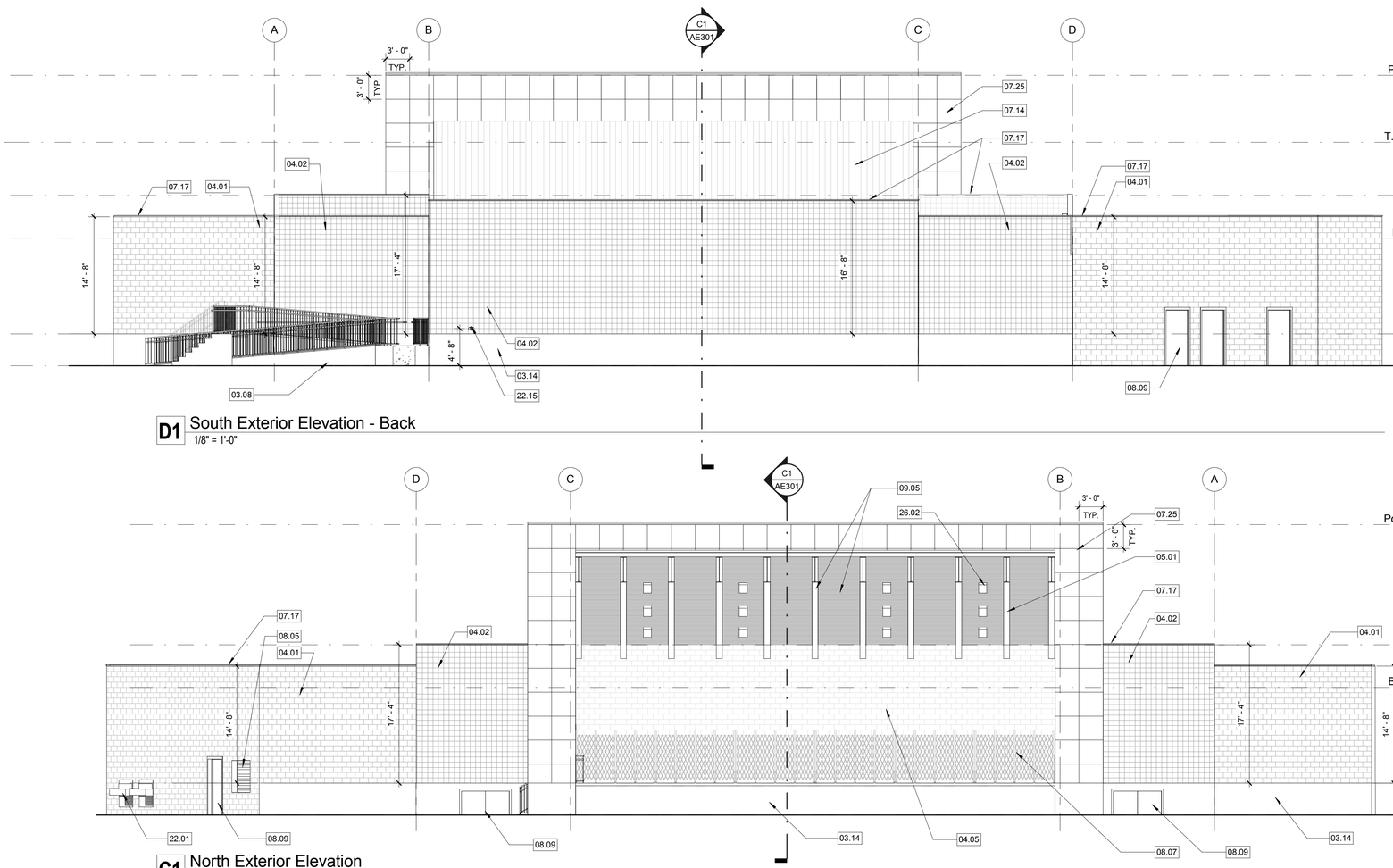
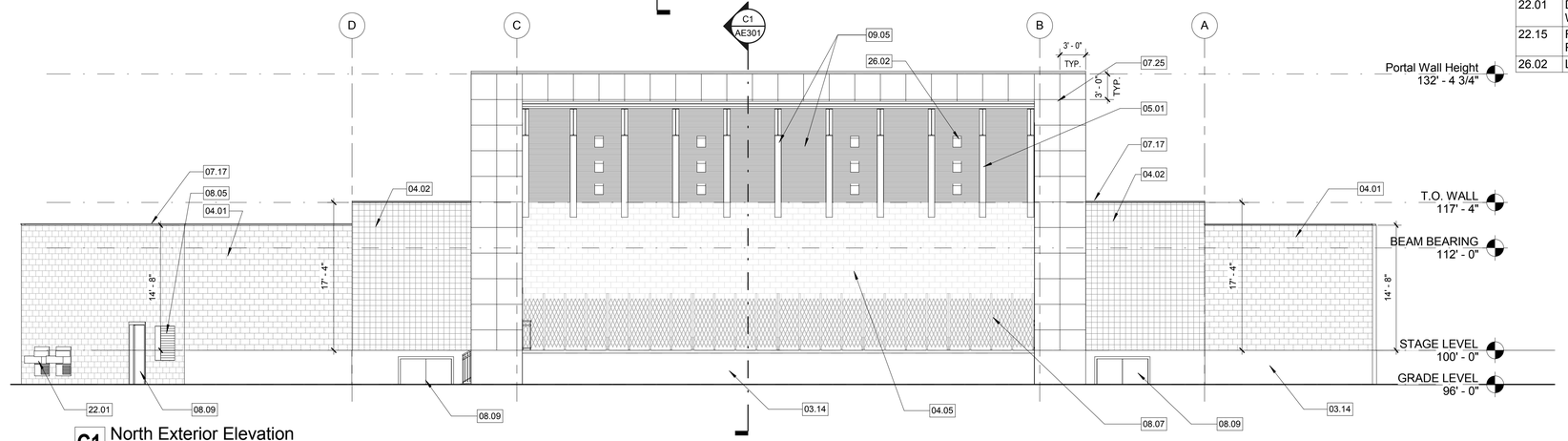
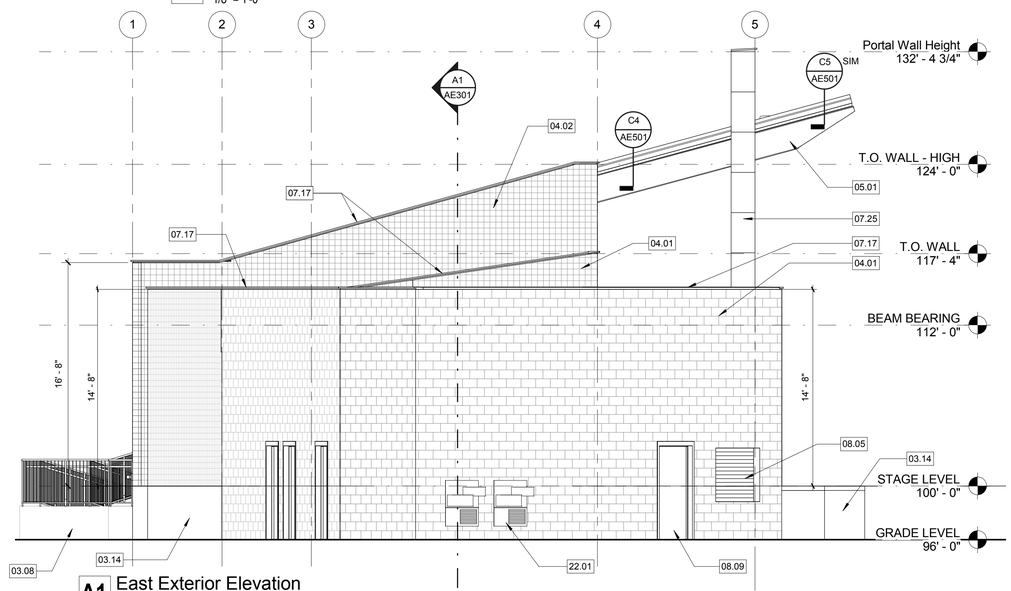


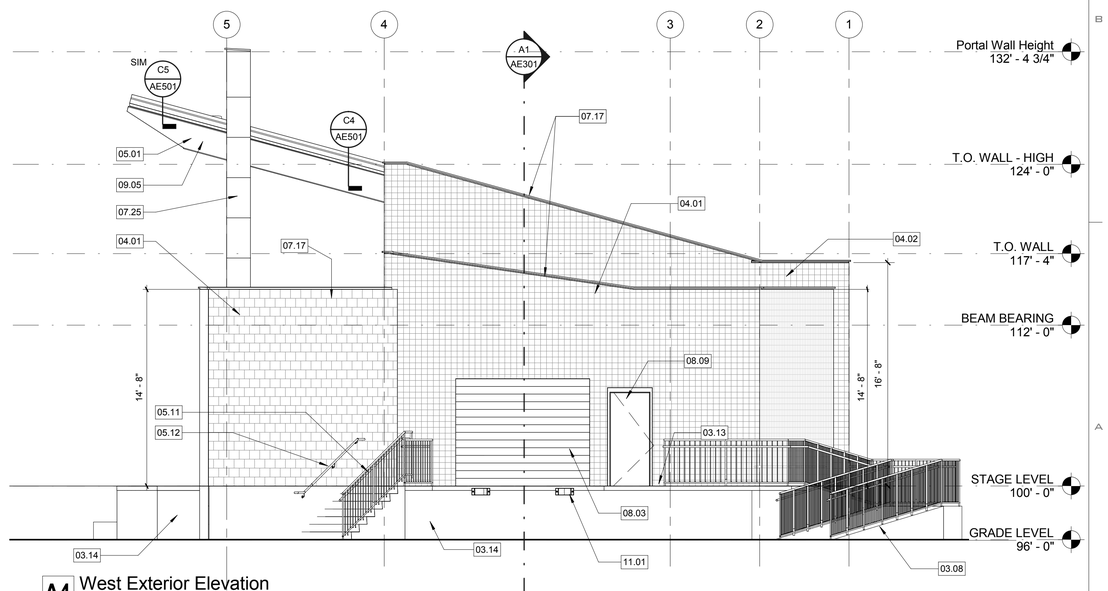
D1 South Exterior Elevation - Back
1/8" = 1'-0"



C1 North Exterior Elevation
1/8" = 1'-0"



A1 East Exterior Elevation
3/16" = 1'-0"



A4 West Exterior Elevation
3/16" = 1'-0"

Keynote Legend

03.08	CAST IN PLACE CONCRETE ADA RAMP, 1:12 SLOPE
03.13	LOADING DOCK CONCRETE SLAB OVER COMPACTED BACKFILL
03.14	EXPOSED CONCRETE FOUNDATION WALL WITH ARCHITECTURAL FINISH
04.01	CMU HONED, INTEGRAL COLOR #1, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.02	CMU HONED, INTEGRAL COLOR #2, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.05	STANDARD GREY CMU, PAINTED BLACK ON INTERIOR SIDE OF AUDIENCE-VISIBLE WALLS AT STAGE. RE: FINISH SCHEDULE.
05.01	STEEL BEAM, RE: STRUCTURAL
05.11	STEEL GUARDRAIL, POWDER COATED PAINT, SEE STAIR / RAMP DETAILS
05.12	STEEL HANDRAIL, POWDER COATED PAINT, SEE STAIR / RAMP DETAILS
07.14	STANDING SEAM METAL ROOF W/ DRIP EDGE
07.17	PARAPET COPING
07.25	18 GA WEATHERED STEEL PANEL, SEE SPECIFICATIONS
08.03	INSULATED OVERHEAD COILING DOOR, RE: DOOR SCHEDULE
08.05	OVERHEAD COILING DOOR, MANUAL OPERATION, RE: DOOR SCHEDULE
08.07	SCISSOR GATE. DEPLOYED CONDITION, INCLUDE IN BASE BID. BASIS-OF-DESIGN IS "CISCO-EAGLE PORTABLE FOLDING GATE", WWW.CISCO-EAGLE.COM
08.09	HM DOORS AND FRAMES, PAINTED. SEE DOOR SCHEDULE SHEET AE601 FOR SIZES.
09.05	ALL EXPOSED STRUCTURE PAINTED BLACK
11.01	DOCK BUMPER, SEE SPECIFICATIONS
22.01	DRINKING FOUNTAINS, FOUNTAIN SHOULD ACCOMMODATE WATER BOTTLE FILLER. RE: PLUMBING PLANS
22.15	FIRE DEPARTMENT CONNECTION LOCATION, RE: PLUMBING PLANS
26.02	LIGHT FIXTURE, RE: ELECTRICAL

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Exterior Elevations

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AE201

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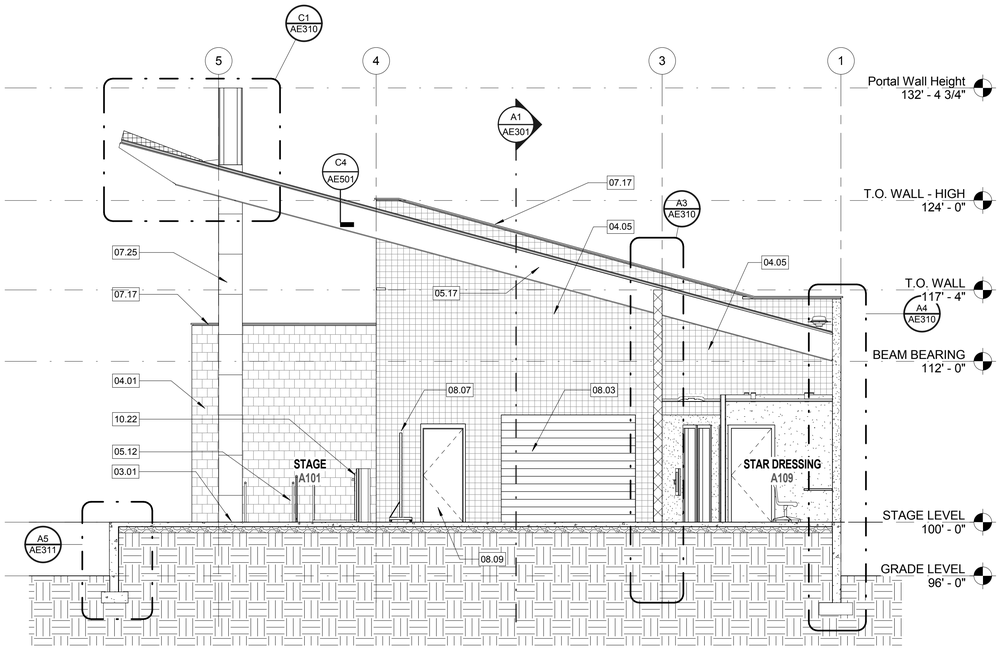
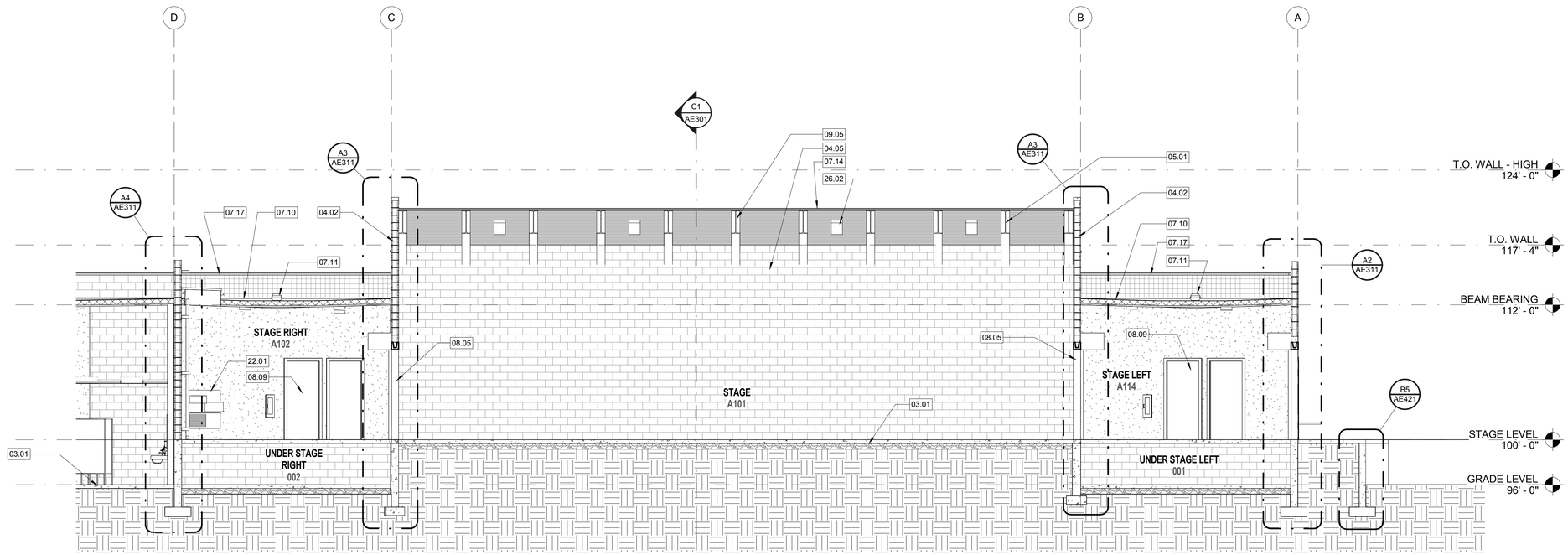


C1 Building Section 1
3/16" = 1'-0"



A1 Building Section 2
3/16" = 1'-0"

Keynote Legend

03.01	CONCRETE SLAB OVER CONT. VAPOR BARRIER OVER MIN 4" FREE DRAINAGE GRAVEL; RE: STRUCT
04.01	CMU HONED, INTEGRAL COLOR #1, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.02	CMU HONED, INTEGRAL COLOR #2, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.05	STANDARD GREY CMU, PAINTED BLACK ON INTERIOR SIDE OF AUDIENCE-VISIBLE WALLS AT STAGE. RE: FINISH SCHEDULE.
05.01	STEEL BEAM, RE: STRUCTURAL
05.12	STEEL HANDRAIL, POWDER COATED PAINT, SEE STAIR / RAMP DETAILS
05.17	STEEL BEAM, EPOXY PAINTED, RE: FINISH SCHEDULE AND STRUCTURAL DWGS
07.10	SINGLE-PLY ROOFING MEMBRANE
07.11	ROOF DRAIN AND OVERFLOW, RE: PLUMBING DRAWINGS FOR PIPING DETAILS
07.14	STANDING SEAM METAL ROOF W/ DRIP EDGE
07.17	PARAPET COPING
07.25	18 GA WEATHERED STEEL PANEL, SEE SPECIFICATIONS
08.03	INSULATED OVERHEAD COILING DOOR, RE: DOOR SCHEDULE
08.05	OVERHEAD COILING DOOR, MANUAL OPERATION, RE: DOOR SCHEDULE
08.07	SCISSOR GATE, DEPLOYED CONDITION, INCLUDE IN BASE BID. BASIS-OF-DESIGN IS "CISCO-EAGLE PORTABLE FOLDING GATE", WWW.CISCO-EAGLE.COM
08.09	HM DOORS AND FRAMES, PAINTED. SEE DOOR SCHEDULE SHEET AE601 FOR SIZES.
09.05	ALL EXPOSED STRUCTURE PAINTED BLACK
10.22	OPTIONAL ADA STAGELIFT. SEE ELECTRICAL PLANS FOR POWER REQUIREMENTS.
22.01	DRINKING FOUNTAINS, FOUNTAIN SHOULD ACCOMMODATE WATER BOTTLE FILLER. RE: PLUMBING PLANS
26.02	LIGHT FIXTURE, RE: ELECTRICAL

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AE301

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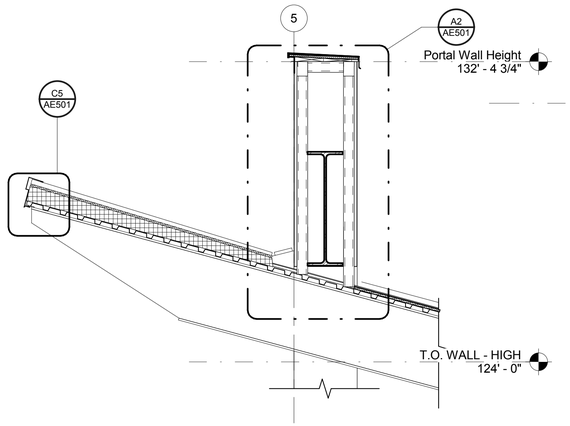
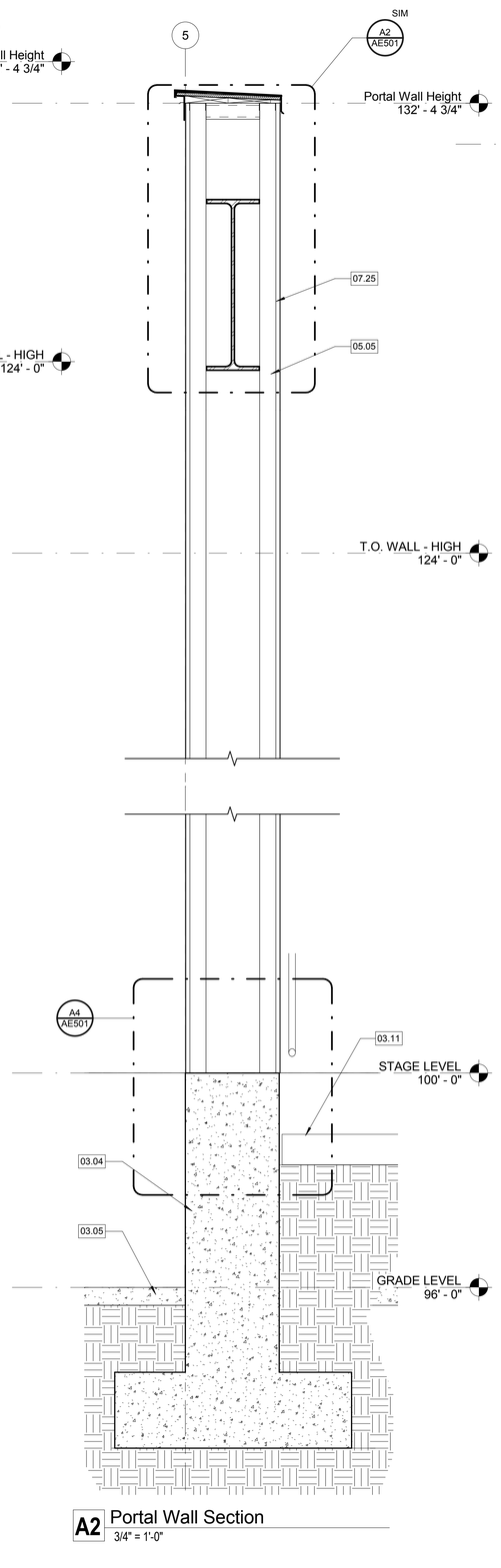
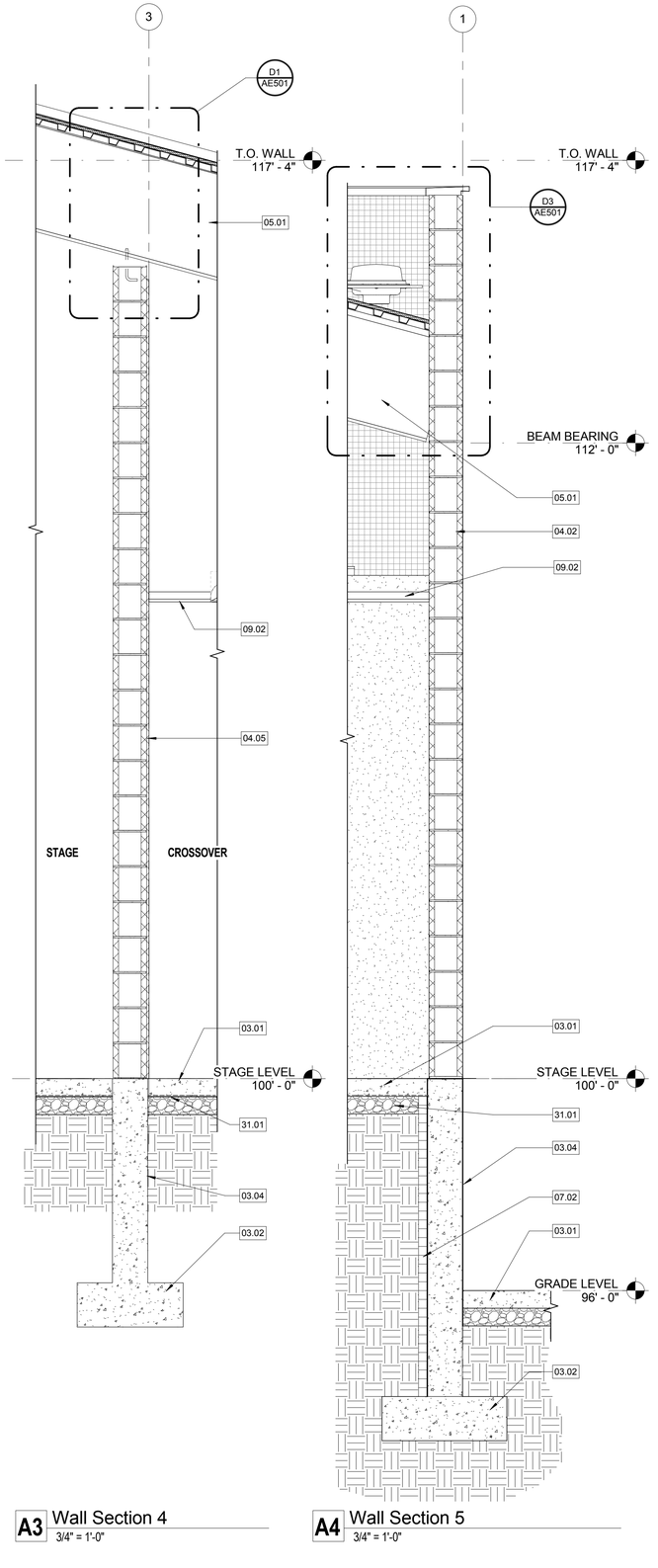


C1 Portal/Roof Section
1/2" = 1'-0"



A2 Portal Wall Section
3/4" = 1'-0"



A3 Wall Section 4
3/4" = 1'-0"

A4 Wall Section 5
3/4" = 1'-0"

Keynote Legend

03.01	CONCRETE SLAB OVER CONT. VAPOR BARRIER OVER MIN 4" FREE DRAINAGE GRAVEL; RE: STRUCT
03.02	CONCRETE FTG, RE: STRUCT'L
03.04	CONCRETE WALL, RE: STRUCT'L
03.05	CONCRETE SLAB, SLOPE AWAY FROM BUILDING
03.11	CAST IN PLACE CONCRETE STAIRS
04.02	CMU HONED, INTEGRAL COLOR #2, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.05	STANDARD GREY CMU, PAINTED BLACK ON INTERIOR SIDE OF AUDIENCE-VISIBLE WALLS AT STAGE. RE: FINISH SCHEDULE.
05.01	STEEL BEAM, RE: STRUCTURAL
05.05	3 5/8" STEEL STUD
07.02	2" CONT. RIGID INSULATION BOARD ALONG OUTSIDE FACE OF FOUNDATION WALL FROM 6" BELOW FINISH GRADE TO TOP OF FOOTING. INSTALL DRAINAGE BOARD ON EXTERIOR OF BOARD INSULATION.
07.25	18 GA WEATHERED STEEL PANEL, SEE SPECIFICATIONS
09.02	SCHEDULED CEILING
31.01	4" FREE DRAIN GRAVEL FILL

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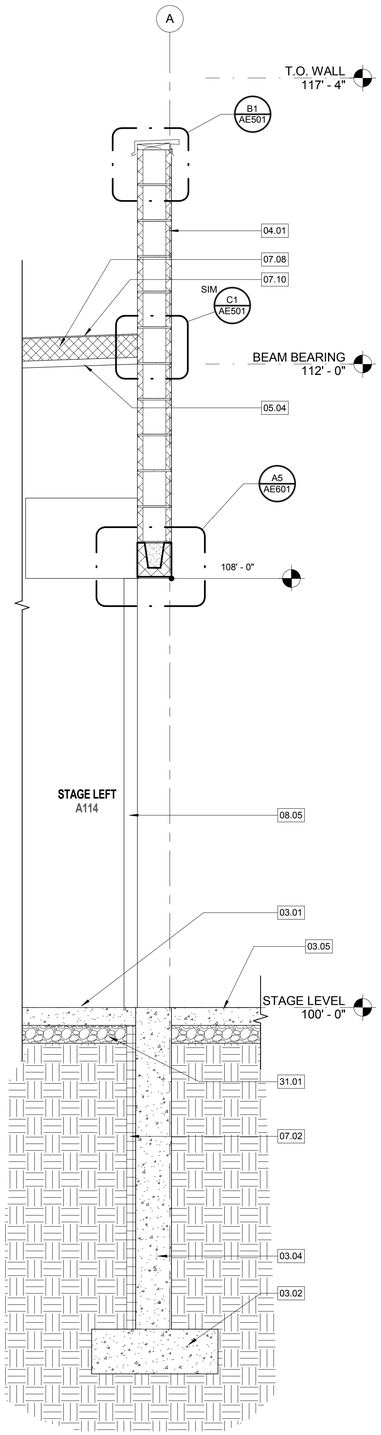
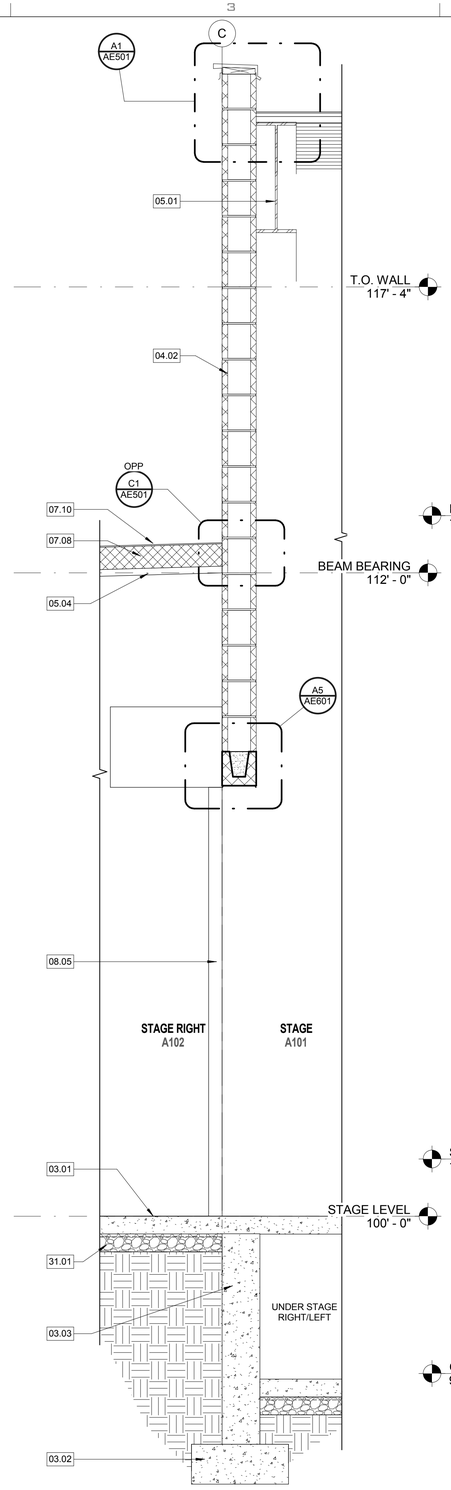
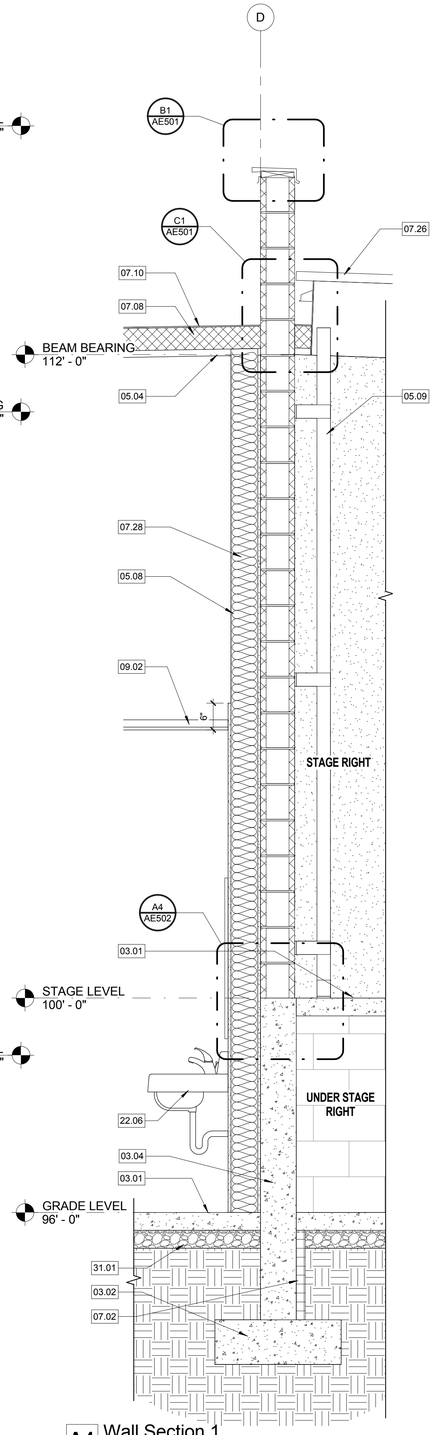


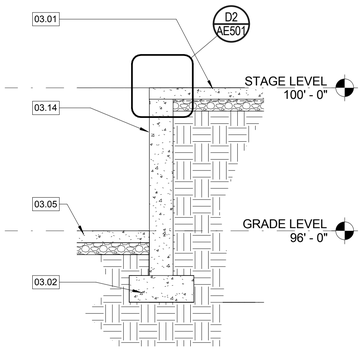
A2 Wall Section 3
3/4" = 1'-0"



A3 Wall Section 2
3/4" = 1'-0"



A4 Wall Section 1
3/4" = 1'-0"



A5 Stage Front Section
1/2" = 1'-0"

Keynote Legend

03.01	CONCRETE SLAB OVER CONT. VAPOR BARRIER OVER MIN 4" FREE DRAINAGE GRAVEL; RE: STRUCT
03.02	CONCRETE FTG, RE: STRUCT'L
03.03	CONCRETE FDN, RE: STRUCT'L
03.04	CONCRETE WALL, RE: STRUCT'L
03.05	CONCRETE SLAB, SLOPE AWAY FROM BUILDING
03.14	EXPOSED CONCRETE FOUNDATION WALL WITH ARCHITECTURAL FINISH
04.01	CMU HONED, INTEGRAL COLOR #1, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
04.02	CMU HONED, INTEGRAL COLOR #2, SEE SPECIFICATIONS, RE: STRUCTURAL FOR SIZE AND REINFORCING
05.01	STEEL BEAM, RE: STRUCTURAL
05.04	METAL DECK, RE: STRUCTURAL
05.08	6" METAL STUD WALL, RE: WALL TYPES ON FLOOR PLAN.
05.09	PAINTED METAL ROOF ACCESS LADDER
07.02	2" CONT. RIGID INSULATION BOARD ALONG OUTSIDE FACE OF FOUNDATION WALL FROM 6" BELOW FINISH GRADE TO TOP OF FOOTING. INSTALL DRAINAGE BOARD ON EXTERIOR OF BOARD INSULATION.
07.08	RIGID INSULATION
07.10	SINGLE-PLY ROOFING MEMBRANE
07.26	ROOF HATCH, 4' X 4' MIN. CONTRACTOR RESPONSIBLE FOR COORDINATION WITH ROOF FRAMING.
07.28	5 1/2" BATT INSULATION
08.05	OVERHEAD COILING DOOR, MANUAL OPERATION, RE: DOOR SCHEDULE
09.02	SCHEDULED CEILING
22.06	ADA HEIGHT SINK, RE PLUMBING PLANS
31.01	4" FREE DRAIN GRAVEL FILL

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AE311

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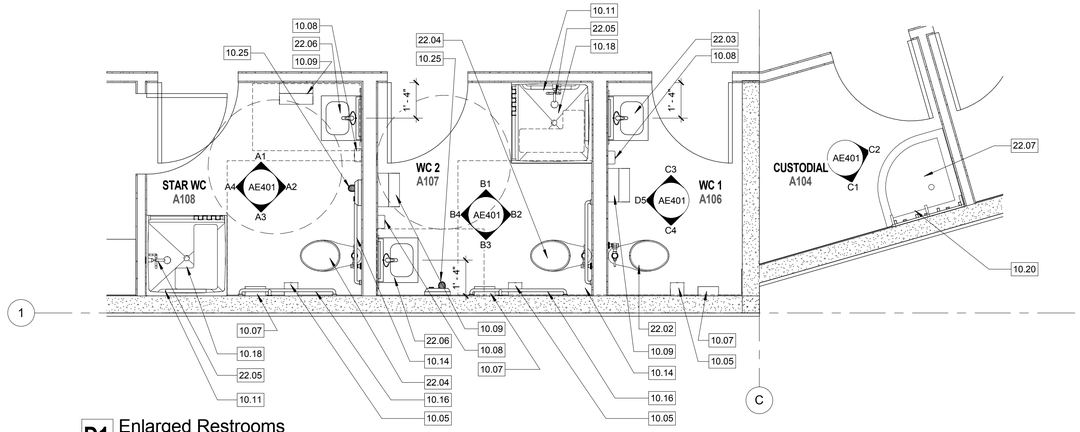
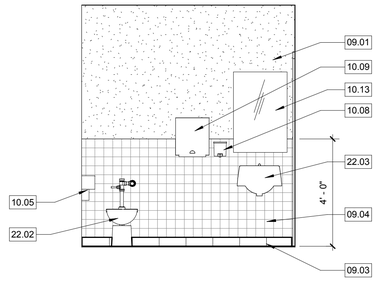


D1 Enlarged Restrooms
3/8" = 1'-0"



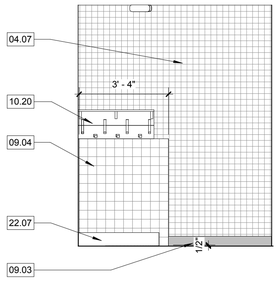
D5 A106 WC 1 West Elevation
3/8" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

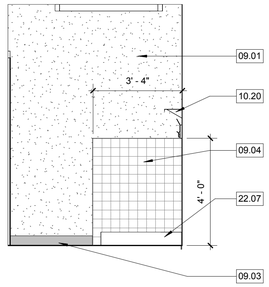
1. SEE SHEET G003 FOR STANDARD AND ADA MOUNTING HEIGHTS FOR ALL ACCESSORIES

Keynote Legend

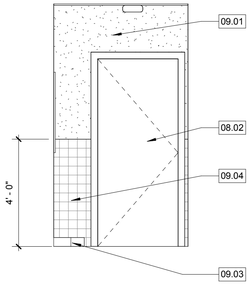
04.07	CMU WALL WITH BLOCK FILLER, PAINTED.
06.05	PLASTIC LAMINATE COUNTER TOP AND BACKSPLASH
06.06	SUPPORT BRACKETS, SEE COUNTER TOP SECTION
08.02	PAINTED HOLLOW METAL DOOR AND FRAME, RE: DOOR SCHEDULE
09.01	5/8" GYP. BD, PAINTED, RE: FINISH SCHEDULE
09.03	BASE AS SCHEDULED, RE FINISH SCHEDULE
09.04	CERAMIC TILE; RE: FINISH SCHEDULE
10.05	TOILET PAPER DISPENSER, RE: ACCESSORY SPEC
10.07	SANITARY NAPKIN DISPOSAL, RE: ACCESSORY SPEC
10.08	SOAP DISPENSER, RE: ACCESSORY SPEC
10.09	PAPER TOWEL DISPENSER RE: ACCESSORY SPEC
10.11	GRAB BAR, RE: TYPICAL MOUNTING HEIGHTS SHEET G003
10.13	2'-0" X 3'-0" MIRROR, TYP. SEE ACCESSORY SPEC AND DETAIL SHEET AE502 FOR BACKING DETAIL AT GYP BOARD.
10.14	36" GRAB BAR, RE: ACCESSORY SPEC AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.15	18" VERTICAL GRAB BAR, RE: ACCESSORY SPEC AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.16	42" GRAB BAR, RE: ACCESSORY SPEC SHEET AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.18	PRE-FABRICATED TRANSFER ADA SHOWER INSERT WITH INTEGRAL SEAT, SEE SPECIFICATIONS. RE: G003 ACCESSORY MOUNTING HEIGHTS
10.19	8'-0" X 3'-0" MIRROR, RE: ACCESSORY SPEC.
10.20	SHELF WITH MOP AND BROOM RACK, RE: ACCESSORY SPEC
10.21	SHOWER CURTAIN AND ROD
10.25	HAND DRYERS, TYP. RE: ACCESSORY SPEC
22.02	TOILET FIXTURE, RE: PLUMBING PLANS
22.03	SINK, RE; PLUMBING PLANS
22.04	ADA HEIGHT TOILET FIXTURE, RE PLUMBING PLANS
22.05	ADA SHOWERHEAD, RE PLUMBING PLANS
22.06	ADA HEIGHT SINK, RE PLUMBING PLANS
22.07	FLOOR SINK, RE PLUMBING PLANS



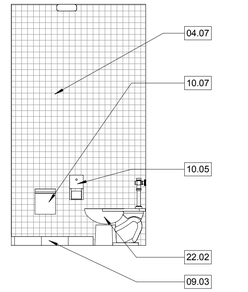
C1 A104 Custodial South Elevation
3/8" = 1'-0"



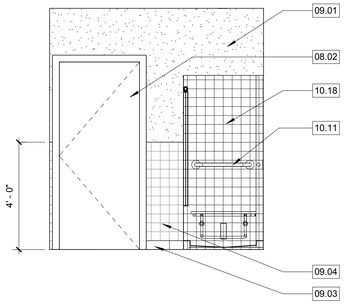
C2 A104 Custodial East Elevation
3/8" = 1'-0"



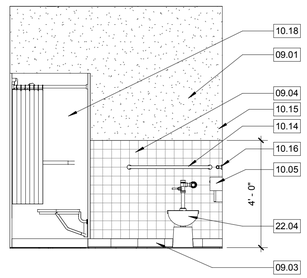
C3 A106 WC 1 North Elevation
3/8" = 1'-0"



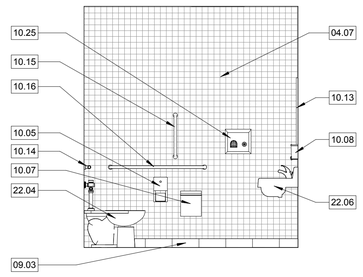
C4 A106 WC 1 South Elevation
3/8" = 1'-0"



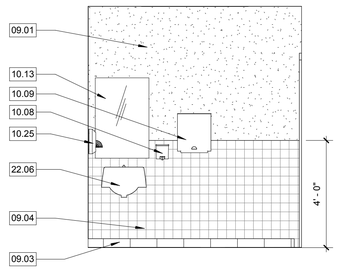
B1 A107 WC 2 North Elevation
3/8" = 1'-0"



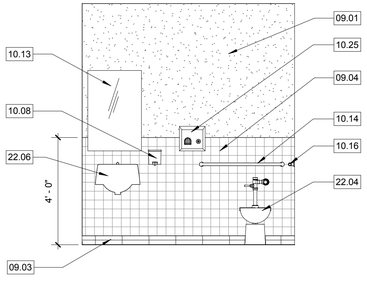
B2 A107 WC 2 East Elevation
3/8" = 1'-0"



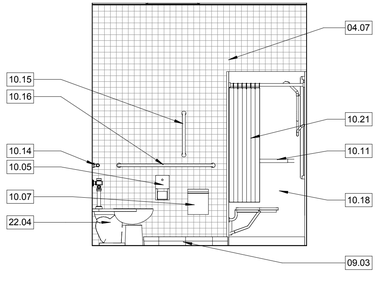
B3 A107 WC 2 South Elevation
3/8" = 1'-0"



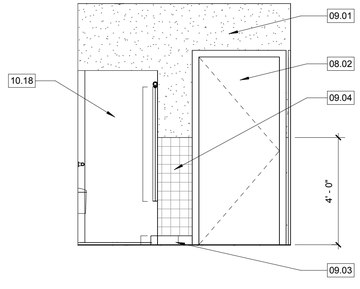
B4 A107 WC 2 West Elevation
3/8" = 1'-0"



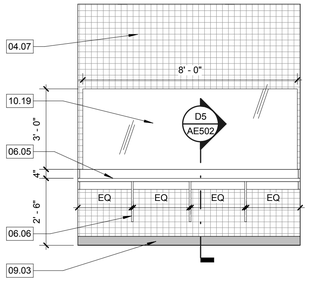
A2 A108 STAR WC East Elevation
3/8" = 1'-0"



A3 A108 STAR WC South Elevation
3/8" = 1'-0"



A4 A108 STAR WC West Elevation
3/8" = 1'-0"



A5 A109 STAR DRESSING
3/8" = 1'-0"

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AE401

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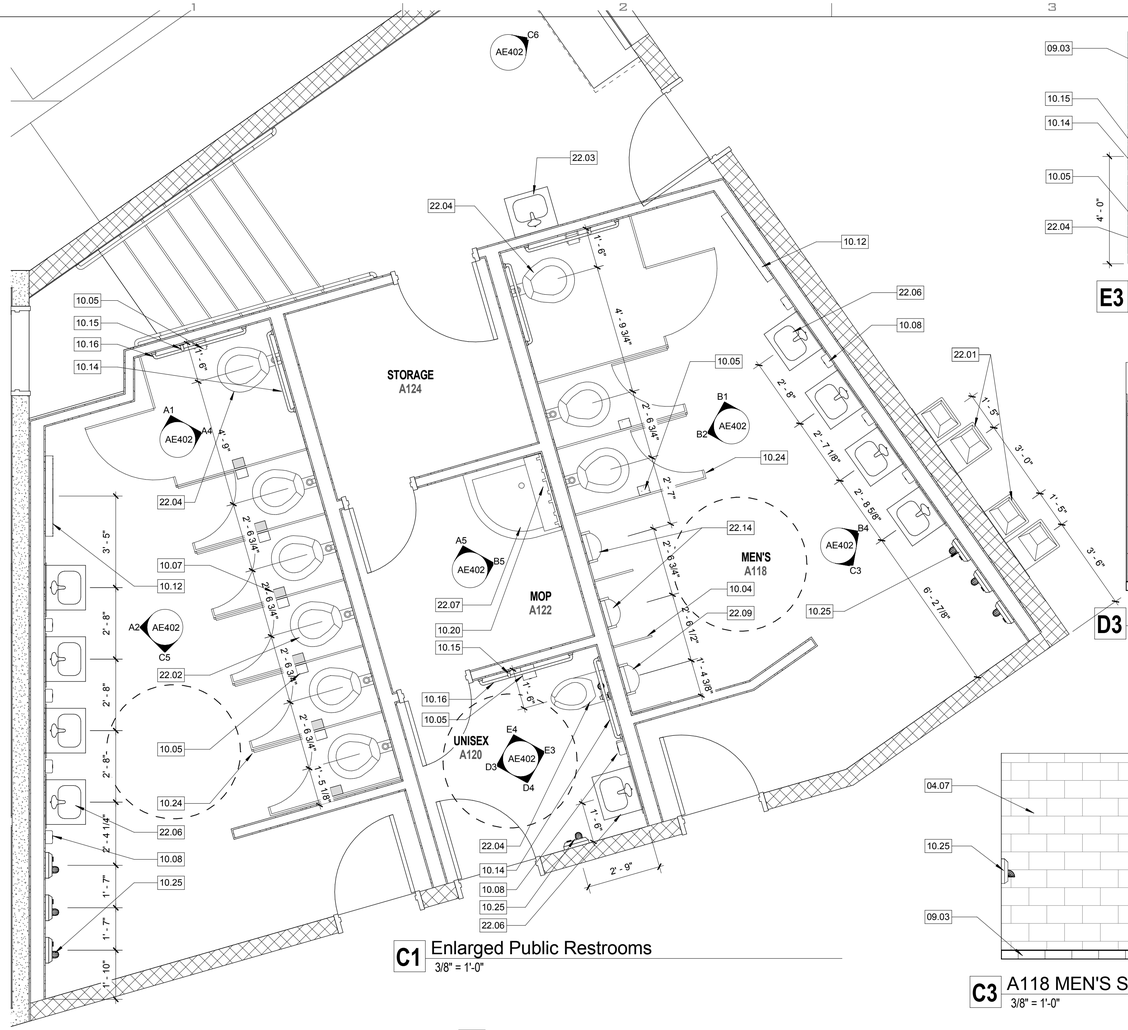
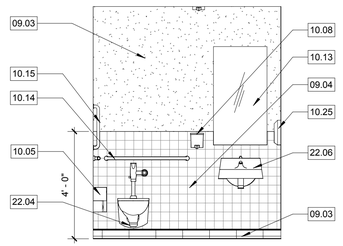
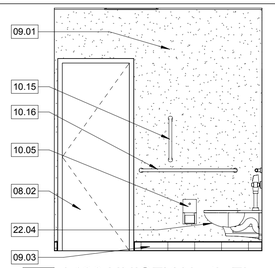


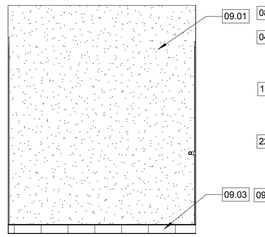
C1 Enlarged Public Restrooms
3/8" = 1'-0"



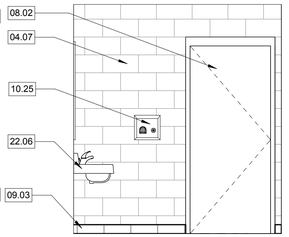
E3 A120 UNISEX East Elevation
3/8" = 1'-0"



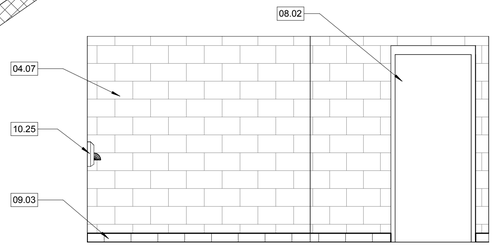
E4 A120 UNISEX North Elevation
3/8" = 1'-0"



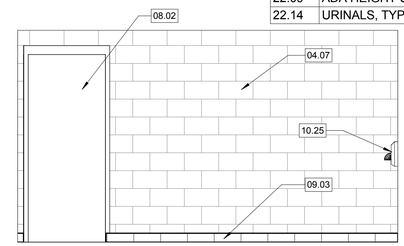
D3 A120 UNISEX West Elevation
3/8" = 1'-0"



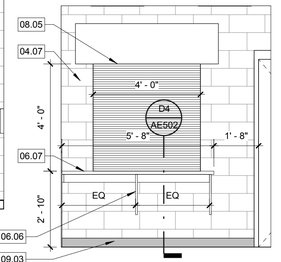
D4 A120 UNISEX South Elevation
3/8" = 1'-0"



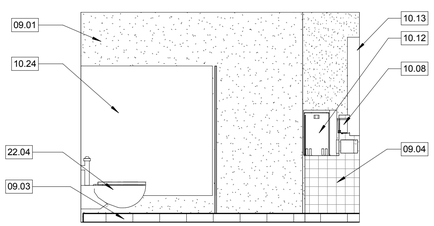
C3 A118 MEN'S South Elevation
3/8" = 1'-0"



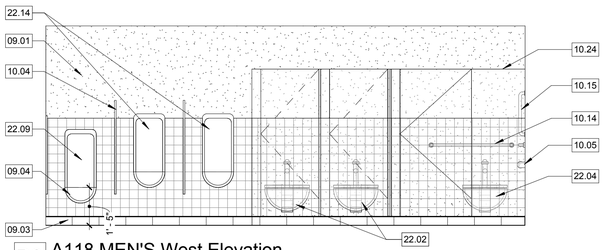
C5 A116 WOMEN'S South Elevation
3/8" = 1'-0"



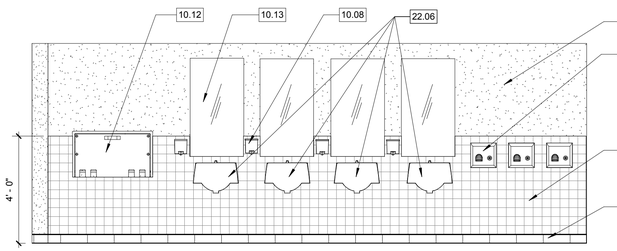
C6 A128 Concessions
3/8" = 1'-0"



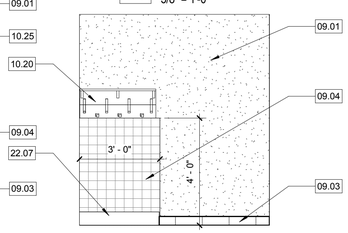
B1 A118 MEN'S North Elevation
3/8" = 1'-0"



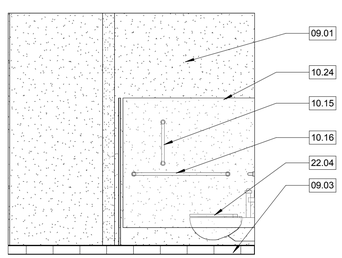
B2 A118 MEN'S West Elevation
3/8" = 1'-0"



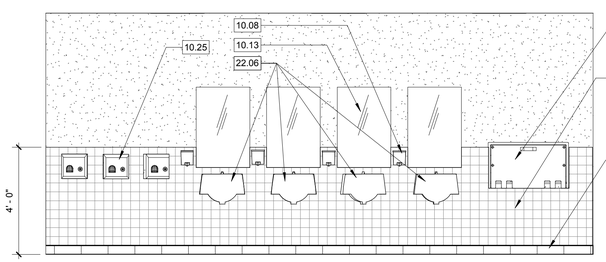
B4 A118 MEN'S East Elevation
3/8" = 1'-0"



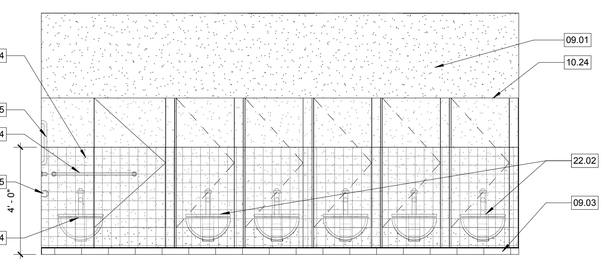
B5 A122 MOP West Elevation
3/8" = 1'-0"



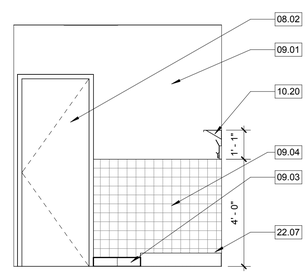
A1 A116 WOMEN'S North Elevation
3/8" = 1'-0"



A2 A116 WOMEN'S West Elevation
3/8" = 1'-0"



A4 A116 WOMEN'S East Elevation
3/8" = 1'-0"



A5 A122 MOP North Elevation
3/8" = 1'-0"

GENERAL NOTES - INTERIOR ELEVATIONS

1. SEE SHEET G003 FOR STANDARD AND ADA MOUNTING HEIGHTS FOR ALL ACCESSORIES

Keynote Legend

04.07	CMU WALL WITH BLOCK FILLER, PAINTED.
06.06	SUPPORT BRACKETS, SEE COUNTER TOP SECTION
06.07	STAINLESS STEEL COUNTER TOP
08.02	PAINTED HOLLOW METAL DOOR AND FRAME, RE: DOOR SCHEDULE
08.05	OVERHEAD COILING DOOR, MANUAL OPERATION, RE: DOOR SCHEDULE
09.01	5/8" GYP. BD, PAINTED, RE: FINISH SCHEDULE
09.03	BASE AS SCHEDULED, RE FINISH SCHEDULE
09.04	CERAMIC TILE; RE: FINISH SCHEDULE
10.04	URINAL SCREEN, TYP. PER PLAN AND SPECS
10.05	TOILET PAPER DISPENSER, RE: ACCESSORY SPEC
10.07	SANITARY NAPKIN DISPOSAL, RE: ACCESSORY SPEC
10.08	SOAP DISPENSER, RE: ACCESSORY SPEC
10.12	BABY CHANGING STATION, TYP. PER PLANS AND SPECS
10.13	2'-0" X 3'-0" MIRROR, TYP. SEE ACCESSORY SPEC AND DETAIL SHEET AE502 FOR BACKING DETAIL AT GYP BOARD.
10.14	36" GRAB BAR, RE: ACCESSORY SPEC AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.15	18" VERTICAL GRAB BAR, RE: ACCESSORY SPEC AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.16	42" GRAB BAR, RE: ACCESSORY SPEC SHEET AND TYPICAL MOUNTING HEIGHTS SHEET G003
10.20	SHELF WITH MOP AND BROOM RACK, RE: ACCESSORY SPEC
10.24	TOILET PARTITIONS, TYP. PER PLAN AND SPECIFICATIONS
10.25	HAND DRYERS, TYP. RE: ACCESSORY SPEC
22.01	DRINKING FOUNTAINS, FOUNTAIN SHOULD ACCOMMODATE WATER BOTTLE FILLER. RE: PLUMBING PLANS
22.02	TOILET FIXTURE, RE: PLUMBING PLANS
22.03	SINK, RE; PLUMBING PLANS
22.04	ADA HEIGHT TOILET FIXTURE, RE PLUMBING PLANS
22.06	ADA HEIGHT SINK, RE PLUMBING PLANS
22.07	FLOOR SINK, RE PLUMBING PLANS
22.09	ADA HEIGHT URINAL. RE: PLUMBING PLANS
22.14	URINALS, TYP. PER PLANS AND SPECIFICATIONS

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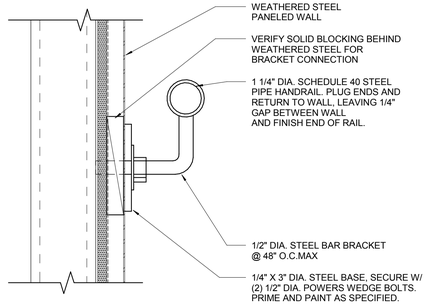
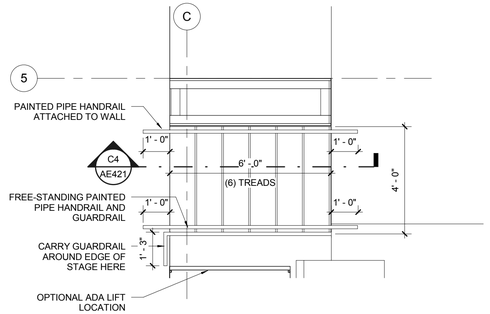
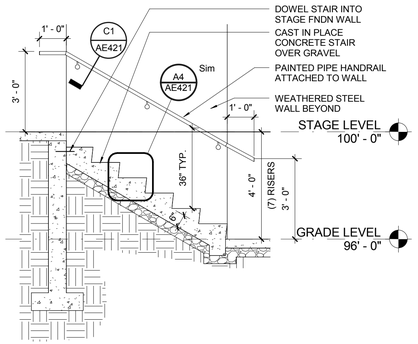


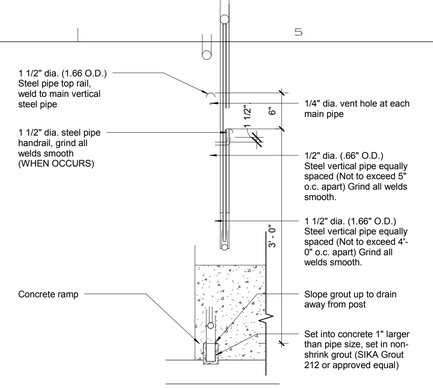
C1 Handrail Attachment - Weathered Steel Wall
3" = 1'-0"



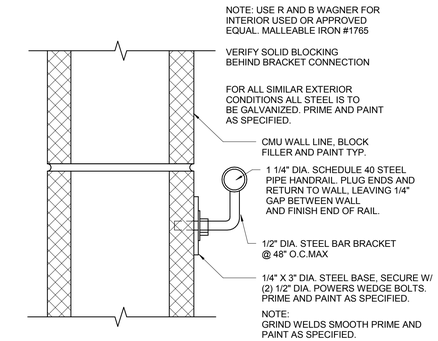
C2 Stage Stair / ADA Lift
3/8" = 1'-0"



C4 Stair Section at Stage
3/8" = 1'-0"



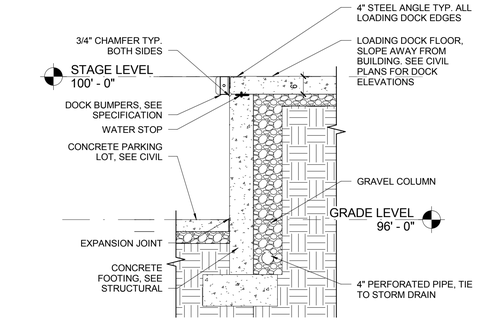
D5 TYP Handrail - Ramp Section
1" = 1'-0"



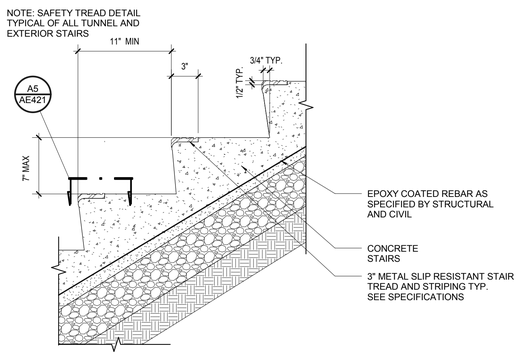
C5 Handrail Attachment - CMU
1" = 1'-0"

B2 Stage Right - Stair
3/8" = 1'-0"

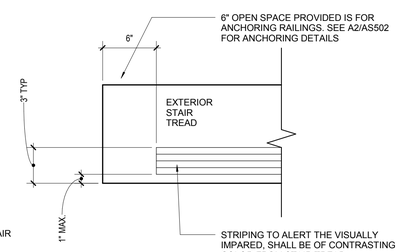
B3 Stair Section
3/8" = 1'-0"



B5 Section Thru Loading Dock
1/2" = 1'-0"



A4 Stair Detail
1 1/2" = 1'-0"



A5 Typ Stair Tread
1 1/2" = 1'-0"

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sheet:
AE421

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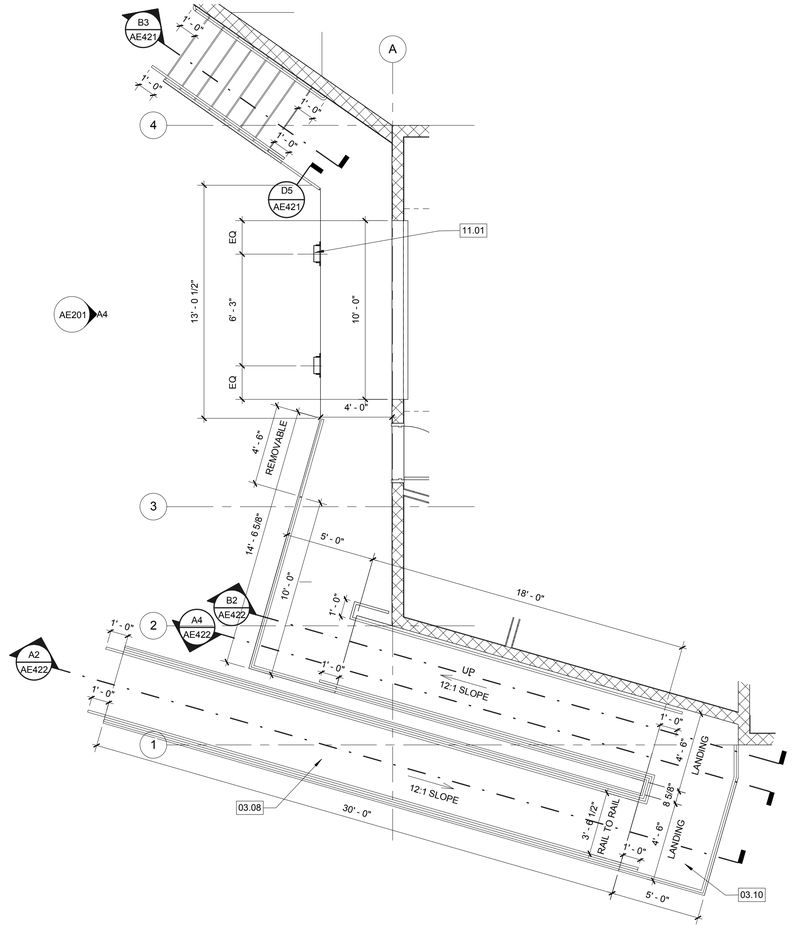
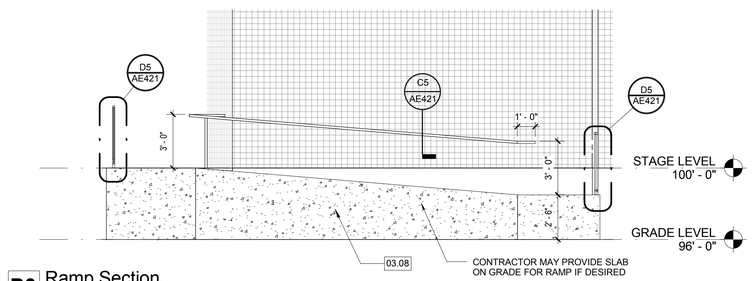
Keynote Legend

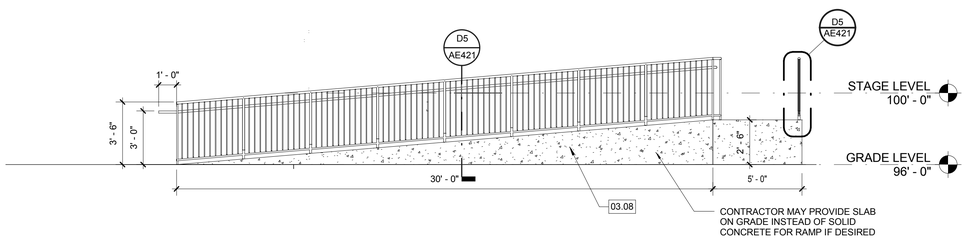
03.08	CAST IN PLACE CONCRETE ADA RAMP, 1:12 SLOPE
03.10	CAST IN PLACE CONCRETE LANDING
11.01	DOCK BUMPER, SEE SPECIFICATIONS



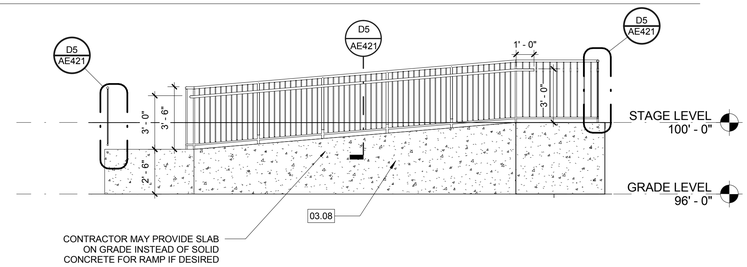


B2 Ramp Section
1/4" = 1'-0"

B3 Ramp And Dock Area
1/4" = 1'-0"



A2 Ramp Section
1/4" = 1'-0"



A4 Ramp Section
1/4" = 1'-0"

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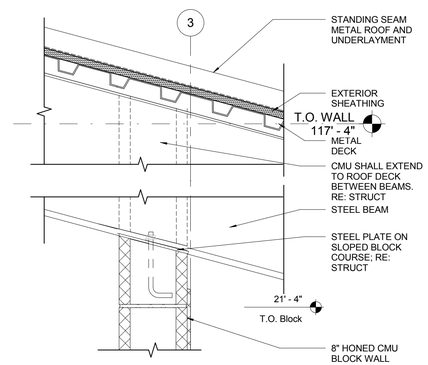
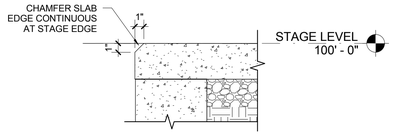
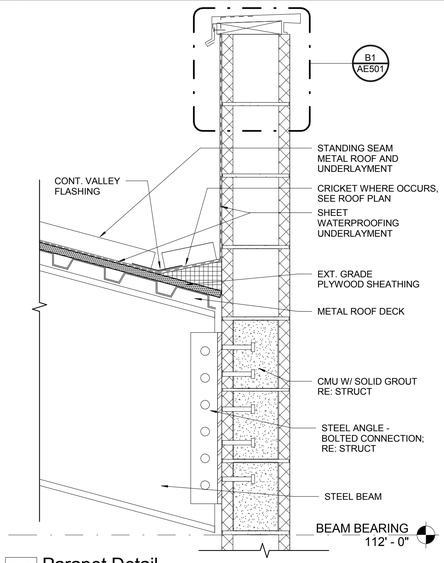


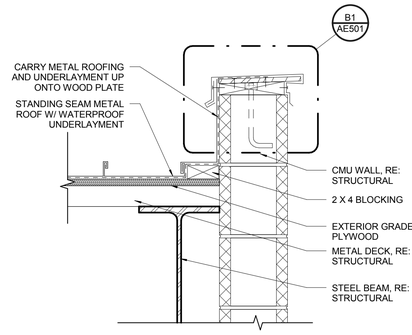
D1 Rear Stage Wall to Roof Condition
1 1/2" = 1'-0"



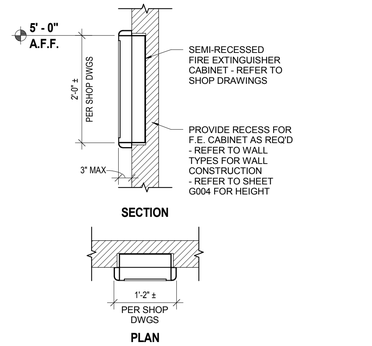
D2 Stage Edge Detail
1 1/2" = 1'-0"



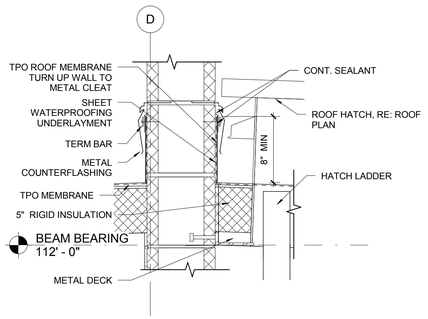
D3 Parapet Detail
1 1/2" = 1'-0"



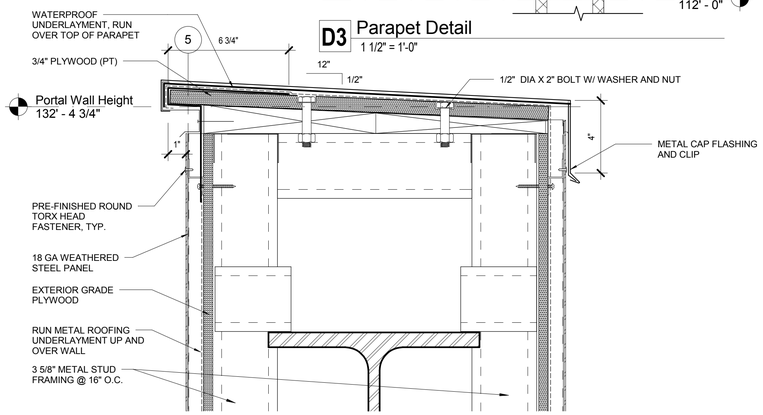
D4 Standing Seam Roof to Wall Detail
1 1/2" = 1'-0"

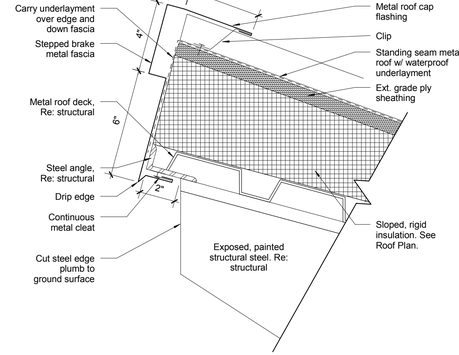


D5 Fire Extinguisher Cabinet
3/4" = 1'-0"



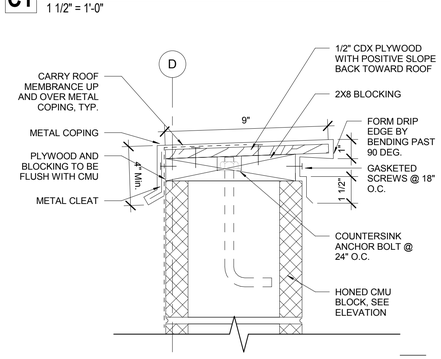
C1 TPO Roof To Wall Detail
1 1/2" = 1'-0"



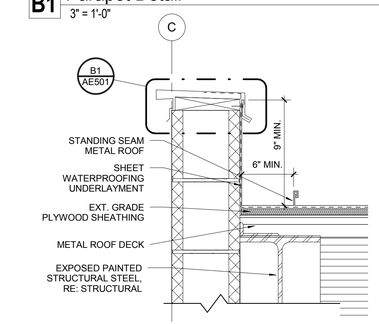


C4 Roof Canopy Edge Detal
1 1/2" = 1'-0"

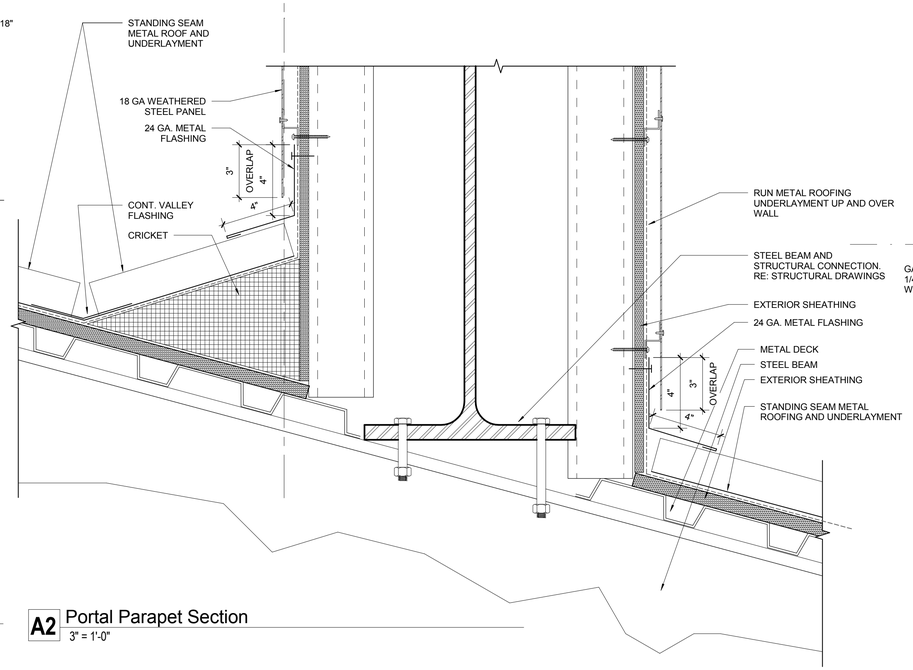
C5 Front Canopy Roof Edge
3" = 1'-0"



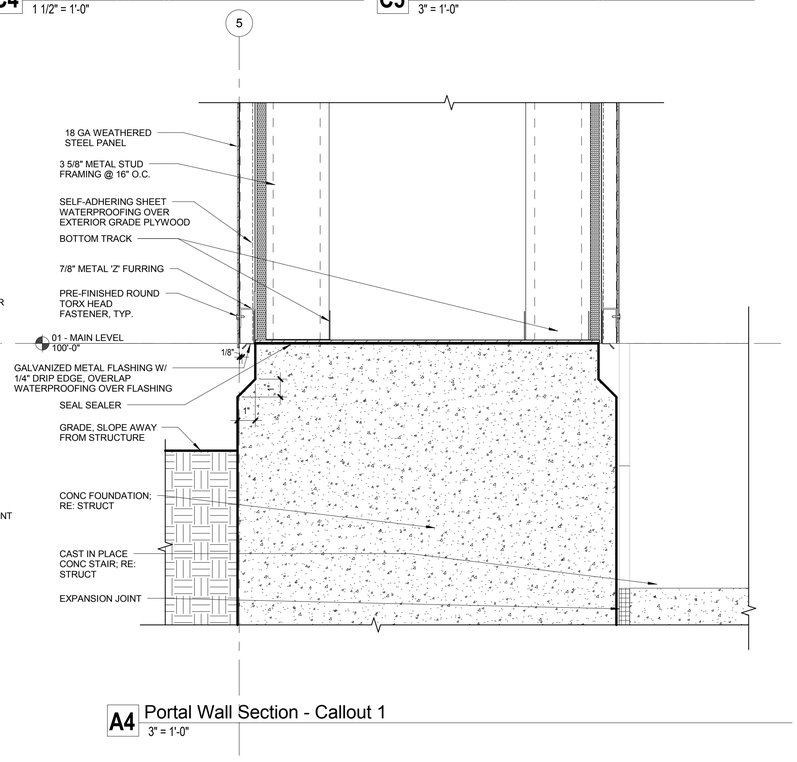
B1 Parapet Detail
3" = 1'-0"



A1 Roof Canopy CMU Edge Detail - Typ
1 1/2" = 1'-0"



A2 Portal Parapet Section
3" = 1'-0"



A4 Portal Wall Section - Callout 1
3" = 1'-0"

STATE OF COLORADO
KELLY BOYD MORGAN
ARCHITECT
LICENSED ARCHITECT
7-15-16

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Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Details

sheet:
AE501

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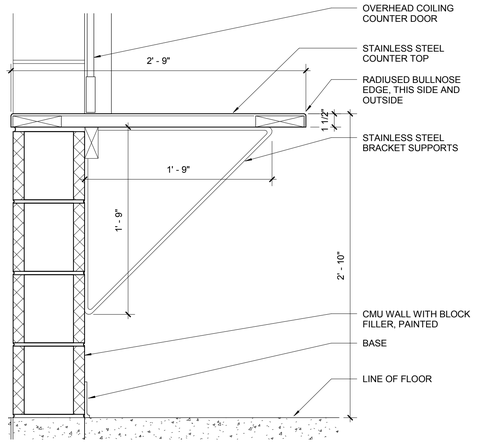
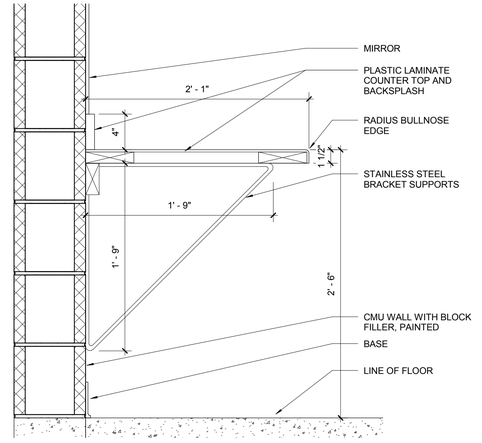
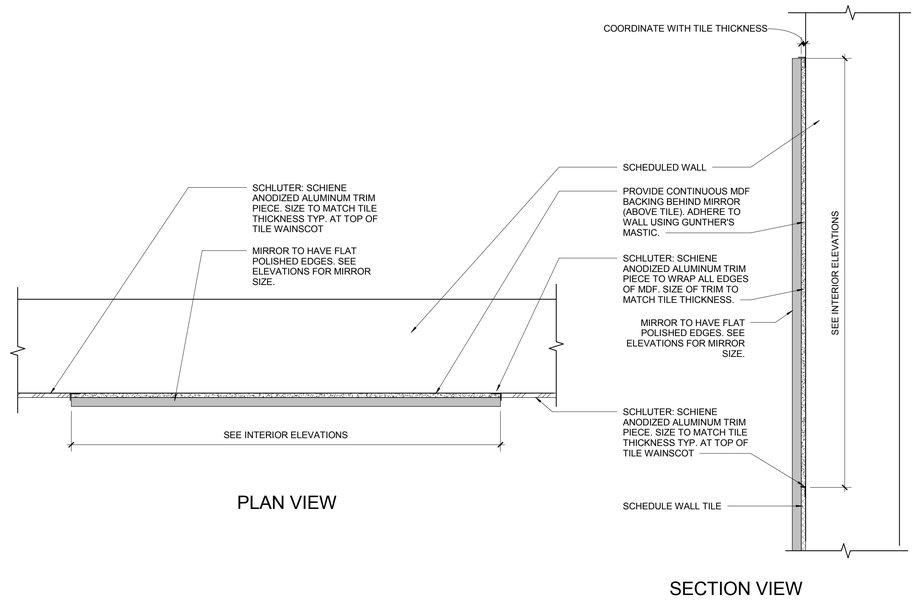


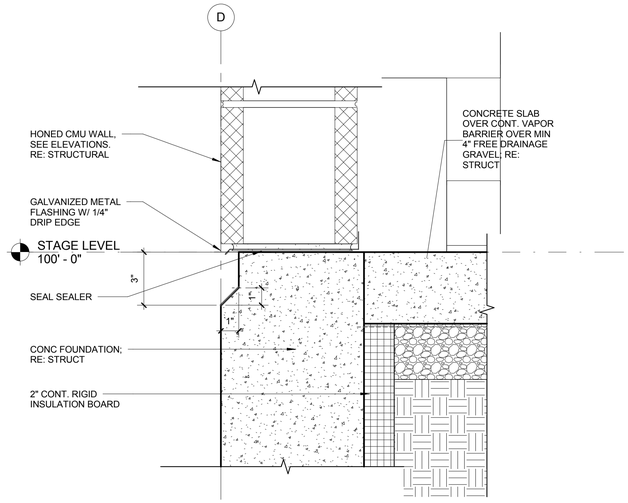
D4 Counter Top Section
1 1/2" = 1'-0"



D5 Counter Top Section
1 1/2" = 1'-0"



A2 Restroom Mirror Detail
3" = 1'-0"



A4 Typ Foundation Detail
3" = 1'-0"

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project#: 14.0650
date: July 15, 2016

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title:
Details

sheet:
AE502

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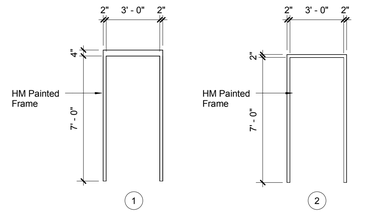
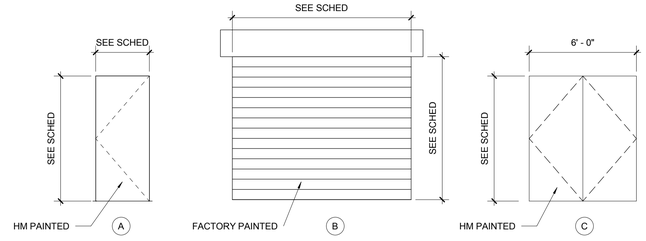
DOOR SCHEDULE

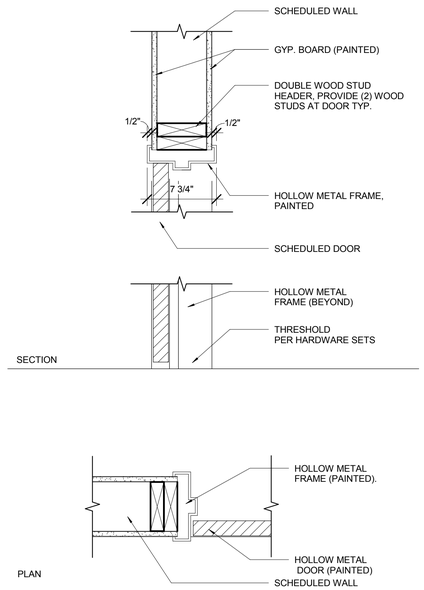
Door Number	Door Width	Door Height	Door Thickness	Door Type	Door Material	Door Finish	Door Hardware Set	Frame Type	Frame Material	Frame Finish	Head	Jamb	Sill	Fire Rating	Comments
001	6' - 0"	3' - 0"	1 3/4"	C			03	2							
002	6' - 0"	3' - 0"	1 3/4"	C			03	2							
101A	3' - 0"	7' - 0"	1 3/4"	A			06	1	HM		A5/A601	A5/A601	A5/A601		
101B	10' - 0"	8' - 0"	2"	B			01	MFR			A6/A601	A6/A601	A6/A601		
101C	3' - 0"	7' - 0"	1 3/4"	A			06	1	HM		A5/A601	A5/A601	A5/A601		
101D	10' - 0"	8' - 0"	2"	B			01	MFR			A6/A601	A6/A601	A6/A601		
102	3' - 0"	7' - 0"	1 3/4"	A			07	1	HM		A5/A601	A5/A601	A5/A601		
103	3' - 0"	7' - 0"	1 3/4"	A			09	2	HM		A4/A601	A4/A601	A4/A601		
104	3' - 0"	7' - 0"	1 3/4"	A			09	2	HM		A4/A601	A4/A601	A4/A601		
106	3' - 0"	7' - 0"	1 3/4"	A			12	2	HM		A4/A601	A4/A601	A4/A601		
107	3' - 0"	7' - 0"	1 3/4"	A			12	2	HM		A4/A601	A4/A601	A4/A601		
108A	3' - 0"	7' - 0"	1 3/4"	A			12	2	HM		A4/A601	A4/A601	A4/A601		
108B	3' - 0"	7' - 0"	1 3/4"	A			13	2	HM		A4/A601	A4/A601	A4/A601		
109	3' - 0"	7' - 0"	1 3/4"	A			11	2	HM		A4/A601	A4/A601	A4/A601		
110	3' - 0"	7' - 0"	1 3/4"	A			11	2	HM		A4/A601	A4/A601	A4/A601		
111	3' - 0"	7' - 0"	1 3/4"	A			10	2	HM		A4/A601	A4/A601	A4/A601		
112	3' - 0"	7' - 0"	1 3/4"	A			09	2	HM		A4/A601	A4/A601	A4/A601		
113	3' - 0"	7' - 0"	1 3/4"	A			09	2	HM		A4/A601	A4/A601	A4/A601		
114A	3' - 0"	7' - 0"	1 3/4"	A			02	1	HM		A5/A601	A5/A601	A5/A601		
114B	10' - 0"	8' - 0"	2"	B			01	MFR			A6/A601	A6/A601	A6/A601		
116	3' - 0"	7' - 0"	1 3/4"	A			04	1							
118	3' - 0"	7' - 0"	1 3/4"	A			04	1							
120	3' - 0"	7' - 0"	1 3/4"	A			05	1							
122A	2' - 6"	7' - 0"	1 3/4"	A			09	2							
122B	2' - 6"	7' - 0"	1 3/4"	A			09	2							
124	3' - 0"	7' - 0"	1 3/4"	A			08	2							
128A	3' - 0"	7' - 0"	1 3/4"	A			02	1							
128B	4' - 0"	4' - 0"	2"	B			01	MFR							



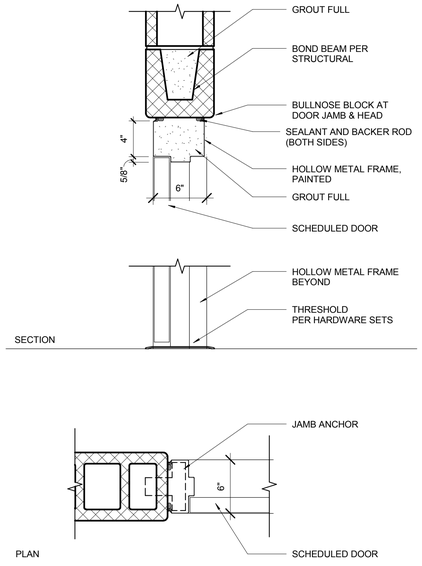
Frame Type
1/4" = 1'-0"



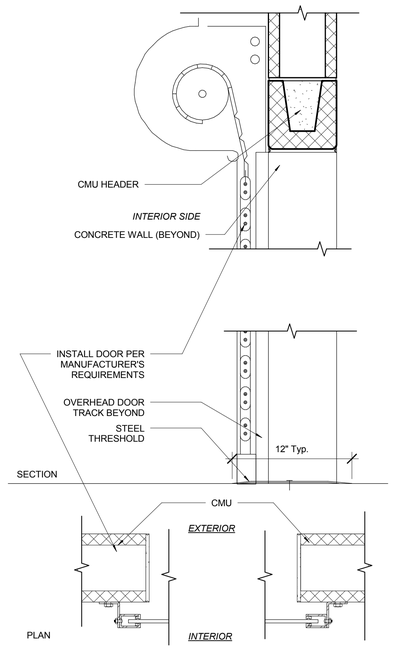
Door Type
1/4" = 1'-0"



A3 Typical HM Interior Door
1 1/2" = 1'-0"



A4 Typical HM Door @ CMU
1 1/2" = 1'-0"



A5 Roll Up Door Head
1 1/2" = 1'-0"

STATE OF COLORADO
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7-15-16

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LAS COLONIAS AMPHITHEATER

Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Door/Window Schedules & Types

sheet:
AE601

100% CONSTRUCTION DOCUMENTS

INTERIOR FINISH LEGEND

CODE	MATERIAL	MANUFACTURER	PRODUCT NAME / NUMBER	COLOR / FINISH	SIZE	COMMENTS
TILE						
FT-1	Ceramic Tile	Daltile	Paver Surface / 0Q78	Golden Brown / Quarry Paver	6" x 6"	
WT-1	Ceramic Tile	Daltile	Matte Group 1	Matte Almond X735	3" x 6"	Lay in Subway Tile brick pattern - Rittenhouse Collection
CEILING						
ACT-1	Suspended Acoustical Tile	USG	Frost 419 FLB Edge	Flat White 050	24" x 24"	On Centricitee DXT Grid. See Reflected Ceiling Plan for layout
CONCRETE						
SC-1	Sealed Concrete	-	-	-	-	
BASE		-	-		-	
RB-1	Rubber Base	Roppe	700 Series	175 Slate	4" H	
RB-2	Rubber Base	Roppe	700 Series	100 Black	4" H	
TB-1	Ceramic Tile	Daltile	Matte Group 1 / S3419T	Matte Almond X735	4 1/4" x 6"	
PAINT						
PNT-1	Paint	Sherwin Williams	Interior Paint- SemiGloss	SW 7627 White Heron		
PNT-2	Paint	Sherwin Williams	Interior Paint- Matte	SW 6989 Domino		Epoxy Paint, applies to Side and Rear Walls at Stage A101
PNT-3	Paint	Sherwin Williams	Interior Paint- Matte	SW 6989 Domino		Epoxy Paint, applies to Exposed Steel Deck and Structure above Stage A101
PNT-4	Paint	Sherwin Williams	Interior Paint- SemiGloss	SW 7068 Grizzle Gray		Epoxy Paint, applies to Exterior HM Doors/Frames and Guardrail/Handrails
STAINLESS STEEL COUNTERTOP						
SS-1	Stainless Steel	-	-	18 gauge min. thickness		
LAMINATE						
PL-1	Plastic Laminate	Wilsonart Laminate	7983-38	Boardwalk Oak		Bullnose Edge
TRANSITION STRIPS						
TS-1	Tile to Concrete	Schluter	RENO-RAMP	Aluminum		

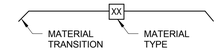
ROOM FINISH SCHEDULE

Number	Name	Finishes				Comments
		Floor	Wall	Base	Ceiling	
001	UNDER STAGE LEFT	SC-1	-	-	-	
002	UNDER STAGE RIGHT	SC-1	-	-	-	
A101	STAGE	SC-1	PNT-2	RB-2	PNT-3	
A102	STAGE RIGHT	SC-1	-	RB-2	-	
A103	SECURE STORAGE	SC-1	PNT-1	RB-1	ACT-1	
A104	CUSTODIAL	SC-1	* WT-1/PNT-1	RB-1	ACT-1	* SEE ELEVATIONS
A105	CROSSOVER	SC-1	* PNT-1	RB-2	ACT-1	* PNT-1 ONLY ON SOUTH GYP. BD. WALL
A106	WC 1	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A107	WC 2	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A108	STAR WC	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A109	STAR DRESSING	SC-1	PNT-1	RB-1	ACT-1	
A110	OFFICE	SC-1	PNT-1	RB-1	ACT-1	
A111	MECHANICAL	SC-1	-	-	ACT-1	
A112	ELECTRICAL	SC-1	-	-	ACT-1	
A113	IT	SC-1	-	-	ACT-1	
A114	STAGE LEFT	SC-1	-	RB-2	-	
A116	WOMENS	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A118	MEN'S	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A120	UNISEX	FT-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A122	MOP	SC-1	* WT-1/PNT-1	TB-1	ACT-1	* SEE ELEVATIONS
A124	STORAGE	SC-1	PNT-1	RB-1	ACT-1	
A128	CONCESSIONS	SC-1	PNT-1	RB-1	ACT-1	

GENERAL NOTES - FINISH PLAN

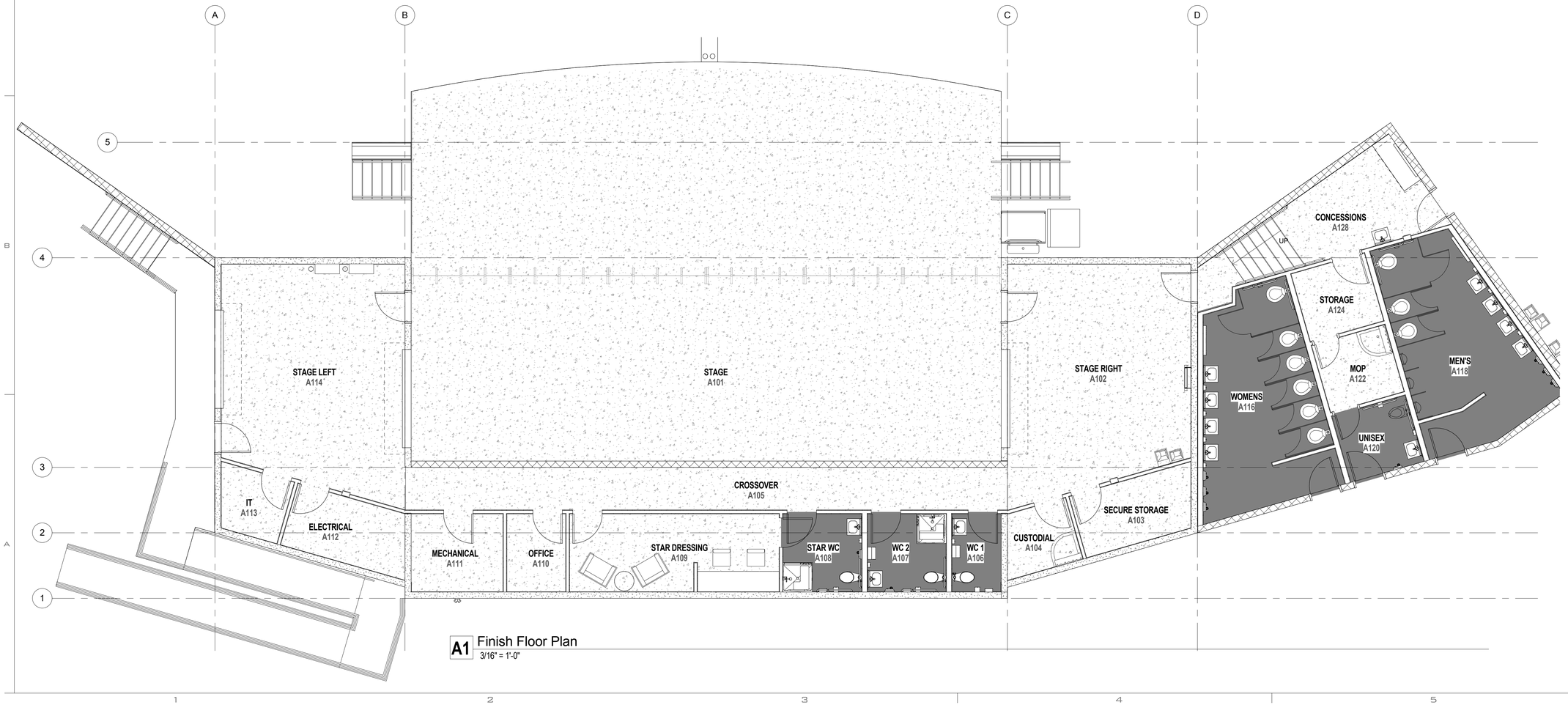
1	SEE FLOOR PLANS FOR INTERIOR ELEVATIONS
2	ALL METAL STUDS WALLS TO DECK ABOVE, SEE SHEET AE501 FOR WALL TYPES
3	PROVIDE DEFLECTION TRACKS AT ALL STUD WALLS, SEE DETAIL X/AEXXX
4	ALL MATERIALS TO BE INSTALLED PER SPECIFIC MANUFACTURER'S INSTALLATION RECOMMENDATIONS
5	ALL EXPOSED METAL TO BE INSTALLED PER SPECIFIC MANUFACTURER'S INSTALLATION RECOMMENDATIONS
6	FLOORING MATERIAL TRANSITIONS TO OCCUR AT CENTER LINE OF DOOR THRESHOLDS, U.N.O.
7	PREPARE FLOORS/WALLS TO RECIEVE FINISH MATERIAL. REFER TO MANUFACTURERS RECOMMENDATIONS FOR SURFACE PREPERATION. NOTIFY ARCHITECT IF CONDITIONS ARE INADEQUATE FOR REQURED INSTALLATION.
8	REFER TO ROOM FINISH SCHEDULE AND MATERIAL LEGEND IN SHEET AE610 FOR MORE INFORMATION
9	SEE AE501 FOR WALL TYPES
10	CONTRACTOR TO PROVIDE SOLID BLOCKING AT ALL CASE WORK, FIXED FURNISHINGS AND EQUIPMENT. COORDINATE WITH ELEVATIONS, SECTIONS AND FURNITURE AND FIXTURE SHEETS AND SPECIFICATIONS. SEE SHEET AE901 FOR TYP. DETAILS

SYMBOL LEGEND:



FT-1

SC-1



A1 Finish Floor Plan
3/16" = 1'-0"

STATE OF COLORADO
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Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
Finish Floor Plan

sheet:
AF100

100% CONSTRUCTION DOCUMENTS

GENERAL STRUCTURAL NOTES

GENERAL

1. The structural notes are intended to complement the project specifications. Specific notes and details in the drawings shall govern over the structural notes and typical details.

2. Typical details and sections shall apply where specific details are not shown.

3. The contractor shall verify all site conditions and dimensions. If actual conditions differ from those shown in the contract drawings, the contractor shall immediately notify the architect/engineer before proceeding with the fabrication or construction of any effected elements.

4. Omissions or conflicts between the contract drawings and/or specifications shall be brought to the attention of the architect/engineer before proceeding with any work involved. In case of conflict, follow the most stringent requirement as directed by the architect/engineer at no additional cost to the owner.

5. The contractor shall submit a written request to the architect/engineer before proceeding with any changes, substitutions or modifications. Any work done by the contractor before receiving written approval will be at the contractor's risk.

6. The contractor shall coordinate with all trades any items that are to be integrated into the structural system such as openings, penetrations, mechanical and electrical equipment, etc. Sizes and locations of mechanical and other equipment that differs from those shown on the contract drawings shall be reported to the architect/engineer.

7. The contractor shall provide adequate shoring and bracing as required for his method of erection. Shoring and bracing shall remain in place until final connections for the permanent members are completed. The building shall not be considered stable until all connections are completed. Walls shall not be considered self-supporting and shall be braced until the roof system is completed.

8. The contractor shall not cut or core any holes in masonry or concrete walls without prior review by the architect/engineer.

9. Site observations by BHB Consulting Engineers, P.C.'s field representative shall not be construed as approval of construction procedures nor special inspection.

10. Detailing and shop drawing production for structural elements will require information (including dimensions) contained in the architectural, structural and/or other consultants' drawings. The structural drawings shall be used in conjunction with the architectural and other consultant's drawings. Some dimensions and elements such as elevations, depressions, slopes, mechanical housekeeping pads, etc. are not shown in the structural drawings. All dimensions shown on structural drawings shall be verified by contractor with architectural, mechanical and electrical drawings.

11. Review of shop drawing submittals by BHB Consulting Engineers, P.C. is for general compliance only and is not intended for approval. The shop drawing review shall not relieve the contractor from the responsibility of completing the project according to the contract documents.

12. Shop drawings made from reproductions of the contract drawings will be rejected unless the contractor signs a release agreement prior to the shop drawings being reviewed.

13. Only an authorized representative of BHB Consulting Engineers, P.C. may make changes to these contract drawings. BHB Consulting Engineers, P.C. shall not be held responsible or liable for any claims arising directly or indirectly from changes made without written authorization by an authorized representative of BHB Consulting Engineers, P.C.

14. Bidding, pricing or construction done prior to receiving final building permits from the authorities having jurisdiction is at the contractors own risk. Changes to the drawings may be required as part of the plan check process. BHB Consulting Engineers P.C. will not be held liable for, nor compensate for, changes to these drawings before final jurisdiction approval is obtained.

BASIS OF DESIGN

1. Governing Code — International Building Code 2012
   a. Risk Category — II
2. Snow Loads
   a. Ground Snow Load — P_g = 30 psf
   b. County Required Roof Snow Load — $P_f = P_g$ = 30 psf plus Snow Drift
3. Seismic Loads
   a. Seismic Importance Factor, I_e — 1.0
   b. Seismic Design Category — B
   c. Mapped Spectral Acceleration — S_s = 0.156g; S_1 = 0.055g
   d. Soil Site Class — D
   e. Soil Site Coefficients — F_a = 1.6; F_v = 2.4
   f. 5% Damped Design Spectral Response Acceleration — $S_{DS} = 2/3 * F_a * S_S = 0.167g$; $S_{D1} = 2/3 * F_v * S_1 = 0.087g$
   g. Seismic-Force-Resisting System — Masonry Shear Walls
   h. Response Modification Coefficient — R = 5.0
   i. System Over-strength Factor — 2.5
   j. Deflection Amplification Factor — 3.5
   k. Fundamental Building Period — T = 0.189 seconds
   l. Seismic Response Coefficient — $Cs = SDS * I_e / R$; $Cs = SD1 * I_e / (R*T)$
   m. W — Dead Loads of Structure
   n. Base Shear — $V = C_S * W = 0.033$ W (Strength Design)
   o. Analysis Procedure — Equivalent Lateral Force (Static)
4. Wind Loads
   a. Wind Velocity (3 Second Gust) — 115 mph (Strength); 90 mph (Allowable (I_w = 1.0))
   b. Exposure Type — C
   c. Internal Pressure Coefficient, GCpi — +/-0.18
   d. Topographic Factor, Kzt — 1.0
   e. Components and Cladding Wind Force Table (psf; Strength Design

Component Elevation above grade	Effective Wind Area for Component (sq ft.)				
	10 sq ft.	20 sq ft.	50 sq ft.	100 sq ft.	500 sq ft.
15	-38.6	-36.0	-32.6	-30.0	-23.9
20	-41.0	-38.2	-34.6	-31.8	-25.4
25	-43.0	-40.1	-36.3	-33.4	-26.7
30	-44.7	-41.7	-37.7	-34.7	-27.7
35	-46.1	-43.0	-38.9	-35.8	-28.6
40	-47.5	-44.3	-40.0	-36.8	-29.4
45	-48.6	-45.4	-41.0	-37.8	-30.2
50	-49.7	-46.4	-42.0	-38.6	-30.8
55	-50.7	-47.3	-42.8	-39.4	-31.5
60	-51.7	-48.2	-43.6	-40.1	-32.1

FOUNDATION

1. Soils Report
   a. Author — Huddleston-Berry,
   b. Dated — January 27, 2015
   c. Project No 00208-0057
2. Soil Bearing Pressure: — 1500 psf, on Compacted Fill.
3. Frost Protection: 12 inches minimum to bottom of footing.
   Contractor shall field verify that the footing elevations and final grades indicated on the plans will provide the minimum frost protection. The contractor shall notify the architect/engineer if there are any locations where the minimum frost protection might not be achieved prior to placing concrete.sd
4. Lateral Soil Pressure Fluid Equivalent Density.
   a. Active — 35 pcf (retaining walls)
   b. At Rest — 55 pcf (rigid foundation walls)
   c. Passive — 300 pcf
5. Coefficient of Friction — 0.4

EARTHWORK

1. All footings shall bear on 2 feet of compacted structural fill. See detail 10/S501.
2. Consult the project specifications and soils report for further earthwork requirements.

CONCRETE

1. Materials, unless noted otherwise:
   a. Normal weight aggregates — ASTM C 33
      i. Combined aggregate gradation for slabs and other designated concrete shall be 8% - 18% for large top size aggregates (1½ in.) or 8% - 22% for smaller top size aggregates (1 in. or ¾ in.) retained on each sieve below the top size and above the No. 100.
      ii. Maximum Aggregate Size shall be not be larger than:
         1. 1/5 the narrowest dimension of the forms
         2. 1/3 the depth of the slab
         3. ¾ the minimum clear spacing between bars
   b. Reinforcing Steel — ASTM 615 Grade 60 (Fy = 60 ksi). Use Grade 40 (Fy = 40 ksi) for field bent dowels with spacings indicated reduced by 1/3.
   c. Deformed Bar Anchors (DBA) — ASTM A496
   d. Headed Stud Anchors (HSA) — ASTM A108
   e. Anchor Rods — ASTM F1554, Grade 36, with ASTM A563 heavy hex nuts and hardened washers Grade A
   f. Admixtures:
      i. Air-entraining admixtures shall comply with ASTM C 260 (when used).
      ii. Calcium chloride shall not be added to the concrete mix.
      iii. Water-reducing admixture shall comply with ASTM C 494/C 494M, Type A (when used)
      iv. Retarding admixture shall comply with ASTM C 494/C 494M, Type B (when used).
      v. Water-reducing and retarding admixture shall comply with ASTM C 494/C 494M, Type D (when used).
      vi. High-range, water-reducing admixture shall comply with ASTM C 494/C 494M, Type F (when used).
      vii. High-range, water-reducing and retarding admixture shall comply with ASTM C 494/C 494M Type G (when used).
      viii. Admixture manufacturer shall have ISO 9001 Quality Certification. To ensure compatibility all admixtures shall be from the same manufacturer.
   g. Type I/II cement complying with ASTM C-150 shall be used for all concrete. Cement source shall remain the same for the entire job
   h. Blended cement Type GU complying with ASTM C1157
   i. Fly Ash - ASTM C618, Class F – 25% maximum cementitious content
   j. The water/cementitious materials ratios shall meet the requirements of Table 4.3.1 of ACI 318.
   k. Provide air entraining as recommended by Table 4.4.1 of ACI 318. Concrete that extends above grade and is exposed to freezing and thawing while moist shall be air-entrained.
   l. No aluminum conduit or product containing aluminum or any other material injurious to concrete shall be embedded in concrete.
2. Compressive strengths of concrete at 28 days shall be as follows
   a. Interior Footings& Interior Foundation Walls — Strength 4,500 psi; Classification F1, S0, P0, C0
   b. Exterior Footings & Exterior Foundation Walls — Strength 4,500 psi; Classification F1, S0, P0, C0
   c. Slabs on Grade — Strength 4,500 psi; Classification F2, S0, P0, C1
   d. All Site Concrete with Reinforcement — Strength 5,000 psi; Classification F3, S0, P1, C2
   e. All Site Concrete without Reinforcement — Strength 4,500 psi; Classification F3, S0, P1
   f. Normal Weight Concrete over Steel Deck — Strength 3,500 psi; Classification F0, S0, P0, C0
3. 3" thick (6" overall) normal weight concrete slab shall be poured over the steel deck. Reinforce slab with a macro-synthetic fiber reinforcing (ASTM C 1116 Type III) minimum of 2 inches (50 mm) in length, and aspect ratio of 50 to 90. Provide 4 lbs minimum per cubic yard. Fiber manufacturer shall provide 2 hour fire resistance certification from UL.
   a. At contractor's option, the welded wire fabric may be used in lieu of fiber reinforcing with the following requirements:
      i. 6" x 6" – W2.1/W2.1 welded wire fabric minimum, unless noted otherwise. Welded Wire Fabric shall be placed 1" to 1-1/2" below the top of the slab.
4. Only one grade or type of concrete shall be poured on the site at any given time.
5. The contractor shall be responsible for the design, detailing, care, placement and removal of all formwork and shores.
   a. Supporting forms and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction load to which they may be subjected. In no case, however, shall forms and shoring be removed in less than 24 hours after concrete placement.
6. Reinforcement shall have the following concrete cover:

	Clear Cover
a. Cast-in-place Concrete	
i. Cast against and permanently exposed to earth	3"
ii. Formed concrete exposed to earth or weather:	
#6 thru #18 bars	2"
#5 and smaller bars	1-1/2"
iii. Concrete not exposed to weather or in contact with ground:	
Slabs, Walls, Piers, Joists: #11 bars and smaller	¾"
Beams, Columns: Primary Reinf., Ties, Stirrups, Spirals	1-1/2"

7. Construction Joints, Control (Contraction) Joints:
   a. Control joints shall be installed in slabs on grade so the length to width ratio of the slab is no more than 1.25:1. Control joints shall be completed as soon as final set is achieved and it is okay to operate the cutter on the slab. Final set is typically achieved within the first 4 to 6 hours of the slab pour. For early entry saw cutting, joints should be cut within the first 1 to 4 hours, depending on weather conditions and concrete hydration rate. Where saw cut joints cannot be cut along the entire projected length of the joint, a 90 degree hand grinder or other tool shall be used to complete the joint. Control joints may be installed by:
      i. Saw cut a depth of 1/4 the thickness of the slab (1 1/4" ± for early entry saws)
      ii. Tooled joints a depth of 1/4 the thickness of the slab
   b. For concrete slabs-on-grade that are to receive no floor covering, install construction or control joints in slabs on grade at a spacing not to exceed 30 times the slab thickness in any direction, unless noted otherwise. For interior concrete slabs-on-grade that are to receive floor coverings the contractor has the option to eliminate control joints. Construction joints shall not exceed a distance of 125'-0" o.c. in any direction.
   c. Do not provide control joints in concrete slabs over metal deck.
8. Construction
   a. Use chairs or other support devices recommended by the CRSI to support and tie reinforcement bars prior to placing concrete. Reinforcing steel for slabs on grade shall be adequately supported. Support reinforcing steel of slabs on grade with precast concrete units. Lifting the reinforcing off the grade during placement of concrete is not permitted.
   b. Concrete to be mechanically consolidated during placement per ACI standards.
   c. Contractor shall coordinate placement of all openings, curbs, dowels, sleeves, conduits, bolts, inserts and other embedded items prior to concrete placement.
   d. All embeds and dowels shall be securely tied to formwork or to adjacent reinforcing prior to the placement of concrete.
   e. No pipes, ducts, sleeves, etc shall be placed in structural concrete unless specifically detailed or approved by the structural engineer. Penetrations through walls when approved shall be built into the wall prior to concrete placement. Penetrations will not be allowed in footings or grade beams unless detailed. Piping shall be routed around footings and grade beams and unless detailed. Footings shall be stepped to avoid piping.
   f. Reinforcing Bars shall not be welded. Do not substitute reinforcing bars for DBAs or HSAs.
9. Detailing:
   a. Lap splice lengths shall be detailed to comply with the "Concrete Reinforcing Bar Lap Splice Schedule" on sheet S-601. Splices may be made with mechanical splices capable of 125% tension capacity of the bar being spliced. Mechanical splices shall be the positive connecting type coupler and shall meet all International Building Code requirements and shall have a current ICC-ES report or IAPMO Certification. Use "Lenton" Standard Couplers (ICC ER-3967), "Bar-Lock" (ICC ESR-2495) or equal with internal protector. If mechanical splices are used, splices or couplers on adjacent bars shall be staggered a minimum of 24" apart along the longitudinal axis of the reinforcing bars.
   b. At joints provide reinforcing dowels to match the member reinforcing, unless noted otherwise.
   c. At all discontinuous control or construction slab on grade joints, provide 2 - #4 x 48 inches.
   d. Corner Bars: Provide corner bars at intersecting wall corners using the same bar size and spacing as the horizontal wall reinforcing. Corner bars shall lap the horizontal reinforcing with the required lap splice length.
   e. All vertical reinforcing shall be doweled to footings, or to the structure below with the same size and spacing as the vertical reinforcing for the element above. Dowels extending into footings shall terminate with a 90 degree standard hook and shall extend to within 4" of the bottom of the footing. Footing dowels (#8 bars and smaller) with hooks need not extend more than 20" into footings.
   Horizontal wall reinforcing shall be continuous through construction and control joints.

POST-INSTALLED ANCHORS

1. Adhesive Anchors
   a. For concrete, the adhesive shall be HIT RE 500-SD (ICC-ES ESR-2322) by Hilti Inc., HIT-HY 200 with Safe Set™ Technology (ICC-ES ESR-3187) by Hilti Inc., Powers PE1000 + (ICC-ES ESR-2583) by Powers Fasteners Inc, SET-XP (ICC-ES ESR-2508) by Simpson Strong-Tie or AT-XP (IAPMO-UES ER-263) by Simpson Strong-Tie Inc., Sika AnchorFix-3001 (ICC-ES ESR-3608) by Sika Corporation
   b. For grouted masonry, the adhesive shall be HIT-HY 70 (ICC-ES ESR-2682) by Hilti Inc., SET-XP (IAPMO UES ER-265) by Simpson Strong-Tie Inc. or AT-XP (IAPMO UES ER-281) by Simpson Strong-Tie Inc., or CIA GEL (ICC-ES ESR-1702) by USP.
   c. Follow all of the manufacturer's recommendations and certification testing reports for adhesive installation.
   d. Alternative epoxies may be used if an ICC-ES ESR or IAPMO-UES ER approval for use in cracked concrete is submitted to the structural engineer prior to use.
2. Mechanical Anchors
   a. For concrete, the mechanical anchor shall be Kwik Bolt TZ (ICC-ES ESR-1917) by Hilti Inc., Strong-Bolt 2 (ICC-ES ESR-3037) by Simpson Strong-Tie Inc. or Power-Stud+ SD1 (ICC-ES ESR-2818) by Powers Fasteners Inc.
   b. For grouted masonry, the mechanical anchor shall be Kwik Bolt 3 (ICC-ES ESR-1385) by Hilti Inc., Wedge-All (ICC-ES ESR-1396) by Simpson Strong-Tie or Strong-Bolt 2 (IAMPO-UES ER-240) by Simpson Strong-Tie or Power-Stud+ SD1 (ICC-ES ESR-2966) by Powers Fasteners Inc.
   c. Follow all of the manufacturer's recommendations and certification testing reports for mechanical anchor installation.
   d. Alternative mechanical anchors may be used if an ICC-ES ESR or IAPMO-UES ER approval for use in cracked concrete is submitted to the structural engineer prior to use.
3. Screw Anchors
   a. For concrete and grouted masonry, the screw anchors shall be Titen HD (ICC-ES ESR-2713 for concrete only and ICC-ES ESR-1056 for grouted masonry) by Simpson Strong-Tie, or Wedge-Bolt + (ICC-ES

CHRISTIANSEN HOFHEINS 323828-2203 07/15/16 PROFESSIONAL ENGINEER STATE OF UTAH

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title:

GENERAL STRUCTURAL NOTES

sheet:

S001

100% CONSTRUCTION DOCUMENTS

GENERAL STRUCTURAL NOTES

ESR-2526 for concrete only and ICC-ES ESR-1678 for grouted masonry) by Powers Fasteners Inc or Kwik HUS-EZ (ICC-ES ESR-3027 for concrete only and ICC-ES ESR-3056 for grouted masonry) by Hilti Inc.
b. Follow all of the manufacturer's recommendations and certification testing reports for screw anchor installation.
c. Alternative screw anchors may be used if an ICC-ES ESR or IAPMO-UES ER approval for use in cracked concrete is submitted to the structural engineer prior to use.

4. Powder Actuated Fasteners
a. For fasteners driven into steel, the fastener shall be X-U P8 TH Universal Knurled Shank Fastener (ICC-ES ESR-2269) by Hilti Inc., PDPA (ICC-ES ESR-2138) by Simpson Strong-Tie Inc. or 8mm Head Spiral CSI Drive Pin (ICC-ES ESR-1995) by Powers Fasteners Inc.
b. For fasteners driven into concrete or masonry, the fastener shall be X-U Universal Knurled Shank Fastener (ICC-ES ESR-2269) by Hilti Inc., PDP or PDPA (ICC-ESR-2138) by Simpson Strong-Tie Inc. or 8mm Head Spiral CSI Drive Pin (ICC-ES ESR-1995 for concrete only) by Powers Fasteners Inc.
c. Follow all of the manufacturer's recommendations and certification testing reports for powder actuated fastener installation.
d. Alternative powder actuated fasteners may be used if an ICC-ES ESR or IAPMO-UES ER approval for use in cracked concrete is submitted to the structural engineer prior to use.

MASONRY

1. Materials, unless noted otherwise:
a. Concrete Masonry Units (CMU) ASTM C90: Lightweight Grade N, Type 1 (minimum net area unit strength of 2,800 psi). f'_m = 2,000 psi. If the masonry units do not meet the specified strength of 2,800 psi, the contractor may use prism testing per ASTM C1341 to determine f'_m of 2,000 psi minimum.
b. Mortar Cement: Use Type "S" 1800 psi minimum compressive
c. Masonry Grout ASTM C476: grout shall attain a minimum compressive strength of 2,000 psi at 28 days.
d. Reinforcing Steel ASTM 615 Grade 60 (Fy = 60 ksi)
e. Deformed Bar Anchors (DBA) ASTM A496
f. Headed Stud Anchors (HSA) ASTM A108
g. Anchor Rods ASTM F1554, Grade 36,with ASTM A563 heavy hex nuts and ASTM F436 hardened washers

2. Reinforcement shall have the following cover:
a. Typical reinforcement shall have a minimum coverage of one bar diameter over all the bars, but not less than 3/4". When masonry is exposed to soil, minimum coverage shall be 1.5".

3. Construction Requirements:
a. Masonry coursing shall be coordinated with the architectural drawings.
b. All units shall be laid with full mortar beds on the face shells. All head joints shall be filled solidly with mortar for a distance in from the face of the units not less than the thickness of the longitudinal face shells. Cells which are to be grouted shall have full head joints.
c. Masonry walls, beams and columns shall be constructed with running bond, unless noted otherwise.
d. All cells containing reinforcement, embeds, anchor bolts, etc. shall be filled solid with grout. Grout shall be placed by mechanical vibration during placing and re-vibrated after excess moisture has been absorbed but before workability is lost. Rodding of grout is not allowed.
e. Where walls are not grouted solid, each grout pour shall terminate flush with the top of the uppermost unit except at cells with vertical reinforcing where the grout shall be 1-1/2 inches below top of unit to provide construction key.
f. Grout pours shall be limited to 4'-0" unless written approval is obtained from the engineer of record.
g. All walls below grade shall be grouted solid.
h. Vertical cells to be filled with grout shall have vertical alignment sufficient to maintain a clear, unobstructed vertical cell measuring not less than 2 inches by 3 inches. All steel reinforcement shall be secured against displacement prior to grouting by wire positioners or other suitable devices at intervals not exceeding 200 bar diameters or 10 feet maximum, or at bar splice locations. Vertical reinforcing shall be located at the center of the wall unless noted otherwise
i. Reinforcing Bars shall not be welded. Do not substitute reinforcing bars for DBAs or HSAs.
j. Control Joints: Spacing shall not exceed 30'-0". See architectural drawings for locations.
k. Grout all beam and joist pockets solid after installation of beams and joists.
l. Embed channels and plates shall be placed so as to create a flush surface with the face of the wall.
m. Anchor bolts and headed stud anchors shall be set in a grouted cell. Anchor bolts and headed stud anchors shall have 1" grout surrounding the shank at its penetration. Grout shall be flush with the face or top of the masonry.

4. Detailing Requirement
a. Lap all masonry reinforcing per "Masonry Reinforcing Lap Schedule" on sheet S-601. Mechanical splice couplers shall be used for (2) #6 bars and larger in a single cell. Also mechanical splice couplers for all #7 bars and larger. Mechanical splices shall be capable of developing 125% tension capacity of the bar being spliced. Mechanical splices shall be the positive connecting type coupler and shall meet all International Building Code requirements. Use "Cadweld", "Lenton" Standard Couplers, "Bar-Lock" or equal with internal protector. Joint reinforcement shall lap a minimum of 6 inches.
b. All vertical reinforcing shall be doweled to the foundation wall, footing (structure below) and to the structure below with the same size dowel, spacing (and in the same core) as the vertical wall reinforcing above.
c. Corner Bars: Provide corner bars at intersecting wall corners using the same bar size and spacing as the horizontal wall reinforcing. Corner bars shall lap the horizontal reinforcing with the required lap splice length.
d. Wall Openings: For unscheduled openings wider than 24 inches, provide reinforcing on all sides per detail 6/S501. Also, for all scheduled openings, provide horizontal bar at bottom of opening per detail 6/S501. Vertical bars shall extend from floor level below to the floor, or roof level above. Horizontal bars for all openings shall extend a minimum of 48 bar diameters beyond the corners of the opening. Where a 48 bar diameter extension is not possible, extend bars as far beyond the opening as possible and terminate the bar(s) with a 90 degree standard ACI hook.
e. Horizontal wall reinforcing shall be continuous through joining concrete walls, masonry walls, columns, and pilasters. Provide a key between the wall and the column or pilaster. Horizontal wall reinforcing shall be placed inside the column vertical reinforcing.
f. Horizontal wall reinforcing shall terminate with a hook at edge of openings and at each side of control joints except at floor and roof levels, lintels, beams and at top of parapets. See details 7/S501 and 9/S501.
g. All masonry column ties shall terminate with 135 degree hooks plus a 6 bar diameter extension (4" minimum).

STRUCTURAL STEEL

1. Material:
a. Wide Flanges Section ASTM A992 (50 ksi)
b. All Thread Rods, Other Shapes & Plates ASTM A36 (36 ksi)
c. Square or Rectangular HSS ASTM A500 (46 ksi) Grade B or C
d. Deformed Bar Anchors (DBA) ASTM A496
e. Headed Stud Anchors (HSA) ASTM A108
f. Non-Metallic Shrinkage Resistant Grout ASTM C 1107
g. Anchor Rods ASTM F1554, Grade 36, with ASTM A563 heavy hex nuts and ASTM F436 hardened washers Grade A
h. Bolted Connections: ASTM A325 with ASTM A563 nuts and ASTM F436 hardened washers.

2. Fabrication and construction shall comply with the latest edition of the following Codes and Standards:
a. American Institute of Steel Construction (AISC), "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," with "Commentary".
b. AISC "Code of Standard Practice" excluding the following: Section 3.2, Section 4.4, Section 4.4.1,
c. AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts"
d. American Welding Society (AWS), Structural Welding Code (specific items do not apply when they conflict with the AISC requirements).
e. AISC "Seismic Provision for Structural Steel Buildings"- ANSI/AISC 341

3. Welding
a. Field weld flags that have been put in these documents are for suggestion only. The contractor has the option to substitute shop welding for field welding or vice versa. The steel fabrication and steel erection drawings must clearly distinguish between shop welds and field welds prior to any work being performed.
b. Steel fabricators shall indicate the shop welds that are excluded from their bids. Steel erectors shall indicate the field welds that are excluded from their bids. It is the responsibility of the contractor to coordinate shop welding and field welding with the appropriate subcontractors.
c. All welding and cutting shall be performed by AWS certified welders.
d. Use E-70 XX or as noted otherwise. E60 XX may be used for welding steel roof and floor decks.
e. All intersecting steel shapes which are not bolted shall be connected by a fillet weld all around, unless noted otherwise. Where fillet weld sizes are not shown they shall be 1/16" less than the thinnest of the connected parts for thicknesses 1/4" and larger. Fillet welds on plates less than 1/4" shall be of the same size as the thinnest of the connected part.
f. Reinforcing Bars: Do not weld rebar. Do not substitute reinforcing bars for deformed bar anchors (DBAs), machine bolts, or headed stud anchors (HSAs).
g. Do not weld anchor bolts, including "tack" welds.
h. Headed Stud Anchors (HSAs) welding and deformed bar anchor welding shall conform to the manufacturer's specifications.

4. Bolted Connections:
a. Use ASTM A325N bolts for steel to steel connections, as noted herein or as noted on the drawings. A325N bolts shall be used in connections for simple span framing and beam (or girder) to bearing plate connections. Tighten bolts to a snug tight condition. See sheet S602.

5. Provide full-depth web-stiffener plates at each side of all beams at all bearing points. Stiffener plates shall be the thickness called out below unless noted otherwise and shall be welded both sides with fillet welds all around:

FLANGE WIDTH	STIFFENER THICKNESS	WELD SIZE
Less than 8 1/4"	1/4"	3/16"
8 1/4" to 12 1/4"	3/8"	1/4"
12 1/4" to 16 ½"	1/2"	5/16"
16 ½" to 20 ¾"	5/8"	3/8"

COMPOSITE STEEL BEAMS

1. Composite beams are indicated on the framing plans with the suffix ( ). The number inside the brackets indicates number of headed studs for this beam or section of beam. Beams or section of beams shall have the headed studs spaced uniformly over the entire beam length.

2. All headed stud type shear connectors shall be in conformance with ASTM A-108. Dimensions shall comply with AISC. Use 3/4" diameter studs. Headed studs shall extend 1 ½ inches minimum above the top of the steel deck after welding. Headed studs shall be applied through the metal deck to the top flange of the steel section or welded directly to the steel section.

3. The minimum center-to-center spacing of stud connectors shall be six (6) diameters along the longitudinal axis of the supporting composite beam and four (4) diameters transverse to the longitudinal axis of the supporting composite beam. The maximum center to center spacing shall not exceed 32".

4. All composite beams shall be precambered. C= 0.00" on the plans denotes precamber dimension (upward) in inches.

METAL DECKING

1. Steel deck shall comply with the latest requirements of the Steel Deck Institute.

2. All deck shall be 3-span continuous minimum. In areas where 3-span conditions are not possible, the contractor shall provide heavier gage deck as required to provide the equivalent loading of the deck under a three span condition.

3. 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. Light weight suspended acoustical ceilings with a total weight of 50 lbs per attachment may be hung from roof deck. The hangers shall be staggered to distribute the loads over multiple deck flutes.

4. All deck supporting members shall be dry before welding.

5. Clinch seams before welding interlocking seams.

Steel Roof Deck
a. Steel roof deck shall be 1.1/2" deep X 20 gage minimum painted, type "B" wide rib deck with interlocking side seams with the following properties:

	20 Gage
Minimum S ($in^3/_{ft}$) =	0.234
Minimum I ($in^4/_{ft}$) =	0.213

b. Minimum allowable deck diaphragm shear values shall be 600 plf for a 7'-0" deck span.
c. Maximum diaphragm flexibility factor shall be 13.2 for a 7'-0" deck span.
d. Weld steel roof deck to supporting framing members with 3/4" diameter puddle welds at the following spacings (Closer spacing may be used to develop minimum shear requirements.)
i. 6" o.c. to all supports perpendicular to deck corrugations (7 welds per 36" sheet).
ii. 6" o.c. to all supports parallel to deck corrugations.
e. Hilti or Pneutek power driven fasteners are acceptable as an alternative to welds provided the connection meets the diaphragm shear capacity given above. For Hilti call 800-879-8000 extension 6337 for connection information comparison. For Pneutek, call 800-431-8665. If Hilti or Pneutek power driven fasteners are used, the contractor shall submit Hilti's / Pneutek calculations to the Architect/Engineer for review. Also if Hilti of Pneutek power driven fasteners are used, a Hilti / Pneutek representative shall be present before the decking is installed to make sure the installer is properly trained in using the equipment. The Hilti / Pneutek representative shall also make a site visit the day after deck has been started to be installed to verify the power driven fasteners are being installed correctly.
f. Attach interlocking seams with one of the following.
i. 1 ½" long top seam welds at 24" o.c. maximum
ii. Verco PunchLok System at 24" o.c. maximum.
iii. ASC Delta Grip System at 36" o.c maximum
iv. Wheeling Gator-Seismic Shearloc at 30" o.c maximum.
Closer spacing may be used to develop minimum shear requirements. A standard button punch can **not** be used in place of Verco PunchLok, DeltaGrip or Gator-Seismic Shearloc
g. Provide a 2-inch minimum bearing and a 4-inch lap at the splice points.

Steel Floor Deck
a. Steel floor deck shall be 3" deep X 20 gage minimum galvanized (G60) composite type "W" deck with interlocking side seams with the following properties:

	20 Gage
Minimum S ($in^3/_{ft}$) =	0.534
Minimum I ($in^4/_{ft}$) =	0.907

b. Steel deck with 3" thick (6" overall) normal weight concrete slab shall have a minimum allowable diaphragm shear capacity of 2000 lbs/ft. for a 6'-8" deck span.
c. Weld deck to supporting framing members with 3/4" diameter puddle welds at the following spacing (Closer spacings may be used to develop minimum shear requirements.).
i. 12" o.c. to supports perpendicular to deck corrugations (4 welds per 36" wide sheet).
ii. 12" o.c. to all supports parallel to deck corrugations.
d. Hilti or Pneutek power driven fasteners are acceptable as an alternative to welds provided the connection meets the diaphragm shear capacity given above. For Hilti call 800-879-8000 extension 6337 for connection information comparison. For Pneutek, call 800-431-8665. If Hilti or Pneutek power driven fasteners are used, the contractor shall submit Hilti's / Pneutek calculations to the Architect/Engineer for review. Also if Hilti of Pneutek power driven fasteners are used, a Hilti / Pneutek representative shall be present before the decking is installed to make sure the installer is properly trained in using the equipment. The Hilti / Pneutek representative shall also make a site visit the day after deck has been started to be installed to verify the power driven fasteners are being installed correctly.
e. Attach interlocking seams with one of the following.
i. 3/16" Ø button punch at 18" o.c.
ii. 1 1/2" long top seam welds at 36" o.c.
iii. Verco PunchLok System at 36" o.c.,
iv. ASC DeltaGrip System at 36"o.c.
v. Wheeling Seismic Shearloc at 36" o.c.
Closer spacing may be used to develop minimum shear requirements.
f. Provide a 2-inch minimum bearing at supports.

LEGEND OF MARKS AND ABBREVIATIONS

AB	ANCHOR BOLT(S)	k	KIP(S) = 1000 POUNDS
ABV	ABOVE	KLF	KIPS PER LINEAL FOOT
ALT	ALTERNATE	KSF	KIPS PER SQUARE FOOT
APPROX	APPROXIMATE		
ARCH	ARCHITECT(URAL)	LBS	POUNDS
		LF	LINEAL FOOT
BLDG	BUILDING	LLH	LONG LEG HORIZONTAL
BLW	BELOW	LLV	LONG LEG VERTICAL
BM	BEAM	LSH	LONG SIDE HORIZONTAL
BOT	BOTTOM	LSV	LONG SIDE VERTICAL
BRG	BEARING		
BTWN	BETWEEN	MAS	MASONRY
		MAX	MAXIMUM
CC.	CENTER-TO CENTER	MCJ	MASONRY CONTROL JOINT
C.J.	CONST/CONTROL JOINT	MC-x	MASONRY COLUMN MARK
CMU	CONCRETE MASONRY UNIT	MECH	MECHANICAL
COL	COLUMN	MFR	MANUFACTURER
CONC	CONCRETE	MIN	MINIMUM
CONST	CONSTRUCTION	MISC	MISCELLANEOUS
CP-x	CONCRETE PIER	ML-x	MASONRY LINTEL
CRW-x	CONCRETE RETAINING WALL	MP-x	MASONRY PIER
CTR	CENTER	MW-x	MASONRY WALL
CW-x	CONCRETE WALL		
		NIC	NOT IN CONTRACT
DB	DECK BEARING	NTS	NOT TO SCALE
DBA	DEFORMED BAR ANCHOR		
DBE	DECK BEARING ELEVATION	O.C.	ON CENTER
DBL	DOUBLE	O.F.	OUTSIDE FACE
DET	DETAIL	OPNG	OPENING
DIA	DIAMETER	OPP	OPPOSITE
DIM	DIMENSION		
DN	DOWN	PAF	POWER-ACTUATED FASTENER
DWG	DRAWING	PCF	POUNDS PER CUBIC FOOT
DWL	DOWEL	PL	PLATE
		PLF	POUNDS PER LINEAL FOOT
EA	EACH	PSF	POUNDS PER SQUARE FOOT
E.F.	EACH FACE	PSI	POUNDS PER SQUARE INCH
E.J.	EXPANSION JOINT	PT	POINT
ELEC	ELECTRICAL		
ELEV	ELEVATION	REINF	REINFORCING
E.O.D.	EDGE OF DECK	REQD	REQUIRED
E.O.S.	EDGE OF SLAB	R.D.	ROOF DRAIN
EQUIP	EQUIPMENT	RTU	ROOF TOP UNITS
EQ	EQUAL		
E.W.	EACH WAY	SBP-x	STEEL BASE PLATE MARK
EXT	EXTERIOR	SCW	SEISMIC CRITICAL WELD
		SC-x	STEEL COLUMN MARK
FC-x	CONTINUOUS FOOTING MARK	SCP-x	STEEL CAP PLATE MARK
F.D.	FLOOR DRAIN	SHT	SHEET
FDN	FOUNDATION	SI	SPECIAL INSPECTION
F.F.	FINISHED FLOOR	SIM	SIMILAR
FR-x	RECTANGULAR FOOTING	SMU	SUSPENDED MECHANICAL UNITS
FS-x	SQUARE FOOTING MARK	SOG	SLAB-ON-GRADE
FT	FOOT	SQ.	SQUARE
FTG	FOOTING	STAG	STAGGERED
FTS-x	THICKEN SLAB MARK	STD	STANDARD
		STL	STEEL
GA	GAUGE	STR	STRUCTURAL
GALV	GALVANIZED	STS	SELF TAPPING SCREWS
GSN	GENERAL STRUCTURAL NOTES		
		T&B	TOP AND BOTTOM
HB	HORIZONTAL BRIDGING	TEMP	TEMPERATURE
HORIZ	HORIZONTAL	THDS	THREADS
HSA	HEADED STUD ANCHOR	T.O.	TOP OF
HT	HEIGHT	TOC	TOP OF CONCRETE
		TOD	TOP OF DECK
		TOF	TOP OF FOOTING
ICC	INTERNATIONAL CODE COUNCIL	TOS	TOP OF STEEL
IBC	INTERNATIONAL BUILDING CODE	TOW	TOP OF WALL
I.F.	INSIDE FACE	TYP	TYPICAL
IN.	INCH		
INT	INTERIOR	UNO	UNLESS NOTED OTHERWISE
		VERT	VERTICAL
JT	JOINT		
JST	JOIST	W/	WITH
		WT	WALL THICKNESS
		WWF	WELDED WIRE FABRIC
		WWM	WELDED WIRE MESH

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S002

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SPECIAL INSPECTION NOTES

STATEMENT OF SPECIAL INSPECTION AND QUALITY ASSURANCE

Special inspection and quality assurance, as required by section 1704 and 1705 of the 2012 IBC, shall be provided by an independent agency employed by the owner unless waived by the building official.	
The names and credentials of the Special Inspectors to be used shall be submitted to the Building Official for approval.	
Responsibilities of the Special Inspector	
	Special Inspector shall review all work listed in the special inspection schedules herein for conformance with the approved construction plans, specifications and 2012 IBC.
	All testing and inspection reports shall be sent within 24 hours of the test to the architect, engineer, building official and contractor for review. All items not in compliance shall be brought to the immediate attention of the contractor for correction, and if uncorrected, to the architect, engineer and building official.
	Once corrections have been made by the contractor, the special inspector shall submit a final signed report to the building official stating that the work requiring special inspection was, to the best of the special inspector's knowledge, in conformance with the approved construction plans, specifications and 2012 IBC.
Responsibilities of the Contractor	
	The contractor shall submit a written statement of responsibility to the owner and the building official prior to the commencement of work in accordance with 2012 IBC section 1704.4. This statement shall indicate that the contractor will coordinate and cooperate with the required inspections contained herein.
	The contractor shall notify the designated special inspector that work is ready for inspection at least 24 hours before said inspection is required.
	All work requiring special inspection shall remain open and accessible until it has been observed by the special inspector and deemed acceptable through inspection report.
	Special inspection during fabrication is not required if the fabricator is registered and approved to perform such work without special inspection.

SOILS CONSTRUCTION INSPECTIONS

Soils (2012 IBC Section 1705.6)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Site Preparation	-	X	Verify that the site has been prepared in accordance with the soils report prior to placement of prepared fill.
Fill Material	X	-	Verify that the material being used, the maximum lift thickness and the in-place dry density of the compacted fill material comply with the soils report during placement and compaction of the fill material during placement and compaction.
Continuous Footing Backfill: at least one test for each 40 linear feet or less of wall length, but no fewer than 2 tests.	-	X	At each compacted backfill layer.
Spot Footing Backfill: Minimum of one compaction test for each lift for each spot footing.	-	X	At each compacted backfill layer.
See specifications for further requirements.	-	-	

POST-INSTALLED ANCHOR INSPECTIONS

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Post Installed Anchors and Reinforcing Bars (2012 IBC Section 1705.1.1)			
Epoxy Anchors and Reinforcing Bars	-	X	Special inspection shall be performed per manufacturer's requirements and approved ICC-ES reports noted in POST-IINSTALLED ANCHOR section of the General Structural Notes prior to installation of epoxy and anchor rod.
Mechanical Anchors and Screw Anchors	-	X	Special inspection shall be provided per manufacturer's requirements and approved ICC-ES reports noted in POST-INSTALLED ANCHOR section of the General Structural Notes prior to installation of mechanical or screw anchor.

MISCELLANEOUS STEEL CONSTRUCTION INSPECTIONS

Non-destructive Testing (AISC 360-10 Chapter N and AISC 341-10 Chapter J)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Complete penetration groove welds	-	X	Ultrasonic testing shall be performed on 10% of CJP groove welds in butt, T- and corner joints subject to transversely applied tension loading in materials ≤ 5/16" in thickness. Testing rate must be increased if >5% of welds have unacceptable defects.
Access holes (flange > 2")	X	-	
Welded joints subject to fatigue	X	-	

Structural welding of Composite Construction (2012 IBC section 1705.2 and section 1705.11.1 and section 1705.12.2 and AISC 360-10 Chapter N and AISC 341-10 Chapter J)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Material verification of steel deck(s)	-	X	Indentification markings per applicable ASTM standard
Placement and installation of steel deck	X	-	Inspection of steel elements of composite construction prior to concrete placement for each welded joint or member.
Floor and roof deck welding	-	X	Visual inspection is required to confirm that weld meets acceptance criteria of AWS D1.3. Welder qualifications should be verified
Placement and installation of steel headed stud anchors (HSA)	X	-	Inspection of steel elements of composite construction prior to concrete placement for each welded joint or member.
Document acceptance or rejection of steel elements	X	-	Inspection of steel elements of composite construction prior to concrete placement for each welded joint or member.

Welding and testing for Demand Critical Welds (2012 IBC section 1705.11.1 and section 1705.12.2 and AISC 360-10 Chapter N and AISC 341-10 Chapter J)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Base metal thicker than 1-½", when subjected to through thickness weld shrinkage strains.	X	-	Provide ultrasonic inspection for discontinuities directly behind such welds and three inches above and below the weld after joint assembly completion.
Material discontinuities	X	-	Accepted or rejected on the basis of the defect rating in accordance with the IBC Standards as it refers to the testing in A.W.S. D1.1, Chapter 6. All deficient welds shall be corrected and tested at no additional cost to the owner.

Metal deck using mechanical attachments (2012 IBC Table 1705.1.1)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Metal floor prior to concrete placement and metal roof decks.	-	X	Verify size and spacing of shot pins / screws for deck attachment to the supporting structure. Also verify spacing and size of seam attachments.

STEEL WELDED CONNECTIONS INSPECTIONS

Structural Welding (2012 IBC section 1705.2 and section 1705.11.1 and section 1705.12.2 and AISC 360-10 Chapter N and AISC 341-10 Chapter J)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Inspection Tasks Prior to Welding (Operations need not be delayed pending these inspections.)			
Welding procedures specifications and manufacturer certifications for welding consumables shall be available	X	-	
Material identification (type/grade)	-	X	Inspection tasks required to be performed for each welded joint or member.
Welder identification system	-	X	Verify there is a system in place to identify the welder who has welded a joint or member.
Fit-up of groove welds	-	X	Including joint geometry, joint preparation, dimensions, cleanliness, tacking and backing type and fit; to be performed for each welded joint or member.
Configuration and finish of access holes	-	X	Verify configuration and finish.
Fit-up of fillet welds	-	X	Including alignment, gaps at root, dimensions, cleanliness and tacking; to be performed for each welded joint or member.
Check welding equipment	-	X	Operations need not be delayed pending these inspections.
Inspection Tasks During Welding			
Use of qualified welders	-	X	
Control and handling of welding consumables	-	X	Including packaging and exposure control
Cracked tack welds	-	X	Verify no welding over cracked tack welds.
Environmental conditions	-	X	Including wind speed within limits and precipitation and temperature
WPS followed	-	X	Including settings on welding equipment, travel speed, selected welding materials, shielding gas type/flow rate, preheat applied, interpass temperature (min./max.) maintained, proper position (F, V, H, OH)
Welding techniques	-	X	Including interpass and final cleaning, each pass within profile limitations, each pass meets quality requirements
Single-pass fillet welds less than 3/8"	-	X	
Single-pass fillet welds equal or greater than 3/8"	X	-	
Multipass fillet welds	X	-	
Complete and partial penetration groove welds	X	-	
Inspection Tasks After Welding (Operations need not be delayed pending these inspections.)			
Welds cleaned	-	X	
Size, length and location of welds	X	-	Inspection tasks required to be performed for each welded joint or member.
Welds meet visual acceptance criteria such as: crack prohibition, weld/base-metal fusion, crater cross section, weld profiles, weld size, undercut and porosity	X	-	Inspection tasks required to be performed for each welded joint or member.
Arc strikes, k-area, backing removed and weld tabs removed (if required), repair activities	X	-	Inspection tasks required to be performed for each welded joint or member.
Document acceptance or rejection of welded joint or member	X	-	Inspection tasks required to be performed for each welded joint or member.

MASONRY CONSTRUCTION INSPECTIONS

Prior to Construction (2012 IBC section 1705.4 and ACI 530/ASCE 5/TMS 602 1.11)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Review material certificates, mix designs, test results and construction procedures	-	X	Verify that materials conform to the requirements of the approved construction documents. Mix design, test results, material certificates, and construction procedures should be submitted for review. Mortar mix designs shall conform to ASTM C 270 while grout shall conform to ASTM C 476. Material certificates shall be provided for the following: reinforcement; anchors, ties, fasteners, and metal accessories; masonry units; mortar and grout materials. Construction procedures for cold-weather or hotweather construction shall be reviewed.

As Construction begins (2012 IBC section 1705.4 and ACI 530/ASCE 5/TMS 602 Table 1.19.2)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Proportions of site-prepared mortar, construction of mortar joints,	-	X	
Location of reinforcement and connectors	-	X	
Size and location of structural elements	-	X	
Proportions of site-prepared mortar, construction of mortar joints,	-	X	

Prior to grouting and during construction - structural masonry shall have Level B special inspection (2012 IBC section 1705.4 and ACI 530/ASCE 5/TMS 602 Table 1.19.2)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
			Verified for every 5,000 square feet of masonry constructed for periodic special inspection items
Proportions of site-prepared mortar, construction of mortar joints,	-	X	
Size and location of structural elements	-	X	
Grade, type and size of reinforcement, connectors and anchors	-	X	
Location and placement of reinforcement, connectors and anchors	-	X	
Verify grout space is clean prior to grouting	-	X	
Protection of masonry during cold and hot weather	-	X	
Grout placement	X	-	
Observe preparation of grout specimens, mortar specimens and/or prisms	-	X	The contractor has the option of using the "Prism Test Method" per 2012 IBC Section 2105.2.2.2 in lieu of the "Unit Strength Method."

CONCRETE CONSTRUCTION INSPECTIONS

Concrete (2012 IBC Section 1705.3 and Section 1705.12.1) The following concrete elements require special inspection:

All concrete footings, All concrete walls, including foundation walls, Interior concrete slab-on-grade, Concrete fill over metal deck, Concrete piers.

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Protection of concrete during cold and hot weather	-	X	
Verify materials used including use of the required mix design	-	X	Verify mix design meets strength and exposure requirements listed on General Structural Notes
Formwork	-	X	Verify shape, location and member dimensions
Bolts installed in concrete	X	-	Inspection of anchors or embeds cast in concrete is required when allowable loads have been increased or where strength design is used. Prior to and during concrete placement.
Embeds and Inserts installed in concrete	X	-	Prior to and during concrete placement.
Concrete reinforcing steel placement	-	X	Verify that reinforcing is of specified type, grade and size; that it is free of oil, dirt and rust; that it is located and spaced properly; that hooks, bends, ties, stirrups and supplemental reinforcement are placed correctly; that lap lengths, stagger and offsets are provided; and that all mechanical connections are installed per the manufacturer's instructions and/or evaluation report.
Concrete placement and samples	X	-	Cylinders, slump, temperature and air-entrainment shall be done for every 150 cubic yards or each day's production if the day's production is less than 150 cubic yards nor less than once for each 5000 sq. ft of surface area for slabs and walls.
See specifications for further concrete testing requirements.	-	-	

STEEL BOLTED CONNECTIONS INSPECTIONS

High Strength bolted connections (2012 IBC section 1705.2.1, section 1705.11.1 and section 1705.12.2 and AISC 360-10 Chapter N and AISC 341-10 Chapter J)

ITEM FOR VERIFICATION & INSPECTION	INSPECTION FREQUENCY		COMMENTS
	CONTINUOUS	PERIODIC	
Inspection Tasks Prior to Bolting (Operations need not be delayed pending these inspections.)			
Manufacturer's certifications available for fastener materials	-	X	
Fasteners	-	X	Marked in accordance with ASTM requirements
Proper fasteners selected for the joint detail	-	X	Including grade, type, bolt length if threads are to be excluded from shear plane.
Proper bolting procedure selected for joint detail	-	X	
Connecting elements	-	X	Including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements
Proper storage	-	X	Storage provided for bolts, nuts, washers and other fastener components
Pre-installation verification testing by installation personnel observed and documented for fastener assemblies and methods used	X	-	Not required if only snug-tight joints are specified per (Section NS.6(1) of AISC 360-10))
Inspection Tasks During Bolting (Operations need not be delayed pending these inspections.)			
Fastener assemblies, of suitable condition,	-	X	Verify that fasteners placed in all holes and washers (if required) are positioned as required.
Joint	-	X	Verify that joint brought to the snug-tight condition (min) unless noted otherwise.
Fastener component	-	X	Verify that fastener component not turned by the wrench prevented from rotating
Pretensioned Fasteners	-	X	Verify that pretensioned fasteners are pretensioned in accordance with the RCSC *Specification*, progressing systematically from the most rigid point toward the free edges (Not required if only snug-tight joints are specified per (Section NS.6(1) of AISC 360-10); Not required for pretensioned joints using turn-of-the-nut method with match-marking, direct-tension-indicators or twist-off type tension)
Inspection Tasks After Bolting			
Document acceptance or rejection of bolted connection	X	-	

STRUCTURAL OBSERVATION PROGRAM

If structural observations are required, they shall be done by the Engineer of Record or an approved subordinate at the stages of construction listed in the Construction Notification Phases section of these notes. At the conclusion of the project, the designated structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that to the best of the structural observer's knowledge have not been resolved (See 1704.5).

STRUCTURAL OBSERVATION PROGRAM REQUIRED BY CODE:	YES	NO
		X

CONSTRUCTION MILESTONE SCHEDULE

CONTRACTOR TO NOTIFY ENGINEER AT THE FOLLOWING CONSTRUCTION PHASES:		Structural Observation Required?
CONCRETE		
Footings, stem walls and piers	Prior to pouring concrete	NO
Concrete over metal floor deck	Prior to pouring concrete	NO
STEEL		
Floor framing	After substantial portion of framing is erected	NO
Roof framing	After substantial portion of framing is erected	NO
Roof deck	After welding/fastening and prior to roofing	NO
MASONRY		
Masonry walls	Prior to pouring grout	NO
No structural observations are required by code		

DEFERRED SUBMITTALS

For the purpose of this section, deferred submittals are defined as per section 107.3.4.1 of the IBC. Submittal documents for deferred submittal items shall be submitted to the engineer, architect and building official for their review for general conformance with the design of the building.

DEFERRED STRUCTURAL SUBMITTALS FOR THIS PROJECT ARE:

None

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FOOTING AND FOUNDATION PLAN NOTES

1. COORDINATE LOCATION OF DEPRESSED SLABS, SLOPED SLABS, AND FLOOR DRAINS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. SEE ARCHITECTURAL AND CIVIL DRAWINGS FOR EXTERIOR CONCRETE WORK AT DOORS, SIDEWALKS, ETC.
3. SEE ARCHITECTURAL DRAWINGS FOR CONTROL JOINT LOCATIONS.
4. SEE "EARTHWORK" NOTES ON SHEET S-001 AND DETAIL 10/S-501 FOR MINIMUM FILL REQUIRED BENEATH FOOTINGS.
5. ALL SPOT FOOTINGS SHALL BE CENTERED UNDER COLUMNS (UNO).
6. SEE DETAILS 1/S-502 AND 2/S-502 FOR CONDITION WHERE BURIED PIPES RUN PARALLEL AND PERPENDICULAR TO FOOTINGS.
7. SEE DETAIL 3/S-502 FOR TYPICAL CONTROL/CONSTRUCTION JOINTS IN CONCRETE SLAB ON GRADE.
8. SEE DETAIL 4/S-501 FOR SLAB REINFORCING WHERE CONTROL JOINTS ARE DISCONTINUOUS.
9. SEE DETAIL 5/S-501 FOR SLAB REINFORCING AROUND MISCELLANEOUS OPENINGS IN CONCRETE WALLS.
10. SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS TO ALL STEEL COLUMNS.
11. SEE 2/S602 FOR COLUMN BASE PLATE AND CAP PLATE.
12. SEE 6/S501 FOR MISC. OPENING IN CMU WALLS.
13. SEE 7/S501 FOR TYPICAL RECESS IN CMU WALLS.
14. SEE 1/S501 FOR FOOTING STEP.

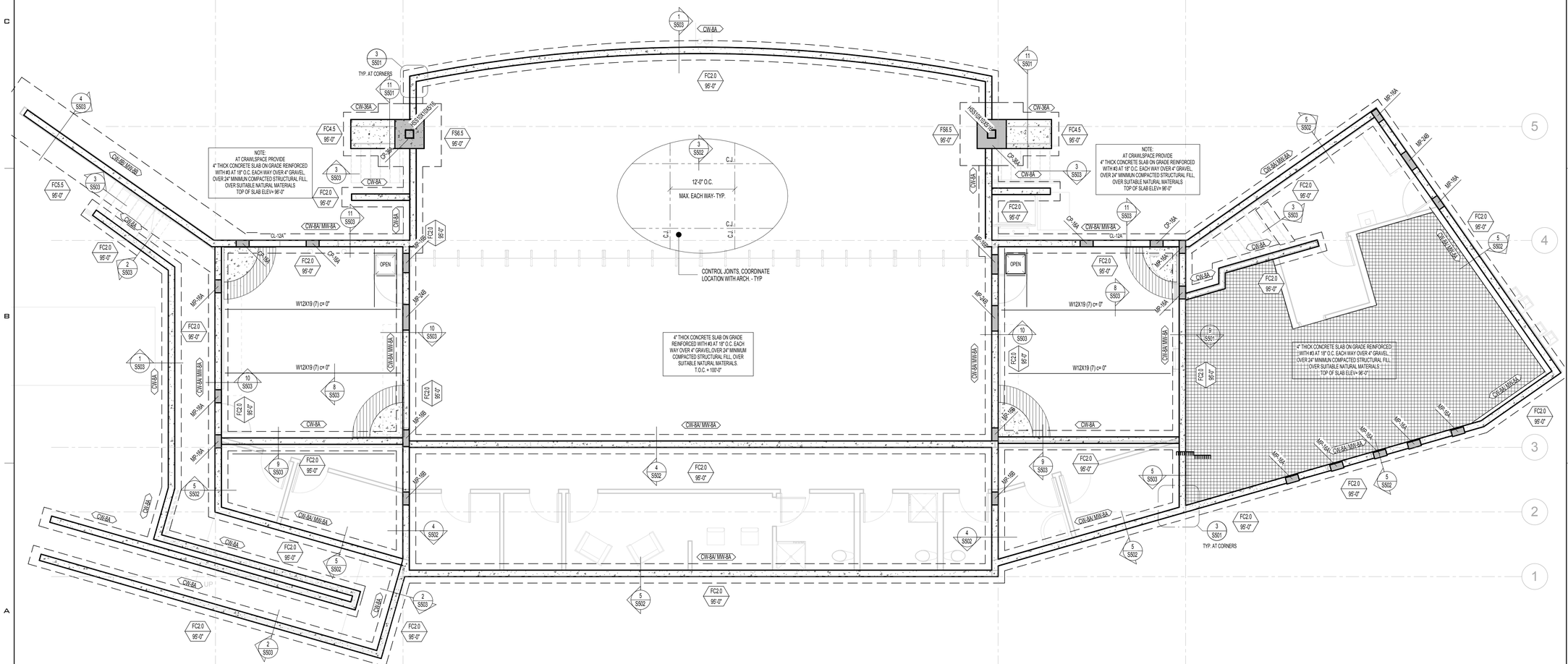
FLOOR FRAMING PLAN NOTES

1. VERIFY ALL FLOOR OPENINGS FOR MECHANICAL SHAFTS, STAIRS, ETC. WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. SEE DETAILS 6/S503 AND 7/S503 FOR FRAMING AROUND ALL OPENINGS.
3. COORDINATE SIZE AND LOCATION OF ALL MECHANICAL OPENINGS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
4. SEE ARCHITECTURAL DRAWINGS FOR DIMENSIONS TO ALL STEEL COLUMNS.

MARKS AND SYMBOLS LEGEND

- SECTION MARK / SHEET NUMBER
- FOOTING DESIGNATION
- TOP OF FOOTING ELEVATION
- TOP OF FOOTING ELEVATION
- INDICATES CONCRETE WALL. DASHED WALLS STOP AT DECK
- INDICATES MASONRY WALL. DASHED WALLS STOP AT DECK
- INDICATES STRUCTURAL WALL ABOVE.
- INDICATES DEPRESSED SLAB. SEE ARCHITECTURAL PLANS.
- CIP-x — INDICATES CONCRETE FOUNDATION WALL TYPE. SEE SCHEDULE ON SHEET S601
- MW-x — INDICATES MASONRY WALL TYPE. SEE SCHEDULE ON SHEET S602
- INDICATES CONCRETE OVER METAL FLOOR DECK. SEE GENERAL STRUCTURAL NOTES ON SHEET(S) S101
- INDICATES FLOOR OFFSET, SEE DETAILS.
- MCJ — INDICATES MASONRY CONTROL JOINT, SEE DETAIL 9/S501
- W_x_ — INDICATES COMPOSITE STEEL BEAM, SEE GENERAL STRUCTURAL NOTES ON SHEET S-002

)x)	INDICATES NUMBER OF HEADED STUD ANCHORS FOR SECTION OF COMPOSITE STEEL BEAM. SEE GENERAL STRUCTURAL NOTES ON SHEET(S) S002
FCx.x	INDICATES CONTINUOUS FOOTING. SEE SCHEDULE ON SHEET S601
FSx.x	INDICATES SPOT FOOTING. SEE SCHEDULE ON SHEET S601
FTSx.x	INDICATES THICKENED SLAB FOOTING. SEE SCHEDULE ON SHEET S601
MP-x	INDICATES MASONRY PIER TYPE. SEE SCHEDULE ON SHEET S602
ML-x	INDICATES MASONRY LINTEL TYPE. SEE SCHEDULE ON SHEET S602
xKxS	INDICATES NUMBER OF KING STUDS AND NUMBER OF BEARING STUDS. SEE DETAIL 5/S511
CP-x	INDICATES CONCRETE PIER. SEE SCHEDULE ON SHEET S601
CL-x	INDICATES CONCRETE LINTEL. SEE SCHEDULE ON SHEET S601
cm"	INDICATES REQUIRED PRE-CAMBER AT MID-SPAN OF STEEL BEAMS.
HSS-x	INDICATES STEEL COLUMN. SEE SCHEDULE ON SHEET S-002 FOR TYPICAL BASE PLATE AND CAP PLATE.



1 FOOTING AND FOUNDATION FLOOR PLAN

3/16" = 1'-0" 0" 4'-0" 8'-0" 16'-0"

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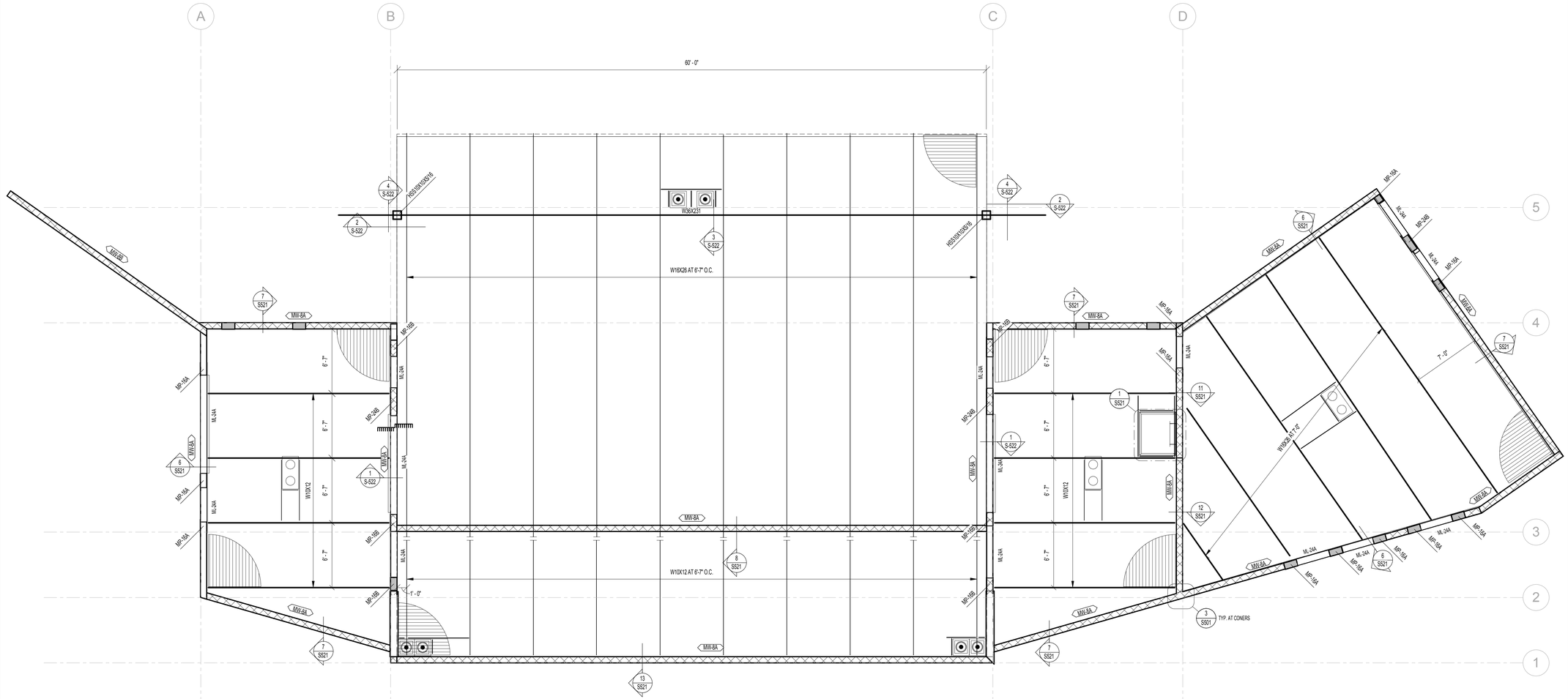
ROOF FRAMING PLAN NOTES

1. VERIFY ALL ROOF OPENINGS FOR MECHANICAL SHAFTS, DRAINS, ETC. WITH ARCHITECTURAL AND MECHANICAL DRAWINGS.
2. ALL ROOF OPENINGS GREATER THAN, OR EQUAL TO, 12" x 12" SHALL BE FRAMED AS INDICATED IN DETAILS 1/S-521 AND 2/S-521. FOR OPENINGS WHICH CUT LESS THAN TWO DECK FLUTES, SEE DETAIL 3/S-521.
3. VERIFY SIZE, WEIGHT, AND LOCATION OF ALL ROOF TOP MECHANICAL UNITS WITH ARCHITECTURAL AND MECHANICAL DRAWINGS. SEE DETAIL 4/S-521 FOR STEEL FRAMES AT ALL ROOF TOP EQUIPMENT. COORDINATE OPENINGS WITH MECHANICAL, ELECTRICAL, AND GENERAL CONTRACTORS.
4. SEE ARCHITECTURAL PLANS FOR DIMENSIONS TO ALL STEEL COLUMNS.

MARKS AND SYMBOLS LEGEND

	SECTION MARK / SHEET NUMBER
	INDICATES MASONRY WALL. DASHED WALLS STOP AT DECK
	INDICATES STRUCTURAL WALL ABOVE.
	INDICATES METAL ROOF DECK. SEE GENERAL STRUCTURAL NOTES ON SHEET(S) S001
_K ("*")	INDICATES K-SERIES JOIST WITH ALLOWABLE TOTAL LOAD / ALLOWABLE LIVE (SNOW) LOAD
_LH ("*")	INDICATES LH-SERIES JOIST WITH ALLOWABLE TOTAL LOAD / ALLOWABLE LIVE (SNOW) LOAD
ML-x	INDICATES MASONRY LINTEL TYPE. SEE SCHEDULE ON SHEET S601
R.D.	INDICATES ROOF DRAIN. SEE DETAIL 2/S511
HSS-x	INDICATES STEEL COLUMN SIZE. SEE SCHEDULE ON SHEET S-602 FOR TYPICAL BASE PLATE AND CAP PLATE.
R.H.	INDICATES ROOF HATCH, SEE DETAIL 1/S521



1 ROOF LEVEL FRAMING PLAN

3/16" = 1'-0" 0" 4'-0" 8'-0" 16'-0"

CHRISTIANSEN HOFHEINS 323828-2203 07/15/16 PROFESSIONAL STRUCTURAL ENGINEER STATE OF UTAH

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LAS COLONIAS AMPHITHEATER

PROJECT ADDRESS:

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project#: 150289
date: 07-15-16

revisions :

title:

ROOF LEVEL FRAMING PLAN

sheet:

S101

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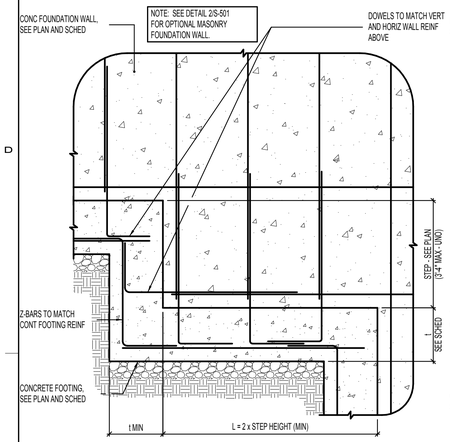
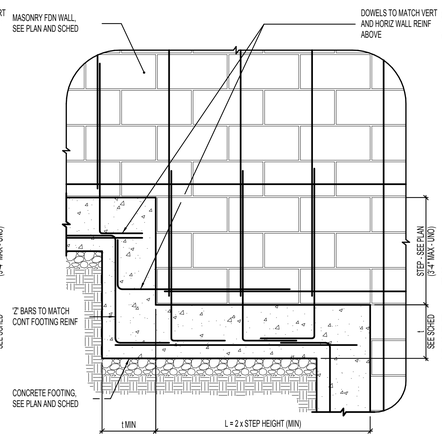


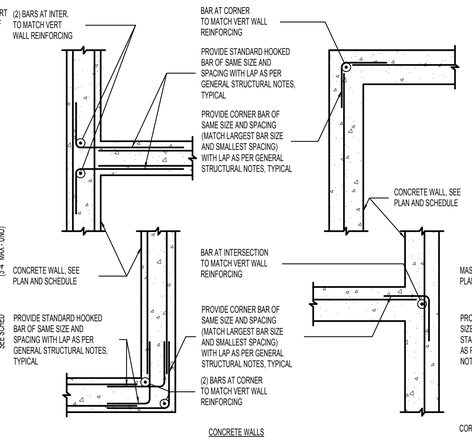
1 TYPICAL FOOTING STEP DETAIL

NO SCALE



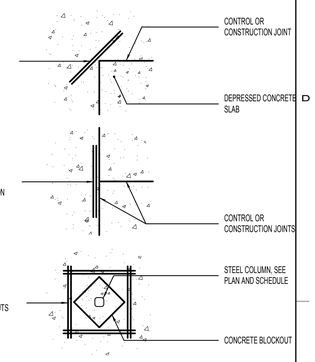
2 TYPICAL FOOTING STEP AT MASONRY FOUNDATION WALL [OPTIONAL]

NO SCALE



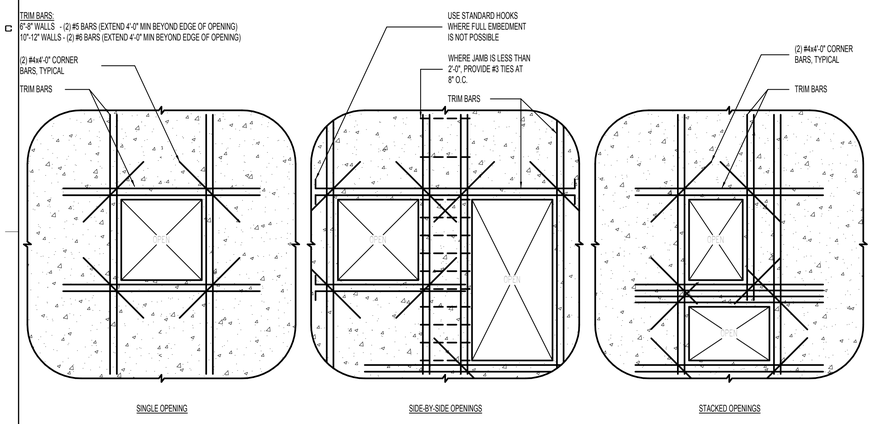
3 TYPICAL CORNER WALL REINFORCING [PLAN VIEW]

NO SCALE



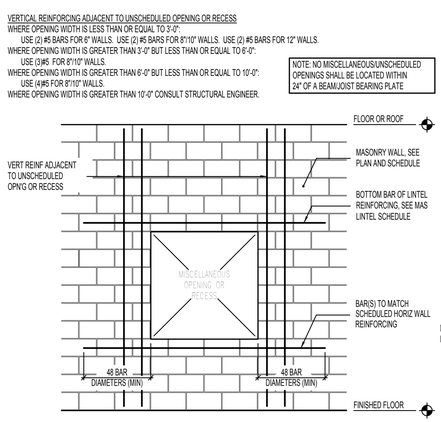
4 LOCATIONS REQUIRING ADDITIONAL SLAB REINFORCING [PLAN VIEW]

NO SCALE



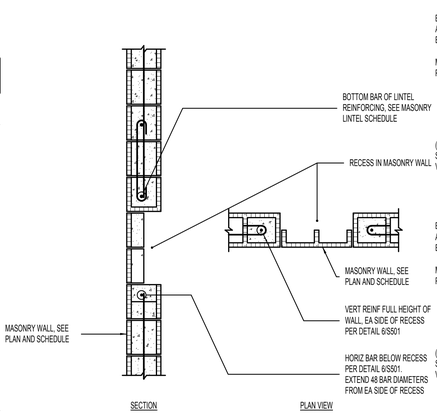
5 JOINT DETAILS AT SLAB DEPRESSIONS
WHERE MISCELLANEOUS OPENING WIDTH IS GREATER THAN 3'-0" WIDE, CONTACT STRUCTURAL ENGINEER.

NO SCALE



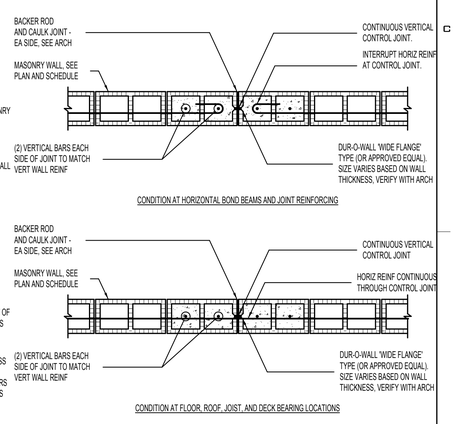
6 REINFORCING AT UNSCHEDULED MISCELLANEOUS OPENINGS OR RECESSES IN MASONRY WALLS

NO SCALE



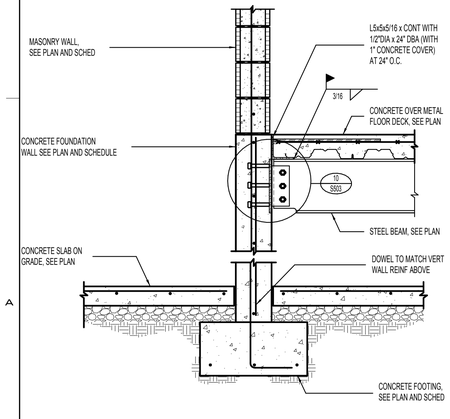
7 TYPICAL REINFORCING AT RECESS IN 8" OR 10" MASONRY WALLS

NO SCALE



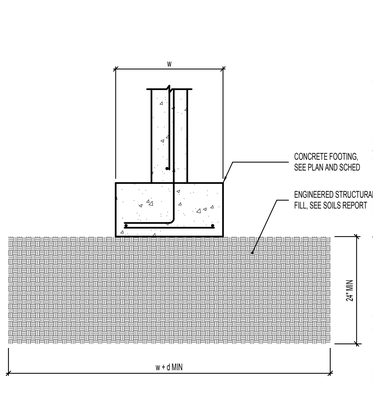
8 MASONRY CONTROL JOINT DETAIL AT 8" OR 10" MASONRY WALLS

NO SCALE



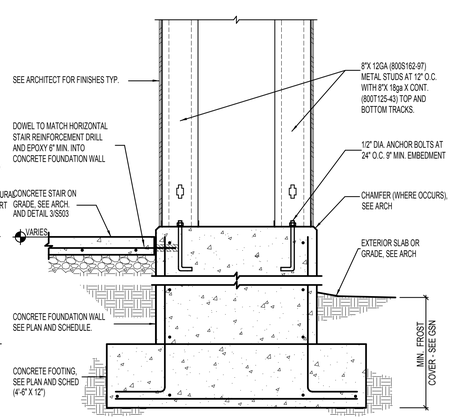
9 FOUNDATION DETAIL

NO SCALE



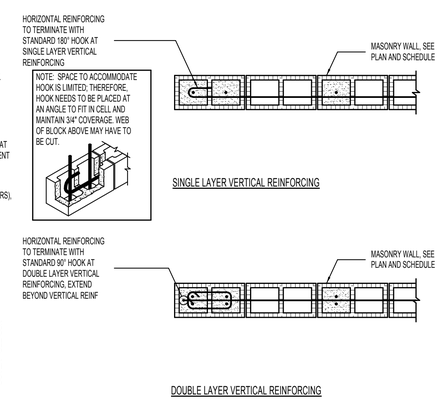
10 ENGINEERED STRUCTURAL FILL DETAIL

NO SCALE



11 FOUNDATION DETAIL

NO SCALE



12 TERMINATION OF HORIZONTAL REINFORCING IN 8" MASONRY WALL [PLAN VIEW]

NO SCALE

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S501

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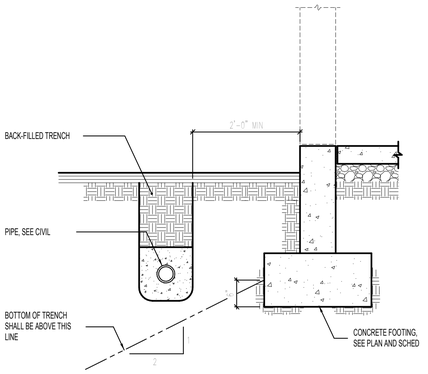
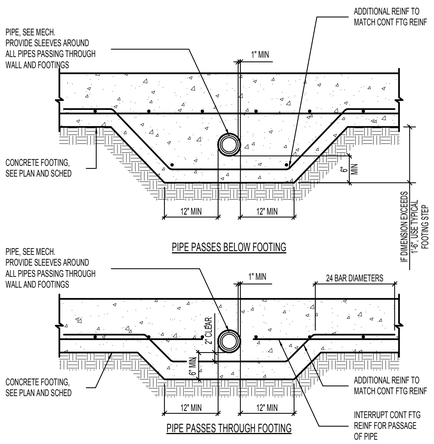


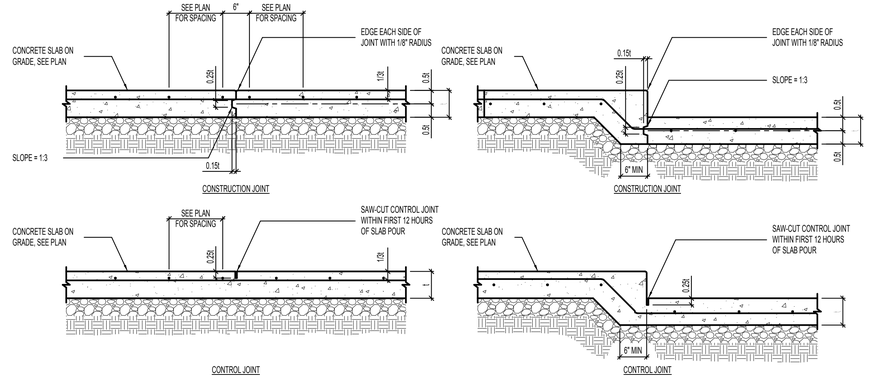
1 CONDITION AT PIPE PARALLEL TO CONCRETE FOOTING

NO SCALE



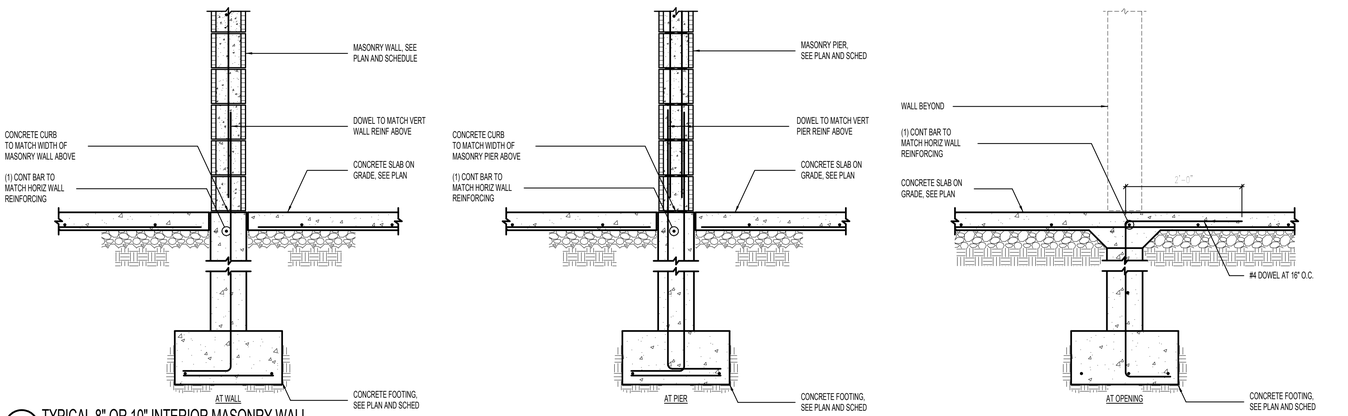
2 CONDITIONS AT PIPE PERPENDICULAR TO FOOTING

NO SCALE



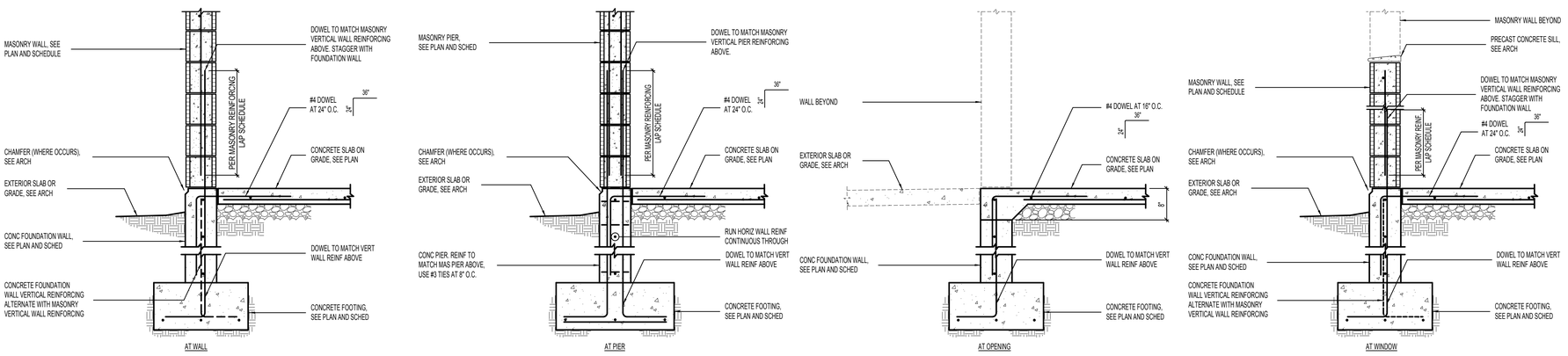
3 TYPICAL SLAB ON GRADE JOINT DETAILS

NO SCALE



4 TYPICAL 8" OR 10" INTERIOR MASONRY WALL ON CONCRETE CURB

NO SCALE



5 FOUNDATION WALL DETAIL AT 8" OR 10" MASONRY WALL

NO SCALE

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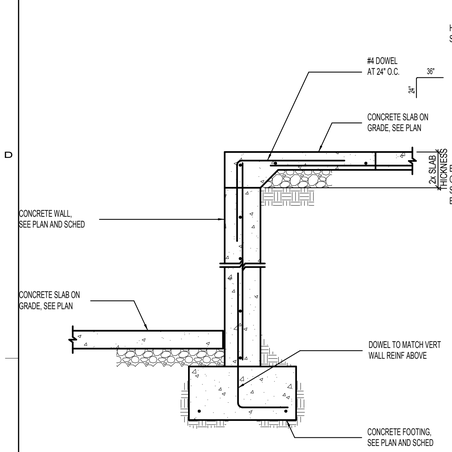
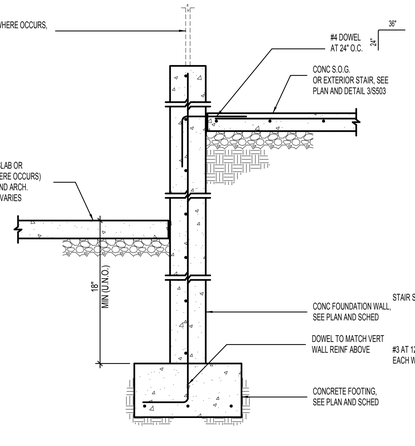


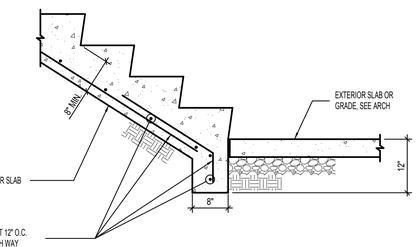
1 OFFSET CONCRETE FOUNDATION WALL

NO SCALE



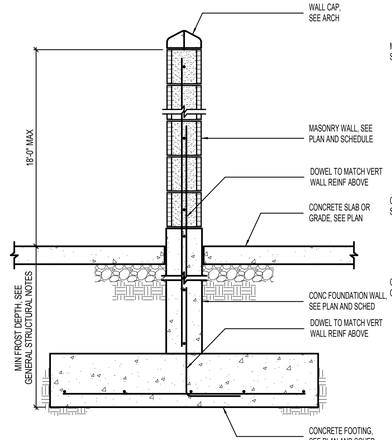
2 CONCRETE STAIR/LOADING (RAMP)

NO SCALE



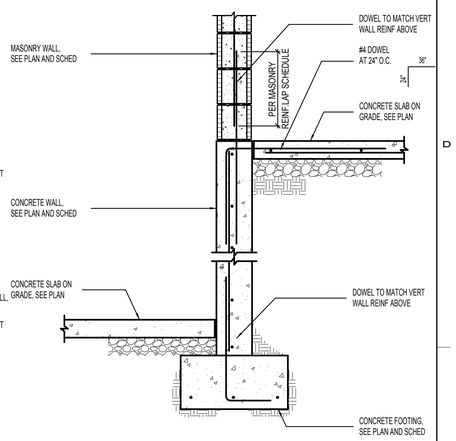
3 STAIR DETAIL

NO SCALE



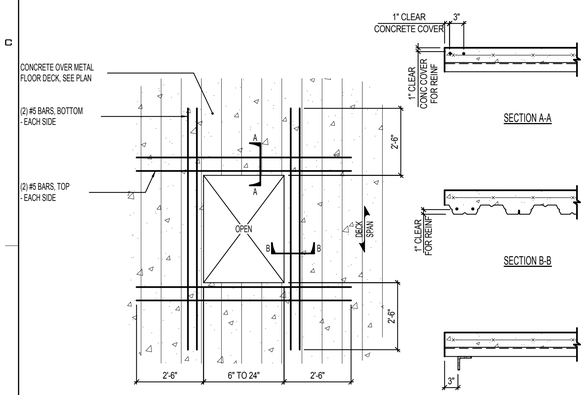
4 MASONRY SCREEN WALL DETAIL

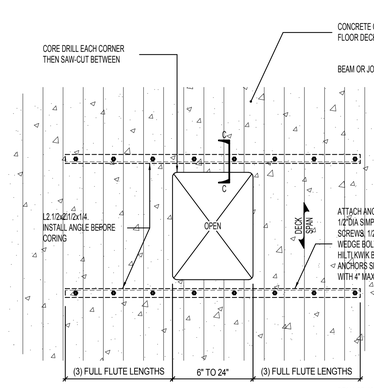
NO SCALE

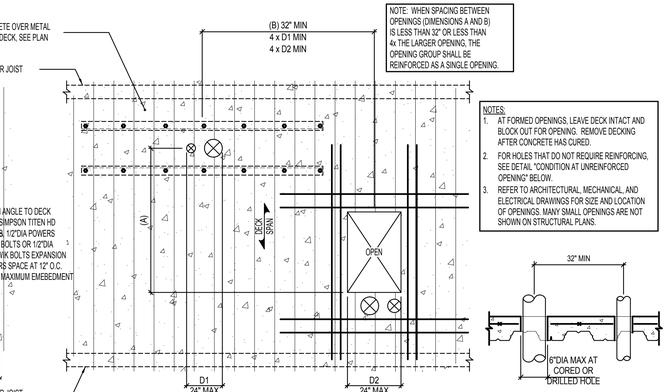


5 OFFSET CONCRETE FOUNDATION WALL

NO SCALE

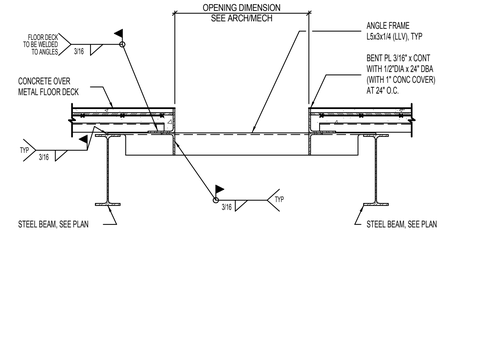






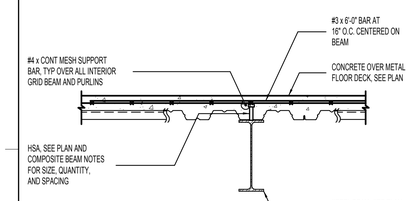
6 MISCELLANEOUS SMALL OPENINGS IN FLOOR SLAB (UP TO 24")

NO SCALE

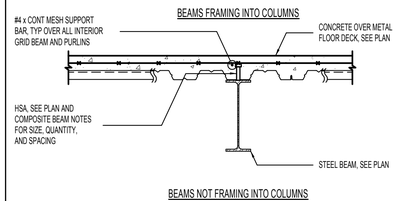


7 TYPICAL FLOOR OPENING DETAIL
[OPENING > 24"]

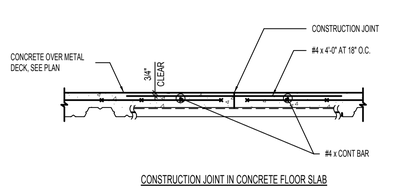
NO SCALE



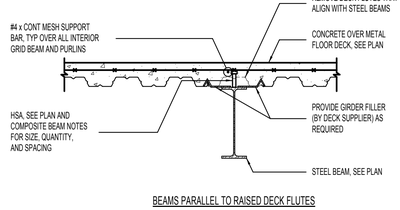
BEAMS FRAMING INTO COLUMNS



BEAMS NOT FRAMING INTO COLUMNS



CONSTRUCTION JOINT IN CONCRETE FLOOR SLAB

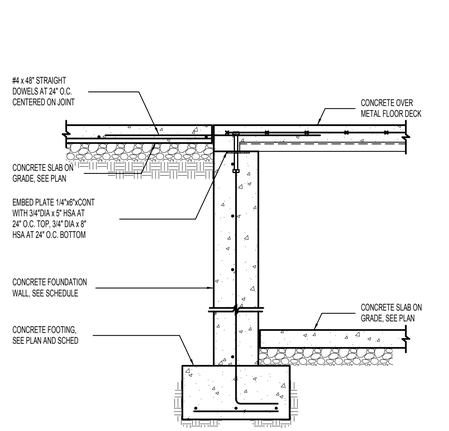


BEAMS PARALLEL TO RAISED DECK FLUTES

8 TYPICAL COMPOSITE BEAM DETAILS

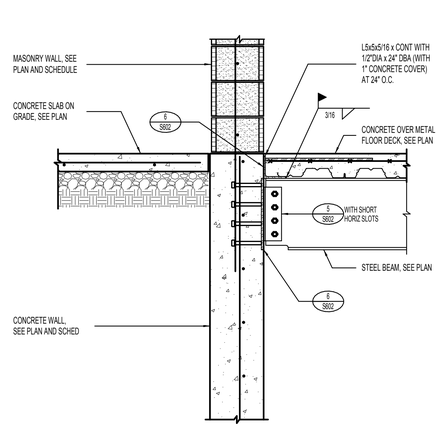
NO SCALE

NO SCALE



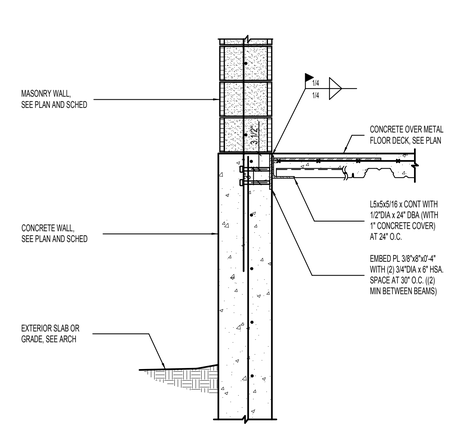
9 FOUNDATION DETAIL AT CRAWLSPACE

NO SCALE



10 TYPICAL BEAM/DECK BEARING AT CONCRETE WALL

NO SCALE



11 TYPICAL DECK BEARING AT CONCRETE WALL

NO SCALE

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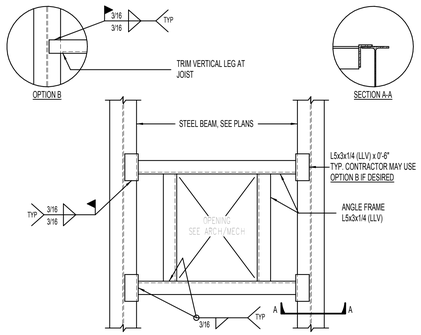
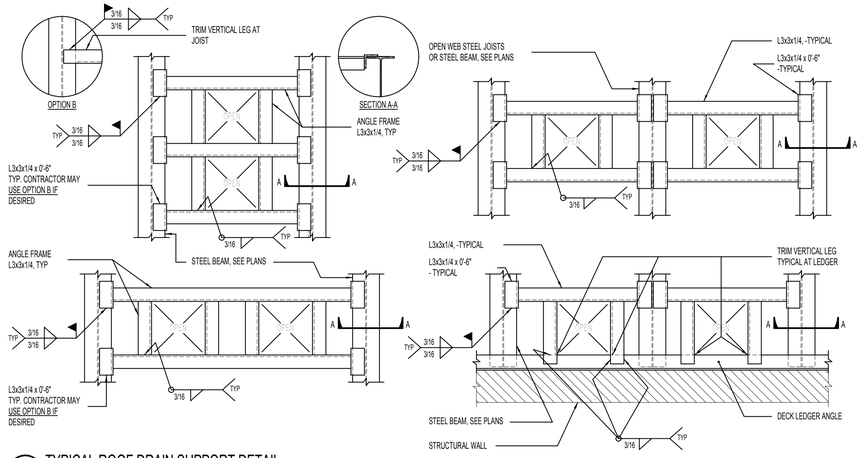
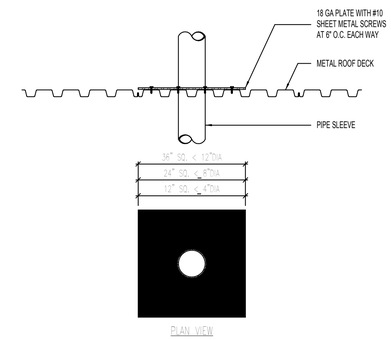


NOTES:
1. SEE DETAIL 3/SS21 FOR OPENINGS LESS THAN 12" IN DIAMETER.
2. SEE TYPICAL ROOF TOP MECHANICAL UNIT SUPPORT DETAIL(S) FOR FRAMES UNDER MECHANICAL UNITS.
3. ROOF DECK TO BE WELDED TO ANGLE FRAMING.

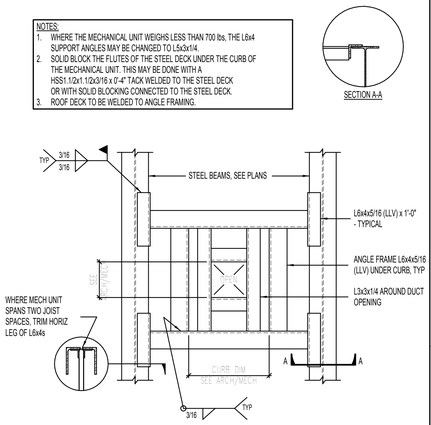
1 TYPICAL ROOF OPENING DETAIL [PLAN VIEW] NO SCALE



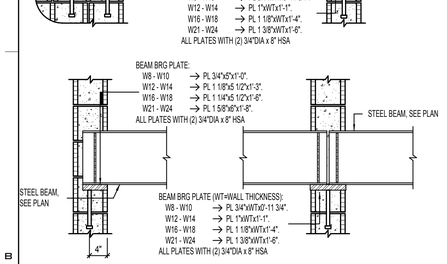
2 TYPICAL ROOF DRAIN SUPPORT DETAIL [PLAN VIEW] NO SCALE



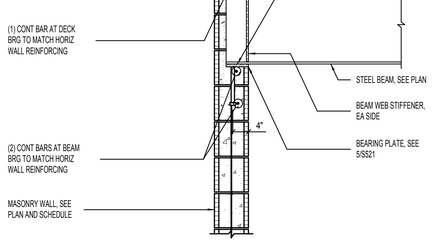
3 TYPICAL PIPE SLEEVE THROUGH ROOF DECK NO SCALE



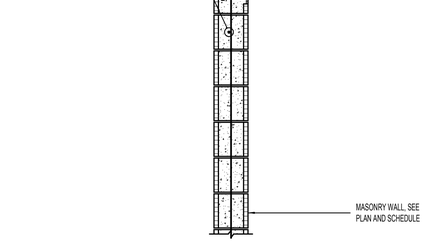
4 TYPICAL ROOF TOP MECHANICAL UNIT SUPPORT DETAIL [PLAN VIEW] NO SCALE



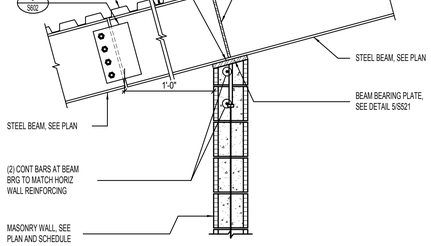
5 BEARING PLATE SCHEDULE FOR ROOF JOIST/BEAM BEARING AT MASONRY WALLS NO SCALE



6 TYPICAL STEEL BEAM/DECK BEARING DETAIL AT 8" OR 10" MASONRY WALLS NO SCALE

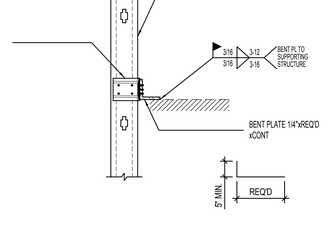


7 DECK BEARING AT MASONRY WALL NO SCALE

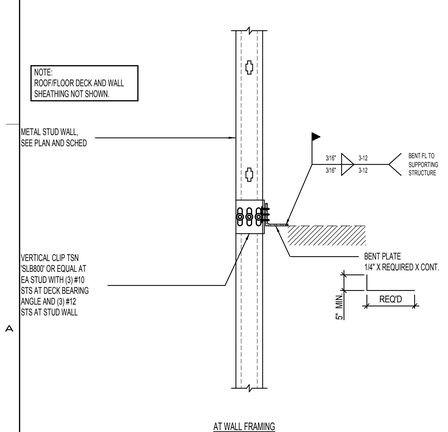


8 CANTILEVERED BEAM BEARING AT 8" OR 10" MASONRY WALL NO SCALE

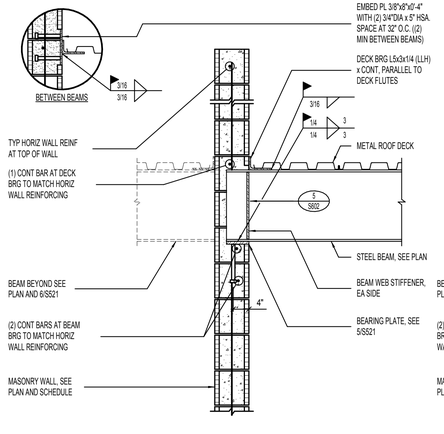
NOTE: REFER TO SPECIFIC DETAILS FOR ORIENTATION OF VERTICAL LEG OF BENT PLATE



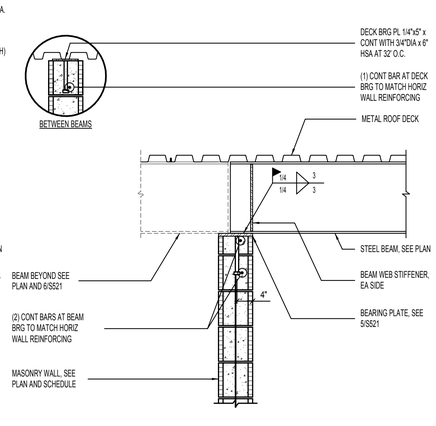
9 TYPICAL METAL STUD FRAMING TO DECK BEARING ANGLE ATTACHMENT [STIFF CONNECTION] NO SCALE



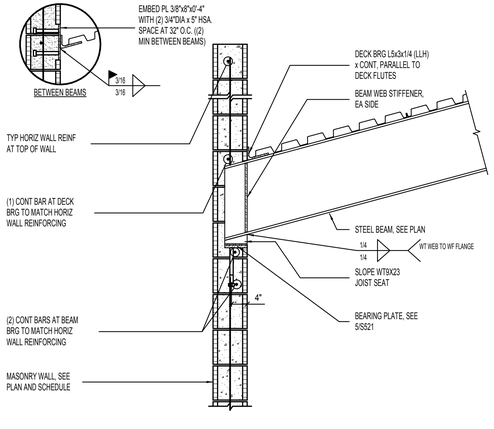
10 TYPICAL METAL STUD FRAMING TO DECK BEARING ATTACHMENT [SLIP CONNECTION] NO SCALE



11 ROOF BEARING DETAIL NO SCALE



12 ROOF BEARING DETAIL NO SCALE



13 CANTILEVERED BEAM BEARING AT 8" OR 10" MASONRY WALL NO SCALE

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LAS COLONIAS AMPHITHEATER

PROJECT ADDRESS:

CITY OF Grand Junction COLORADO

project#: 150289
date: 07-15-16

revisions:

title:

DETAILS

sheet:

S521

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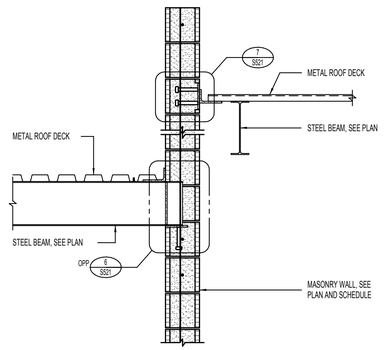
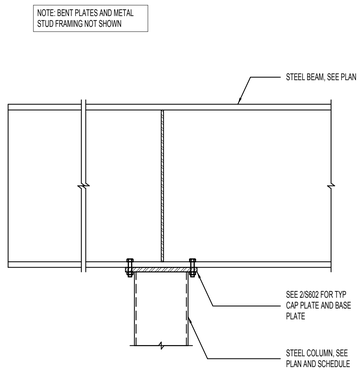


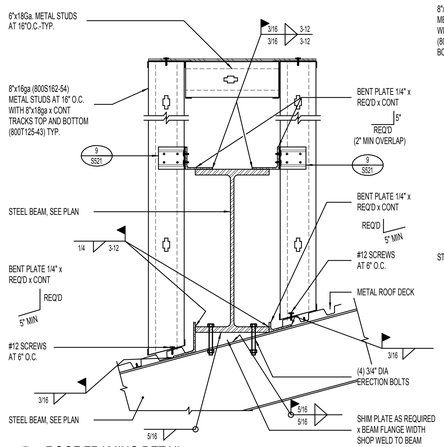
1 ROOF FRAMING DETAIL

NO SCALE



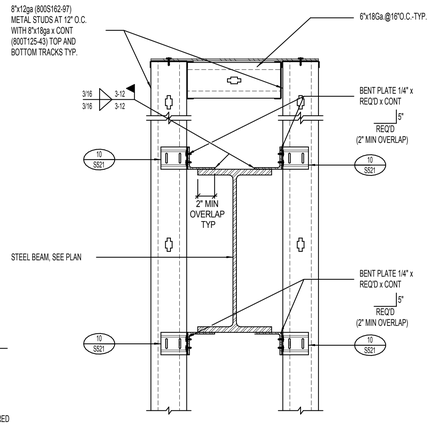
2 TYPICAL BEAM TO COLUMN CONNECTION

NO SCALE



3 ROOF FRAMING DETAIL

NO SCALE



4 FRAMING DETAIL AT STAGE

NO SCALE

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CONCRETE FOOTING SCHEDULE

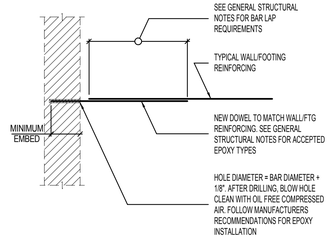
MARK	WIDTH	LENGTH	DEPTH	REINFORCING CROSSWISE				REINFORCING LENGTHWISE				COMMENTS
				No.	SIZE	LENGTH	SPACING	No.	SIZE	LENGTH	SPACING	
FC2.0	2'-0"	CONT	12"	-	#4	1'-8"	48"	3	#4	CONT	EQ	
FC2.5	2'-6"	CONT	12"	-	#5	2'-0"	14"	3	#5	CONT	EQ	
FC3.0	3'-0"	CONT	12"	-	#5	2'-6"	14"	3	#5	CONT	EQ	
FC3.5	3'-6"	CONT	12"	-	#5	3'-0"	14"	3	#5	CONT	EQ	
FC4.0	4'-0"	CONT	12"	-	#5	3'-6"	14"	4	#5	CONT	EQ	
FC4.5	4'-6"	CONT	12"	-	#5	4'-0"	14"	4	#5	CONT	EQ	
FC5.0	5'-0"	CONT	12"	-	#5	4'-6"	14"	5	#5	CONT.	EQ	
FS3.0	3'-0"	3'-0"	12"	3	#5	2'-6"	EQ	3	#5	2'-6"	EQ	
FS3.5	3'-6"	3'-6"	12"	3	#5	3'-0"	EQ	3	#5	3'-0"	EQ	
FS4.0	4'-0"	4'-0"	12"	4	#5	3'-6"	EQ	4	#5	3'-6"	EQ	
FS4.5	4'-6"	4'-6"	12"	4	#5	4'-0"	EQ	4	#5	4'-0"	EQ	
FS5.0	5'-0"	5'-0"	12"	5	#5	4'-6"	EQ	5	#5	4'-6"	EQ	
FS5.5	5'-6"	5'-6"	12"	5	#5	5'-0"	EQ	5	#5	5'-0"	EQ	
FS6.0	6'-0"	6'-0"	12"	6	#5	5'-6"	EQ	6	#5	5'-6"	EQ	
FS6.5	6'-6"	6'-6"	12"	6	#5	6'-0"	EQ	6	#5	6'-0"	EQ	
FS7.0	7'-0"	7'-0"	13"	7	#5	6'-6"	EQ	7	#5	6'-6"	EQ	
FS7.5	7'-6"	7'-6"	14"	8	#5	7'-0"	EQ	8	#5	7'-0"	EQ	
FS8.0	8'-0"	8'-0"	15"	6	#6	7'-6"	EQ	6	#6	7'-6"	EQ	

CONCRETE FOOTING NOTES:
1. PLACE ALL FOOTING REINFORCING IN THE BOTTOM OF THE FOOTING WITH 3" CLEAR CONCRETE COVER (UNO).
2. TOP REINFORCING, WHERE OCCURS, SHALL BE PLACED IN THE TOP OF THE FOOTING WITH 2" MINIMUM CONCRETE COVER.
3. IF FOOTINGS ARE EARTH-FORMED, FOOTINGS SHALL BE 6" LONGER AND WIDER THAN SCHEDULED.
4. RUN CONTINUOUS FOOTING REINFORCEMENT THROUGH SPOT FOOTINGS.
5. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.
6. SOME SCHEDULED FOOTINGS MAY NOT BE USED, SEE FOOTING AND FOUNDATION PLAN FOR FOOTING MARKS.

1 CONCRETE FOOTING SCHEDULE — NO SCALE

EPOXY DOWEL EMBED SCHEDULE

DOWEL SIZE	MINIMUM EMBEDMENT INTO EXISTING CONCRETE
#4	6 1/2"
#5	7 1/2"
#6	10"
#7	1'-1"
#8	1'-4"

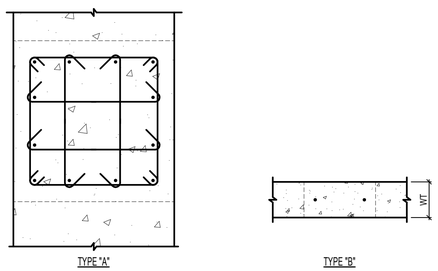


2 EPOXY DOWEL EMBED SCHEDULE — NO SCALE

CONCRETE PIER SCHEDULE

MARK	PIER SIZE	REINFORCING		TYPE	COMMENTS
		VERTICAL	TIES		
CP-16A	WT x16"	(2)#5	-	B	
CP-36A	36"x36"	(12) #7	#3 AT 8"O.C.	A	

CONCRETE PIER NOTES:
1. INSTALL (3) SETS OF TIES WITHIN TOP 5" OF ALL PIERS (UNO).
2. RUN HORIZONTAL CONCRETE WALL REINFORCING CONTINUOUS THROUGH PIER WHEN PIER IS POURED MONOLITHICALLY WITH CONCRETE WALL.
3. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



3 CONCRETE PIER SCHEDULE — NO SCALE

CONCRETE REINFORCING BAR LAP SPLICE SCHEDULE

BAR SIZE	f'c = 3000psi				f'c = 4000psi & f'c = 4500 psi				f'c = 5000psi				f'c = 6000psi			
	REGULAR		TOP		REGULAR		TOP		REGULAR		TOP		REGULAR		TOP	
	CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS		CLASS	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
#3	13"	17"	17"	21"	12"	16"	16"	21"	12"	16"	16"	21"	12"	16"	16"	21"
#4	17"	22"	22"	28"	15"	19"	19"	25"	13"	17"	17"	22"	12"	16"	16"	21"
#5	21"	27"	27"	35"	18"	24"	24"	31"	16"	21"	21"	27"	15"	19"	19"	25"
#6	27"	36"	36"	46"	24"	31"	31"	40"	21"	28"	28"	36"	20"	25"	25"	33"
#7	37"	48"	48"	63"	32"	42"	42"	54"	29"	38"	38"	49"	27"	34"	34"	44"
#8	49"	64"	64"	82"	42"	55"	55"	71"	38"	49"	49"	64"	35"	45"	45"	58"
#9	62"	80"	80"	104"	54"	70"	70"	90"	48"	62"	62"	81"	44"	57"	57"	74"
#10	78"	102"	102"	132"	68"	88"	88"	115"	61"	79"	79"	102"	56"	72"	72"	94"
#11	96"	125"	125"	162"	83"	108"	108"	141"	76"	97"	97"	126"	68"	88"	88"	115"

CONCRETE REINFORCING BAR LAP SPLICE NOTES:
1. THIS SCHEDULE SHALL BE USED FOR ALL BAR SPLICES IN CONCRETE WALLS, UNLESS NOTED OTHERWISE.
2. CLASS 'A' SPLICES MAY BE USED ONLY IN CASES WHERE 50% OR LESS OF THE BARS ARE SPLICED WITHIN THE LAP SPLICE LENGTH.
3. CLASS 'B' SPLICES SHALL BE USED FOR ALL SPLICES UNLESS THE REQUIREMENTS OF NOTE No. 2 ABOVE ARE MET.
4. TIES AND STIRRUPS SHALL NOT BE SPLICED.
5. DO NOT SPLICE VERTICAL BARS IN RETAINING WALLS UNLESS SPECIFICALLY SHOWN.
6. SPLICES FOR BUNDLED BARS:
   a. FOR BUNDLED BARS OF THREE OR LESS, LAP SPLICE LENGTHS SHALL BE MULTIPLIED BY 1.2.
   b. FOR BUNDLED BARS OF FOUR OR MORE, LAP SPLICE LENGTHS SHALL BE MULTIPLIED BY 1.33.
   c. INDIVIDUAL BAR SPLICES WITHIN A BUNDLE SHALL NOT OVERLAP.
   d. ENTIRE BUNDLES SHALL NOT BE LAP SPLICED.
7. FOR ALL LIGHTWEIGHT CONCRETE, LAP LENGTHS SHALL BE MULTIPLIED BY 1.3.
8. FOR ALL EPOXY COATED BARS, LAP LENGTHS SHALL BE MULTIPLIED BY 1.3 FOR TOP BARS AND 1.5 FOR REGULAR BARS.
9. TOP BARS ARE CLASSIFIED AS HORIZONTAL BARS WHERE 12", OR MORE, OF FRESH CONCRETE IS CAST BELOW THE REINFORCING BAR.
10. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.

4 CONCRETE REINFORCING BAR LAP SPLICE SCHEDULE — NO SCALE

CONCRETE WALL SCHEDULE

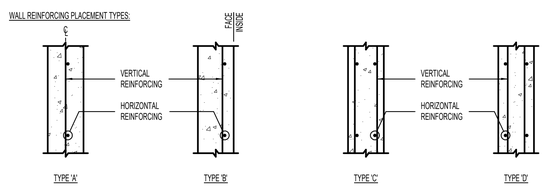
MARK	THICKNESS	REINFORCING			WALL TYPE	COMMENTS
		VERTICAL	HORIZONTAL	TOP AND BOTTOM		
CW-8A	8"	#4 AT 18" O.C.	#4 AT 12" O.C.	(1) #4	A	.
CW-8B	8"	#5 AT 8" O.C.	#4 AT 12" O.C.	(1) #4	A	
CW-36A	36"	#6 AT 12" O.C. E.F.	#6 AT 12" O.C.E.F.	(2) #6	C	

CONCRETE FOUNDATION WALL NOTES:
1. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.
2. CONCRETE FOUNDATION WALLS NOT DESIGNATED ON PLANS SHALL BE REINFORCED AS FOLLOWS:

THICKNESS	VERTICAL REINFORCING	HORIZONTAL REINFORCING
6"	#4 BARS AT 18" O.C.	#4 BARS AT 16" O.C.
8"	#4 BARS AT 18" O.C.	#4 BARS AT 12" O.C.
10"	#4 BARS AT 16" O.C.	#5 BARS AT 15" O.C.
12"	#4 BARS AT 18" O.C. E.F.	#4 BARS AT 16" O.C. E.F.

ABBREVIATIONS:
E.F. EACH FACE
I.F. INSIDE FACE
O.F. OUTSIDE FACE

WALL REINFORCING PLACEMENT TYPES:



5 CONCRETE WALL SCHEDULE — NO SCALE

MASONRY REINFORCING LAP SCHEDULE

BAR SIZE	(1) BAR PER CELL	(2) BARS PER CELL
#3	13"	13"
#4	21"	21"
#5	34"	34"
#6	37"	USE MECH SPLICE COUPLER
#7	USE MECH SPLICE COUPLER	USE MECH SPLICE COUPLER
#8	USE MECH SPLICE COUPLER	USE MECH SPLICE COUPLER

2012 IBC

6 MASONRY REINFORCING LAP SCHEDULE (2000psi) — NO SCALE

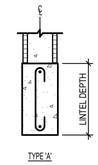
CONCRETE LINTEL SCHEDULE

MARK	THICKNESS	DEPTH	REINFORCING		TYPE	COMMENTS
			HORIZONTAL	STIRRUPS		
CL-12	8"	12"	(2)#5	#3 AT 6" O.C.	A	TERMINATE VERTICAL CMU WALL REINFORCEMENT AT LINTEL WITH A STANDARD 90 DEGREE HOOK

CONCRETE LINTEL NOTES:
1. HORIZONTAL REINFORCING SHALL EXTEND 4'-0" BEYOND EDGE OF OPENING. IF HORIZONTAL REINFORCING CANNOT EXTEND 4'-0" BEYOND EDGE OF OPENING PROVIDE 90° STD HOOK.
2. SPLICE TOP BARS AT MID-SPAN OF LINTEL ONLY AND BOTTOM BARS OVER SUPPORTS ONLY.
3. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.

LINTEL REINFORCING PLACEMENT TYPES:

NOTE:
MASONRY WALL REINFORCEMENT NOT SHOWN.

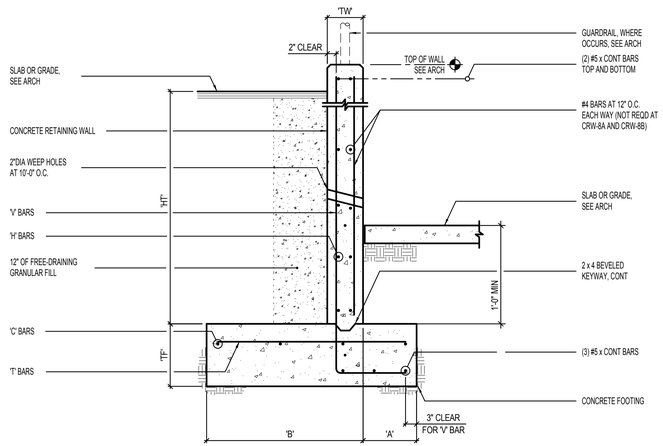


7 CONCRETE LINTEL SCHEDULE — NO SCALE

CONCRETE RETAINING WALL SCHEDULE

MARK	HT	A	B	TW	TF	V		H		T		C		COMMENTS
						SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	SIZE	SPACE	
CRW-8A	0'-8'-0"	1'-2"	1'-10"	8"	12"	#5	16"	#4	12"	#5	14"	#5	12"	.
CRW-8B	5'-1"-7'-0"	2'-8"	2'-10"	8"	12"	#5	12"	#4	12"	#5	14"	#5	12"	
CRW-10A	7'-1"-9'-0"	3'-1"	3'-11"	10"	18"	#6	12"	#5	15"	#5	14"	#5	12"	

CONCRETE RETAINING WALL NOTES:
1. 'V' BARS SHALL NOT BE SPLICED BELOW MID-HEIGHT OF WALL.
2. WHERE 'HT' IS GREATER THAN 9'-0", THEN ONE HALF OF THE 'V' BARS MAY BE DISCONTINUED AT MID-HEIGHT OF WALL.
3. PROVIDE VERTICAL CONTRACTION JOINTS AT 20'-0" O.C. MAXIMUM. SEE ARCHITECTURAL DRAWINGS AND GENERAL STRUCTURAL NOTES.
4. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



8 CONCRETE RETAINING WALL SCHEDULE — NO SCALE

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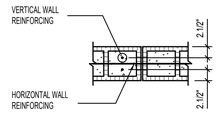
MASONRY WALL SCHEDULE

MARK	THICKNESS	MATERIAL	SOLID GROUT	REINFORCING			COMMENTS
				VERTICAL	HORIZONTAL	JOINTS	
MW-8A	8"	CMU	YES	#5 AT 32" O.C.	#4 AT 24" O.C.	NO	
MW-8B	8"	CMU	YES	#5 AT 8" O.C.	#4 AT 24" O.C.	NO	

MASONRY WALL NOTES:
1. COORDINATE WALL FINISHES, MATERIALS, COURSING, ETC. WITH ARCHITECTURAL DRAWINGS.
2. DO NOT SOLID GROUT WALLS UNLESS REQUIRED BY SCHEDULE, NOTES, OR DETAILS.
3. SOLID GROUT ALL MASONRY COURSES BELOW GRADE.
4. VERTICAL REINFORCING SHALL BE CENTER IN WALL (U/NO).
5. PROVIDE TWO VERTICAL BARS (MIN) AT ALL CORNERS AND END OF WALLS.
6. HORIZONTAL WALL REINFORCING SHALL BE PLACED BETWEEN VERTICAL MASONRY COLUMN REINFORCING BARS.
7. HORIZONTAL WALL REINFORCING SHALL CONTINUE THROUGH MASONRY LINTELS. WHERE BOTH HORIZONTAL WALL REINFORCING AND LINTEL REINFORCING OCCUR IN THE SAME COURSE, USE THE LARGER REINFORCING.
8. MASONRY WALL NOT DESIGNATED IN THE PLANS SHALL BE REINFORCED AS FOLLOWS.

THICKNESS	VERTICAL REINFORCING	HORIZONTAL REINFORCING (NOT SOLID GROUTED)	HORIZONTAL REINFORCING (SOLID GROUTED)
6"	#5 BARS AT 32" O.C.	#4 BARS AT 48" O.C.	#4 AT 24" O.C.
8"	#5 BARS AT 32" O.C.	#5 BARS AT 48" O.C.	#4 AT 24" O.C.
10"	#5 BARS AT 24" O.C.	#6 BARS AT 48" O.C.	#5 AT 24" O.C.
12"	#5 BARS AT 24" O.C.	(2) #5 BARS AT 48" O.C.	(2) #4 AT 24" O.C.

9. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



DOUBLE VERTICAL LAYER WALL REINFORCING

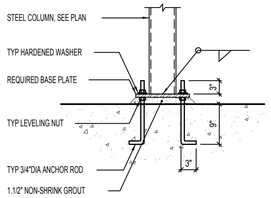
1 NO SCALE

BASE PLATE THICKNESS

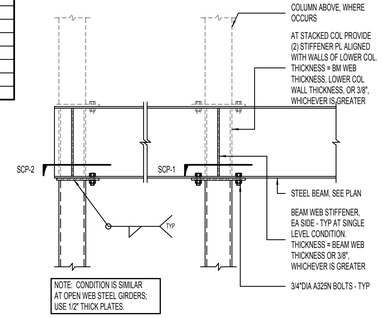
COLUMN SIZE	BASE PLATE THICKNESS
3" ⊡	5/8"
4" ⊡ 4"Ø	5/8"
5" ⊡ 5"Ø	3/4"
6" ⊡ 6"Ø	3/4"
8" ⊡ 8"Ø	3/4"
10" ⊡	1"
12" ⊡	1"

CAP PLATE THICKNESS

CAP PLATE THICKNESS =
BEAM FLANGE THICKNESS or
1/2" (WHICHEVER IS GREATER)

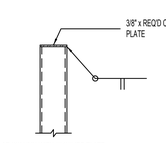


COLUMN BEARING ON CONCRETE



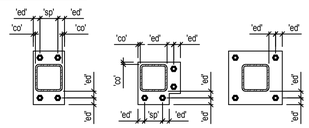
COLUMNS SUPPORTING STEEL FRAMING

STEEL COLUMN NOTES:
1. ANY BASE PLATE BOLT HOLES LARGER THAN THE ROD DIAMETER PLUS 5/16" SHALL HAVE 5/16" PLATE WASHERS INSTALLED BENEATH THE HARDENED WASHERS.
2. ANCHOR RODS SHALL NOT BE WELDED (INCLUDING TACK WELDS).
3. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



AT COLUMN WITH CLOSURE PLATE

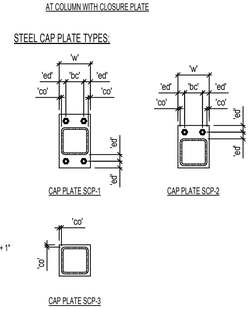
STEEL BASE PLATE TYPES:



COLUMNS IN-LINE WITH WALL (COL LARGER THAN 4")
EXTERIOR CORNERS (COL LARGER THAN 4")
INTERIOR COLUMNS
COLUMNS IN-LINE WITH WALL (4" OR SMALLER COL)
EXTERIOR CORNERS (4" OR SMALLER COL)

PLATE LEGEND
co = 1/2" MINIMUM
ed = 1.1/2" MINIMUM
sp = 3" MINIMUM
bc = BEAM OR GIRDER GAGE
w = BEAM OR GIRDER GAGE + 3"
OR
BEAM OR GIRDER WIDTH + 1"
OR
COLUMN WIDTH + 1"
WHICHEVER IS GREATER

STEEL CAP PLATE TYPES:



CAP PLATE SCP-1
CAP PLATE SCP-2
CAP PLATE SCP-3

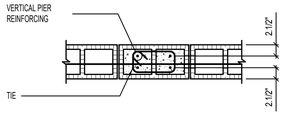
2 STEEL COLUMN BASE PLATE AND CAP PLATE SCHEDULE

NO SCALE

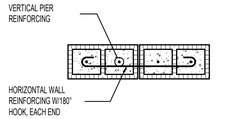
MASONRY PIER SCHEDULE

MARK	SIZE	REINFORCING		REINFORCING SCHEMATIC	COMMENTS
		VERTICAL	TIES		
MP-16A	WT x 16"	(2) #5	NONE		
MP-16B	WT x 16"	(4) #5	#2 AT 8" O.C.		
MP-24A	WT x 24"	(3) #5	NONE		
MP-24B	WT x 24"	(6) #5	#2 AT 8" O.C.		

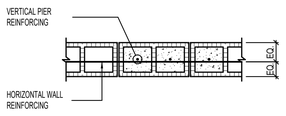
MASONRY PIER NOTES:
1. HORIZONTAL WALL REINFORCING SHALL BE LOCATED TO THE INSIDE OF THE VERTICAL BARS FOR DOUBLE LAYER MASONRY PIERS.
2. VERTICAL REINFORCING AND TIES SHALL EXTEND FULL HEIGHT OF WALL (U/NO).
3. VERTICAL MASONRY PIER REINFORCING SHALL EXTEND INTO THE FOOTING AND TERMINATE WITH A STANDARD 90° HOOK. FOR CONCRETE FOUNDATION WALLS TALLER THAN 5'-0", VERTICAL PIER REINFORCING SHALL DOWEL 4'-0" MINIMUM INTO THE FOUNDATION WALL.
4. IN CONCRETE FOUNDATION WALLS, VERTICAL MASONRY PIER REINFORCING SHALL BE TIED WITH #3 TIES AT THE SAME SPACING AND CONFIGURATION AS THE MASONRY PIER ABOVE.
5. HORIZONTAL REINFORCING OF ADJACENT WALLS SHALL RUN CONTINUOUS THROUGH MASONRY PIERS.
6. WHERE NOTED IN SCHEDULE TIES EXTEND FROM BOTTOM TO TOP OF OPENING AND REPLACE HORIZONTAL WALL REINFORCING.
7. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



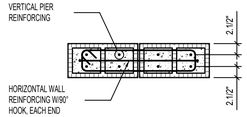
TYPICAL PIER CONFIGURATION SCHEMATIC



TYPICAL ISOLATED PIER CONFIGURATION SCHEMATIC



TYPICAL PIER CONFIGURATION SCHEMATIC



TYPICAL ISOLATED PIER CONFIGURATION SCHEMATIC

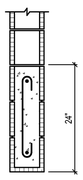
3 MASONRY PIER SCHEDULE

NO SCALE

MASONRY LINTEL SCHEDULE

MARK	DEPTH	MAXIMUM SPAN FOR UNSCHEDULED OPENINGS	REINFORCING		COMMENTS
			HORIZONTAL	STIRRUPS	
ML-24A	24"	10'-0"	(1) #7 TOP AND BOTTOM	#3 AT 8" O.C.	.

MASONRY LINTEL NOTES:
1. LINTEL WIDTH AND MATERIAL TYPE SHALL BE THE SAME AS THE WALL IN WHICH THE LINTEL IS CONSTRUCTED.
2. GROUT MASONRY LINTELS MONOLITHICALLY WITH THE SUPPORT WALL OR COLUMN AT EACH END.
3. MASONRY LINTEL ML-24A SHALL BE USED OVER OPENINGS IN MASONRY WALLS WHEN A SPECIFIC MASONRY LINTEL IS NOT OTHERWISE SPECIFIED. WHEN A LINTEL IS SPECIFIED ON THE PLANS, THE MAXIMUM SPAN AS NOTED IN THIS SCHEDULE SHALL NOT APPLY. CONSULT THE STRUCTURAL ENGINEER FOR LINTELS NOT SPECIFIED ON THE PLANS WHICH HAVE A SPAN GREATER THAN 10'-0".
4. MASONRY LINTEL ML-24A SHALL NOT BE LOCATED DIRECTLY BELOW FLOOR OR ROOF BEAMS OR GIRDERS UNLESS NOTED OTHERWISE ON THE PLANS. JOISTS SHALL NOT BEAR ON ANY LINTEL LESS THAN 16" DEEP. CONSULT THE STRUCTURAL ENGINEER FOR LINTELS NOT SHOWN ON THE PLANS WHICH ARE LOCATED DIRECTLY BELOW FLOOR OR ROOF BEAMS OR GIRDERS.
5. EXTEND ALL HORIZONTAL REINFORCING 48 BAR DIAMETERS MINIMUM BEYOND THE EDGE OF ALL OPENINGS. IF HORIZONTAL REINFORCING CANNOT EXTEND 48 BAR DIAMETERS BEYOND EDGE OF OPENING, PROVIDE 90° STANDARD HOOK.
6. SPLICE TOP BARS AT MIDSPAN OF LINTEL ONLY AND BOTTOM BARS OVER SUPPORTS ONLY.
7. HORIZONTAL WALL REINFORCING SHALL CONTINUE THROUGH MASONRY LINTELS. WHERE BOTH HORIZONTAL WALL REINFORCING AND LINTEL REINFORCING OCCUR IN THE SAME COURSE, USE THE LARGER REINFORCING.
8. DOWEL VERTICAL REINFORCING OF WALL ABOVE LINTEL INTO THE FULL DEPTH OF LINTEL OR 48 BAR DIAMETERS, WHICHEVER IS LESS.
9. SEE GENERAL STRUCTURAL NOTES FOR ADDITIONAL REQUIREMENTS.



ML-24A

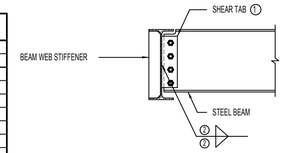
4 MASONRY LINTEL SCHEDULE

NO SCALE

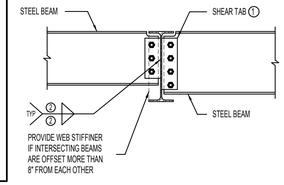
A-325 BOLT SCHEDULE

MAXIMUM BEAM SIZE IN EACH BEAM DEPTH GROUP	A-325N BOLTS		
	No. PER BEAM	SIZE	ASD CAPACITY
W8	2	3/4" DIA.	16.45K
W10	2	3/4" DIA.	21.2K
W12	3	3/4" DIA.	24.45K
W14	3	3/4" DIA.	31.8K
W16	4	3/4" DIA.	42.4K
W18	5	3/4" DIA.	53.0K
W21	6	3/4" DIA.	63.6K
W24	7	3/4" DIA.	74.2K
W27	8	3/4" DIA.	84.8K
W30	9	3/4" DIA.	95.4K

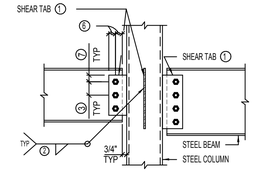
1. SHEAR TAB SHALL BE 3/8" THICK.
2. 5/16" FILLET WELD EACH SIDE OF SHEAR TAB.
3. BOLT SPACING SHALL BE 3" TYP.
4. WHEN MORE THAN ONE ROW OF BOLTS IS NEEDED, THE FIRST ROW SHALL BE A COMPLETE ROW WITH THE REMAINDER OF THE BOLTS PLACED IN A SECOND ROW.
5. HSS COLUMN SHALL HAVE A MINIMUM 1/4" THICKNESS USE A SINGLE ANGLE CONNECTION WHERE STEEL TUBE WALL IS TOO THIN.
6. BOLT EDGE DISTANCE, Leh SHALL BE EQUAL TO TWICE THE BOLT DIAMETER FOR BOTH THE PLATE AND THE BEAM WEB.
7. BOLT EDGE DISTANCE, Lev SHALL BE 1.1/4" FOR BOLT DIAMETERS 7/8" OR LESS AND 1.3/4 BOLT DIAMETER FOR BOLT DIAMETERS GREATER THAN 7/8".
8. ANGLE SIZE SHALL BE 3" FOR SHORT LEG AND 4 TIMES THE BOLT DIAMETER +1" FOR THE LONG LEG.



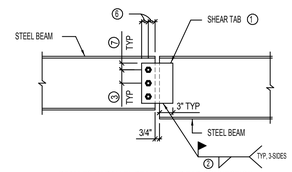
BEAM TO BEAM SHEAR TAB CONNECTION



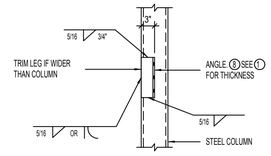
BEAM TO BEAM SHEAR TAB CONNECTION



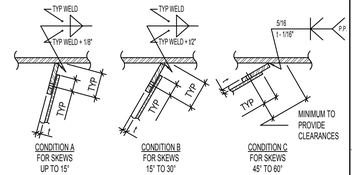
BEAM TO HSS COLUMN SHEAR TAB CONNECTION



BEAM TO PARALLEL BEAM SHEAR TAB CONNECTION



SINGLE ANGLE CONNECTION WHERE REQUIRED BY NOTE No. 5



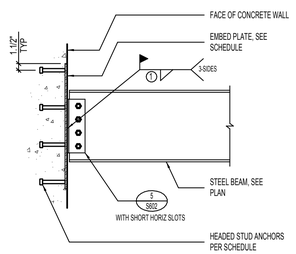
SHEAR CONNECTOR PLATES AT SKEWED MEMBERS

5 TYPICAL 3/4" DIA. BOLTED SHEAR TAB CONNECTIONS WITH BOLT SCHEDULE
[SINGLE SHEAR - STEEL TUBE COLUMNS]

NO SCALE

CONNECTION SCHEDULE

BEAM DEPTH	EMBED PLATE	ANCHORS
W8, W10, W12	PL 1/2"x16"x1'-0"	(3) ROWS OF (2) 3/4"DIA x 5" HSA ((6) TOTAL)
W14, W16	PL 1/2"x28"x1'-0"	(6) ROWS OF (2) 3/4"DIA x 5" HSA ((12) TOTAL)
W18, W21	PL 1/2"x30"x1'-6"	(7) ROWS OF (3) 3/4"DIA x 5" HSA ((21) TOTAL)
1 FILLET WELDS SHALL BE PLATE THICKNESS MINUS 1/16" (1/4" MIN).		



6 TYPICAL EMBED PLATE CONNECTION SCHEDULE FOR CONCRETE WALLS

NO SCALE

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CITY OF Grand Junction COLORADO

project#: 150289
date: 07-15-16

revisions :

title:

SCHEDULES

sheet:

S-602

100% CONSTRUCTION DOCUMENTS

HVAC PIPING LEGEND

NOTE: ALL ABBREVIATIONS MAY NOT BE USED.

RL	REFRIGERANT LIQUID
RS	REFRIGERANT SUPPLY
D	DRAIN LINE
HG	HOT GAS BYPASS
2G	NATURAL GAS (2 PSIG)
G	NATURAL GAS (<0.5 PSI)

SYMBOL LEGEND

SYMBOL	DESCRIPTION
# / SHEET	DETAIL INDICATOR: # INDICATES DETAIL NUMBER, SHEET INDICATES DRAWING SHEET WHERE DETAIL IS SHOWN.
# / SHEET	ELEVATION OR SECTION INDICATOR, EXTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
# / SHEET	ELEVATION OR SECTION INDICATOR, INTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
100	SPACE NUMBER
1	KEYNOTE INDICATOR
	REVISION INDICATOR
	EQUIPMENT INDICATOR
	PLUMBING FIXTURE INDICATOR
TYPE / CFM / SIZE	DIFFUSER/GRILLE INDICATOR
TYPE / SIZE	DIFFUSER/GRILLE INDICATOR
	BREAK, STRAIGHT
	BREAK, ROUND
MATCH LINE / SEE XX/X-XXX	MATCHLINE INDICATOR
— — —	HIDDEN FEATURES LINE: HIDDEN, THIN LINE
— · —	CONTRACT LIMIT LINE: DASHDOT, WIDE LINE
	NEW CONNECTION TO EXISTING
	POINT OF DEMOLITION

DUCTWORK SYMBOL LEGEND

SYMBOL	DESCRIPTION

SINGLE LINE	DOUBLE LINE	DESCRIPTION
		RECTANGULAR SUPPLY DUCT UP
		RECTANGULAR SUPPLY DUCT DOWN
		RECTANGULAR RETURN DUCT UP
		RECTANGULAR RETURN DUCT DOWN
		RECTANGULAR EXHAUST DUCT UP
		RECTANGULAR EXHAUST DUCT DOWN
		ROUND DUCT UP
		ROUND DUCT DOWN
		ACCOUSTICALLY LINED RECTANGULAR DUCT
		90° RECTANGULAR ELBOW WITH TURNING VANES
		90° RADIUS ELBOW R=1.5
		DUCT SIZE OR SHAPE TRANSITION
		OPPOSED BLADE BALANCING DAMPER (O.B.D.) IN RECT DUCT
		BUTTERFLY BALANCING DAMPER IN ROUND DUCTS
		COMBINATION TEE
		SPLITTER DAMPER
		SQUARE OR RECTANGULAR CEILING DIFFUSER
		ROUND CEILING DIFFUSER
		SIDEWALL REGISTER SUPPLY OR RETURN
		ROUND FLEXIBLE DUCT
		RETURN GRILLE
		EXHAUST GRILLE
		FIRE SMOKE DAMPER
		FIRE DAMPER
SD	SD	SMOKE DAMPER
FC	FC	FLEXIBLE CONNECTION
		FLEXIBLE CONNECTION
		DUCT TO BE REMOVED

ABBREVIATIONS

NOTE: ALL ABBREVIATIONS MAY NOT BE USED.

(E)	EXISTING
(F)	FUTURE
AD	ACCESS DOOR
AIR COND	AIR CONDITION(-ING,-ED)
APD	AIR PRESSURE DROP
BD	BALANCING DAMPER
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
BTUH	BTU/HOUR
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CLG	COOLING
COMP	COMPONENT
COND	CONDENS(-ER, -ING, -ATION)
CV	CONTROL VALVE
DB	DRY BULB TEMPERATURE
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DHWR	DOMESTIC HOT WATER RECIRC
DIA	DIAMETER
DISCH	DISCHARGE
DP	DEPTH OR DEEP
EA	EXHAUST AIR
EER	ENERGY EFFICIENCY RATIO
EFF	EFFICIENCY
EG	ETHYLENE GLYCOL
ELEC	ELECTRIC
ELEV	ELEVATION
ENT	ENTERING
EVAP	EVAPORAT(-E, -ING, -ED, -OR)
EWT	ENTERING WATER TEMPERATURE
EXT	EXTERNAL
FC	FLEXIBLE CONNECT(-OR, -ION)
FD	FIRE DAMPER
FLA	FULL LOAD AMPS
FPI	FINS PER INCH
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FSD	FIRE SMOKE DAMPER
GAL	GALLON(S)
GE	GREASE EXHAUST
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HD	HEAD
HG	MERCURY
HP	HORSEPOWER
HR	HOUR
HT	HEIGHT
HTG	HEATING
HZ	HERTZ (FREQUENCY)
ID	INSIDE DIAMETER
IN	INCH
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LG	LENGTH
LH	LATENT HEAT
LRA	LOCKED ROTOR AMPS
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MBH	THOUSAND BTU PER HOUR
MCA	MINIMUM CIRCUIT AMPS
MFR	MANUFACTUR(-ER, -ED)
MIN	MINIMUM
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NPSH	NET POSITIVE SUCTION HEAD
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OD	OUTSIDE DIAMETER
OZ	OUNCE
PD	PRESSURE DROP OR DIFFERENCE
PG	PROPOLENE GLYCOL
PH	PHASE
PPM	PARTS PER MILLION
PRESS	PRESSURE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	PSI ABSOLUTE
PSIG	PSI GAUGE
R	THERMAL RESISTANCE
RA	RETURN AIR
RECIRC	RECIRCULATE
REFR	REFRIGERATION
REQD	REQUIRED
RLA	RATED LOAD AMPS
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SC	SHADING COEFFICIENT
SCFM	STANDARD CUBIC FEET PER MINUTE
SCW	SOFT COLD WATER
SF	SAFETY FACTOR
SH	SENSIBLE HEAT
SL	SEA LEVEL
SP	STATIC PRESSURE
SPEC(S)	SPECIFICATION(S)
SQ	SQUARE
SW	SOIL, WASTE
TA(R)	TRANSFER AIR (RETURN)
TA(S)	TRANSFER AIR (SUPPLY)
TD	TEMP. DROP OR DIFF.
TEMP	TEMPERATURE
THERM	THERMAL
TSTAT	THERMOSTAT
V	VENT
VAC	VACUUM
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY TEMPERATURE
VEL	VELOCITY
VENT	VENT, VENTILATION
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
WB	WET BULB TEMP
WC	WATER COLUMN
WG	WATER GAUGE
WPD	WATER PRESSURE DROP
WT	WEIGHT
WTR	WATER

SYMBOL LEGEND

SYMBOL	DESCRIPTION
	VALVES, METERS, AND GAUGES
	SHUT OFF VALVE
	GATE VALVE
	CHECK VALVE
	AUTO 2-WAY VALVE
	AUTO 3-WAY VALVE
	GLOBE VALVE
	BALL VALVE
	RELIEF VALVE
	CHAIN OPERATED GATE VALVE
	PRESSURE REDUCING VALVE
	BUTTERFLY VALVE
	SOLENOID VALVE
	ANGLE VALVE
	VENTURI
	BALANCING OR PLUG COCK
	FLOW SETTER
	EXPANSION VALVE (REFRIG.)
	GAS COCK
MAV	MANUAL AIR VENT
	STRAINER
	GAUGE COCK
	FLEXIBLE CONNECTION
	PRESSURE GAUGE
	THERMOMETER
	VICTUALIC COUPLING
	REDUCER CONCENTRIC
	REDUCER ECCENTRIC
	REFRIGERANT SITE GLASS
	REFRIGERANT STRAINER
	REFRIGERANT FILTER DRIER
	90 DEG ELBOW UP
	90 DEG ELBOW DOWN
	90 DEG TEE UP
	90 DEG TEE DOWN
	UNION
	CAPPED PIPE
	ANCHOR
	FLOAT AND THERMOSTATIC TRAP

CONTROL LEGEND

SYMBOL	DESCRIPTION
T	THERMOSTAT
S	TEMPERATURE SENSOR
H	HUMIDISTAT

GENERAL HVAC NOTES

1. THE MECHANICAL DRAWINGS SHOW THE GENERAL DESIGN, ARRANGEMENT AND EXTENT OF THE MECHANICAL SYSTEM. BECAUSE OF THE SMALL SCALE OF THE DRAWINGS, THESE DRAWINGS DO NOT SHOW ALL OFFSETS, BENDS OR ELBOWS NECESSARY FOR THE COMPLETE INSTALLATION IN THE SPACE PROVIDED. CONTRACTOR SHALL MAKE SUCH SLIGHT ALTERATIONS AS MAY BE NECESSARY TO MAKE THE SYSTEM COMPLETE AND OPERATIONAL IN ACCORDANCE WITH THE DESIGN INTENT.
   a. MAJOR DEVIATIONS SUCH AS CHANGES IN COMPONENT SIZES, WEIGHTS, QUANTITIES OR MATERIAL REQUIRE PRIOR APPROVAL BY THE DESIGN ENGINEER.
2. THE DRAWINGS AND SPECIFICATIONS HAVE BEEN PREPARED TO SUPPLEMENT EACH OTHER AND SHALL BE INTERPRETED AS IN INTEGRAL UNIT WITH THE ITEMS SHOWN ON ONE AND NOT THE OTHER BEING FURNISHED AND INSTALLED AS THOUGH SHOWN AND CALLED OUT IN BOTH.
3. THE ENTIRE MECHANICAL INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE MOST RECENTLY ADOPTED BUILDING CODES, MECHANICAL CODE, PLUMBING CODE, ELECTRICAL CODE, AND ALL OTHER APPLICABLE CITY, COUNTY, STATE, AND FEDERAL CODES AND REGULATIONS IN EFFECT.
4. THE ENTIRE MECHANICAL INSTALLATION SHALL CONFORM TO ANY CODES, RULES, REGULATIONS AND REQUIREMENTS OF THE BUILDING OWNER.
5. PRIOR TO FABRICATION AND INSTALLATION OF ANY MECHANICAL COMPONENT THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL MECHANICAL WORK WITH ALL OTHER BUILDING TRADES, INCLUDING BUILDING TRADES HIRED DIRECTLY BY THE OWNER. WHERE CONFLICTS MAY OCCUR, THEY SHALL BE RESOLVED PRIOR TO INSTALLATION.
6. THE SPACE ABOVE ALL CEILINGS IS LIMITED. CAREFUL COORDINATION IS REQUIRED WITH ALL TRADES BEFORE ANY PIPE, DUCT, OR EQUIPMENT IS ORDERED AND OR INSTALLED. ANY CONFLICTS AND OR CHANGES FOUND DURING INSTALLATION THAT RESULTS FOR THE LACK OF COORDINATION BY THE CONTRACTORS DURING THE SHOP DRAWING PROCESS ARE THE RESPONSIBILITY OF THE CONTRACTOR.
7. ALL MECHANICAL INFORMATION IS NOT SHOWN ON THE MECHANICAL DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL INFORMATION ON ALL OTHER CONSTRUCTION DOCUMENTS.
8. THE CONTRACTOR SHALL BE RESPONSIBLE TO REVIEW AND USE, WHERE APPROPRIATE, ALL THE MECHANICAL DETAILS SHOWN ON THE DRAWINGS. DETAILS MAY OR MAY NOT BE CALLED OUT ON THE DRAWINGS WITH SYMBOLS OR KEYED NOTES. ANY CHANGES RESULTING FROM FAILURE TO INSTALL THE MECHANICAL SYSTEM WITHOUT USING THE INCLUDED DETAILS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
9. THE STRUCTURE SHOWN ON ALL DETAILS MAY OR MAY NOT PERTAIN TO A PORTION OR ANY PORTION OF THE BUILDING. COORDINATED ALL MOUNTING REQUIREMENTS WITH ARCHITECTURAL AND STRUCTURAL DRAWINGS.
10. ANY PART OF THE MECHANICAL INSTALLATION THAT FAILS, IN UNFIT, OR BECOMES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
11. SEE ARCHITECTURAL REFLECTED CEILING PLAN FOR EXACT LOCATION OF ALL CEILING DIFFUSERS AND GRILLES.
12. CONTRACTOR SHALL OPERATE THE SYSTEM AND DEMONSTRATE ALL ASPECTS OF THE SYSTEM TO THE ENGINEER AND OR OWNER'S REPRESENATIVE PRIOR TO SUBSTANTIAL COMPLETION TO PROVE ALL SYSTEMS ARE OPERATIONAL.
13. DURING CONSTRUCTION, THE CONTRACTOR SHALL MAINTAIN A SET OF AS-BUILT REDLINED RECORD DRAINING AT THE PROJECT SITE. ALL CHANGES IN LAYOUT, ROUTING, EQUIPMENT, COMPONENTS, AND ACCESSORIES SHALL BE RECORDED. THESE REDLINED DRAWINGS SHALL BE GIVEN TO THE ARCHITECT/ENGINEER AFTER THE FINAL INSPECTION IN ACCORDANCE WITH SPECIFICATIONS.

DEFINITIONS

NOTE: ALL DEFINITIONS MAY NOT BE USED

INDICATED: REFERS TO GRAPHIC REPRESENTATIONS, NOTES, OR SCHEDULES ON THE DRAWINGS, OR OTHER PARAGRAPHS OR SCHEDULES IN THE SPECIFICATIONS, AND SIMILAR REQUIREMENTS IN THE CONTRACT DOCUMENTS.
WHERE TERMS SUCH AS "INDICATED", "SHOWN", "NOTED", "SCHEDULED", AND "SPECIFIED" ARE USED, IT IS TO HELP THE READER LOCATE THE REFERENCE.
NO LIMITATION ON LOCATION IS INTENDED.

DIRECTED: TERMS SUCH A "DIRECTED", "REQUESTED", "AUTHORIZED", "SELECTED", "APPROVED", "REQUIRED", "PERMITTED" MEANS "DIRECTED BY THE ENGINEER", "REQUESTED BY THE ENGINEER", AND SIMILAR PHRASES.

APPROVED: WHERE USED IN CONJUNCTION WITH THE ENGINEER'S ACTION ON THE CONTRACTOR'S SUBMITTALS, APPLICATIONS AND REQUESTS, THE TERM "APPROVED" IS LIMITED TO THE ENGINEER'S DUTIES AND RESPONSIBILITIES AS STATED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION DOCUMENTS.

FURNISHED" REFERS TO SUPPLY AND DELIVERY TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, AND INSTALLATION AND SIMILAR OPERATIONS.

INSTALL: REFERS TO OPERATIONS AT THE PROJECT SITE INCLUDING THE ACTUAL, UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING WORKING TO DIMENSION, FINISHING, CURING, PROTECTION, CLEANING AND SIMILAR OPERATIONS.

PROVIDE: MEANS TO "FURNISH AND INSTALL COMPLETE AND READY FOR THE INTENDED USE".
INSTALLER: IS THE CONTRACTOR OR AN ENTITY ENGAGED BY THE CONTRACTOR, EITHER AS AN EMPLOYEE, SUBCONTRACTOR, SUB-SUBCONTRACTOR FOR PERFORMANCE OF A PARTICULAR CONSTRUCTION ACTIVITY, INCLUDING INSTALLATION, ERECTION, APPLICATIONS, AND SIMILAR OPERATIONS. INSTALLERS ARE REQUIRED TO BE EXPERIENCED IN THE OPERATIONS THEY ARE ENGAGED TO PERFORM.

MECHANICAL SHEET INDEX

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project#: 14.0650
date: July 15, 2016

revisions :

title:
HVAC COVER SHEET

sheet:
ME001

100% CONSTRUCTION DOCUMENTS

FIRE SPRINKLER NOTES

1. THE AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE MODIFIED IN ACCORDANCE WITH NFPA 13 AND THE APPLICABLE REQUIREMENTS OF THE LOCAL BUILDING OFFICIAL.
2. A FIRE SPRINKLER FLANS SHALL BE PREPARED BY A LICENSED FIRE SPRINKLER COMPANY AND SUBMITTED TO THE ARCHITECT, DESIGN ENGINEER, LOCAL FIRE MARSHALL AND BUILDING OFFICIAL FOR REVIEW AND APPLICABLE APPROVALS PRIOR TO BEGINNING ANY WORK.
3. THE CONTRACTOR SHALL CALL AND SCHEDULE INSPECTIONS FOR THE REVISIONS TO THE FIRE SPRINKLER SYSTEM IN A TIMELY MANNER WITH THE PROJECT SCHEDULE. INSPECTIONS SHALL BE SCHEDULED A MINIMUM OF 24 HOURS IN ADVANCE OF REQUIREMENTS.
4. UPON COMPLETION OF THE FIRE SPRINKLER SYSTEM, THE CONTRACTOR SHALL HYDROSTATICALLY TEST THE PIPING SYSTEM AT 200 PSIG FOR TWO (2) HOURS OR AS REQUIRED BY THE BUILDING OFFICIAL OR FIRE MARSHALL.
5. PROPERLY COMPLETED "SPRINKLER CONTRACTOR'S MATERIAL AND TEST CERTIFICATES" SHALL BE FURNISHED TO THE ARCHITECT, AND DESIGN ENGINEER.
6. SHUTDOWN OF THE EXISTING FIRE SPRINKLER SYSTEM, TO FACILITATE REMODELING OPERATIONS SHALL BE COORDINATED WITH THE OWNER,
7. SEE REFLECTED CEILING PLAN FOR EXACT LOCATION OF FIRE SPRINKLER HEADS
8. FIRE SPRINKLER HEADS SHALL BE LOCATED IN THE CENTER OF EACH CEILING TILE.

EQUIPMENT SUPPORT NOTES

1. ALL FLOOR MOUNTED EQUIPMENT SHALL BE SECURELY ATTACHED TO HOUSEKEEPING PAD.
2. ALL FLOOR MOUNTED EQUIPMENT WITH FAN(S) OR MOTOR(S) SHALL BE SUPPORTED BY VIBRATION ISOLATORS.
3. ALL SUSPENDED EQUIPMENT SHALL BE INDEPENDENTLY SUPPORTED FROM STRUCTURAL MEMBERS.
4. ALL SUSPENDED EQUIPMENT WITH FAN(S) OR MOTOR(S) SHALL BE PROVIDED WITH VIBRATION ISOLATORS BETWEEN THE EQUIPMENT AND THE STRUCTURAL MEMBERS.
5. EQUIPMENT SHALL NOT BE SUPPORTED FROM ROOF DECK
6. EQUIPMENT SUSPENDED MORE THAN 12" FROM STRUCTURE SHALL BE PROVIDED WITH SEISMIC BRACING

TEST ADJUST & BALANCE NOTES

1. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE COMPLETE TESTING ADJUSTING AND BALANCING FOR THIS PROJECT.
2. THE MECHANICAL SYSTEMS SHALL BE TESTED, ADJUSTED AND BALANCED, INCLUDING SUPPLY AIR SYSTEM, RETURN AIR SYSTEM, EXHAUST AIR SYSTEM, OUTSIDE AIR SYSTEM AND ALL ASSOCIATED EQUIPMENT.
3. CONTRACTOR PERFORMING TESTING ADJUSTING AND BALANCING WORK SHALL BE EITHER AABC OR NEBB CERTIFIED.
4. TESTING ADJUSTING AND BALANCING SHALL BE PERFORMED IN ACCORDANCE WITH THE NEBB OR AABC TEST PROCEDURES.
5. TESTING ADJUSTING AND BALANCING REPORT FORMS SHALL BE STANDARD FORMS FROM EITHER AABC OR NEBB.
6. CONTRACTOR SHALL VERIFY QUANTITIES AND LOCATIONS OF ALL BALANCING DEVICES. CONTRACTOR SHALL VERIFY THAT THESE BALANCING DEVICES ARE ACCESSIBLE AN APPROPRIATE FOR BALANCING AND FOR EFFICIENT SYSTEM AND EQUIPMENT OPERATION PRIOR TO COMMENCING WORK.
7. MECHANICAL (HVAC) EQUIPMENT SHALL BE ADJUSTED TO WITHIN ZERO TO PLUS 10 PERCENT OF SPECIFIED VALUES.
8. MECHANICAL AIR INLETS AND OUTLETS SHALL BE ADJUSTED TO WITHIN 10 PERCENT OF SPECIFIED VALUES.
9. WATER SYSTEMS SHALL BE ADJUSTED TO WITHIN 10 PERCENT OF SPECIFIED VALUES.
10. FINAL BALANCE REPORT SHALL INCLUDE THE FOLLOWING: TEST CONDITIONS FOR FANS, SYSTEM DIAGRAMS, AIR CONDITIONING UNIT TEST REPORTS, FAN TEST REPORTS, AIR TERMINAL DEVICE REPORTS.
11. AFTER THE FINAL BALANCING REPORT IS SUBMITTED TO THE DESIGN ENGINEER AND OWNER, CONTRACTOR SHALL REQUEST THAT A FINAL INSPECTION BE MADE BY THE DESIGN ENGINEER. DURING THE FINAL INSPECTION, DESIGN ENGINEER MAY RANDOMLY SELECT MEASUREMENTS DOCUMENTS IN THE FINAL REPORT TO BE RECHECK BY THE CONTRACTOR.
12. APPROXIMATELY 90 DAYS AFTER SUBMISSION OF THE FINAL BALANCING REPORT, CONTRACTOR SHALL PERFORM ADDITIONAL TESTING ADJUSTING AND BALANCING TO VERIFY THAT BALANCED CONDITIONS ARE BEING MAINTAINED THROUGHOUT EACH SYSTEM AND TO CORRECT UNUSUAL CONDITIONS.
13. ADDITIONAL TESTING ADJUSTING AND BALANCING SHALL BE MADE AS DIRECTED BY THE DESIGN ENGINEER TO CORRECT UNUSUAL CONDITIONS. ADDITIONAL TESTING WILL NOT EXCEED THREE (3) DAYS DURING THE FIRST SIX MONTHS OF OPERATION.
14. IF INITIAL TESTING ADJUSTING AND BALANCING PROCEDURES WERE NOT PERFORMED DURING NEAR-PEAK SUMMER AND WINTER CONDITIONS, PERFORM ADDITIONAL TESTING ADJUSTING AND BALANCING DURING NEAR PEAK SUMMER AND WINTER CONDITIONS.
15. ALL AIR SIDE MECHANICAL (HVAC) SYSTEMS SHALL BE TESTED AND ADJUSTED, AND BALANCED.
16. ALL WATER SIDE MECHANICAL (HVAC) AND PLUMBING PIPING SYSTEMS SHALL BE TESTED, ADJUSTED, AND BALANCED INCLUDING DOMESTIC HOT WATER CIRCULATING PUMPS.

OPER. & MAINT. MANUAL NOTES

1. SUBMIT OPERATIONS AND MAINTENANCE MANUALS IN A PDF ELECTRONIC FILE. ASSEMBLE EACH MANUAL INTO A COMPOSITE ELECTRONICALLY INDEXED FILE. SUBMIT ON DIGITAL MEDIA ACCEPTABLE TO ARCHITECT. NAME EACH INDEXED DOCUMENT FILE IN COMPOSITE ELECTRONIC INDEX WITH APPLICABLE ITEM NAME. INCLUDE A COMPLETE ELECTRONICALLY LINKED OPERATION AND MAINTENANCE DIRECTORY. ENABLE INSERTED REVIEWER COMMENTS ON DRAFT SUBMITTALS.
2. ADDITIONALLY, PROVIDE THREE PAPER COPIES. INCLUDE A COMPLETE OPERATION AND MAINTENANCE DIRECTORY. ENCLOSE TITLE PAGES AND DIRECTORIES IN CLEAR PLASTIC SLEEVES. ARCHITECT WILL RETURN TWO COPIES.
3. SUBMIT EACH MANUAL IN FINAL FORM PRIOR TO REQUESTING INSPECTION FOR SUBSTANTIAL COMPLETION AND AT LEAST 15 DAYS BEFORE COMMENCING DEMONSTRATION AND TRAINING. ARCHITECT WILL RETURN COPY WITH COMMENTS. CORRECT OR REVISE EACH MANUAL TO COMPLY WITH ARCHITECT'S COMMENTS. SUBMIT COPIES OF EACH CORRECTED MANUAL WITHIN 15 DAYS OF RECEIPT OF ARCHITECT'S COMMENTS AND PRIOR TO COMMENCING DEMONSTRATION AND TRAINING.
4. OPERATION MANUALS CONTENT: INCLUDE OPERATION DATA REQUIRED IN INDIVIDUAL SPECIFICATION SECTIONS AND THE FOLLOWING INFORMATION:
   a. SYSTEM, SUBSYSTEM, AND EQUIPMENT DESCRIPTIONS. (USE DESIGNATIONS FOR SYSTEMS AND EQUIPMENT INDICATED ON CONTRACT DOCUMENTS);
   b. PERFORMANCE AND DESIGN CRITERIA IF CONTRACTOR IS DELEGATED DESIGN RESPONSIBILITY; OPERATING STANDARDS;
   c. OPERATING PROCEDURES;
   d. OPERATING LOGS;
   e. WIRING DIAGRAMS;
   f. CONTROL DIAGRAMS;
   g. PIPED SYSTEM DIAGRAMS;
   h. PRECAUTIONS AGAINST IMPROPER USE;
   i. LICENSE REQUIREMENTS INCLUDING INSPECTION AND RENEWAL DATES.
5. OPERATION MANUALS DESCRIPTIONS: INCLUDE THE FOLLOWING:
   a. PRODUCT NAME AND MODEL NUMBER. (USE DESIGNATIONS FOR PRODUCTS INDICATED ON CONTRACT DOCUMENTS);
   b. MANUFACTURER'S NAME;
   c. EQUIPMENT IDENTIFICATION WITH SERIAL NUMBER OF EACH COMPONENT;
   d. EQUIPMENT FUNCTION;
   e. OPERATING CHARACTERISTICS;
   f. LIMITING CONDITIONS;
   g. PERFORMANCE CURVES;
   h. ENGINEERING DATA AND TESTS;
   i. COMPLETE NOMENCLATURE AND NUMBER OF REPLACEMENT PARTS.
   j. WARRANTY
6. OPERATING PROCEDURES: INCLUDE THE FOLLOWING, AS APPLICABLE:
   a. STARTUP PROCEDURES;
   b. EQUIPMENT OR SYSTEM BREAK-IN PROCEDURES;
   c. ROUTINE AND NORMAL OPERATING INSTRUCTIONS;
   d. REGULATION AND CONTROL PROCEDURES;
   e. INSTRUCTIONS ON STOPPING;
   f. NORMAL SHUTDOWN INSTRUCTIONS;
   g. SEASONAL AND WEEKEND OPERATING INSTRUCTIONS;
   h. REQUIRED SEQUENCES FOR ELECTRIC OR ELECTRONIC SYSTEMS;
   i. SPECIAL OPERATING INSTRUCTIONS AND PROCEDURES;
   j. SYSTEMS AND EQUIPMENT CONTROLS:
   i. DESCRIBE THE SEQUENCE OF OPERATION, AND DIAGRAM CONTROLS AS INSTALLED;
      ii. PIPED SYSTEMS:
      iii. DIAGRAM PIPING AS INSTALLED, AND IDENTIFY COLOR-CODING WHERE REQUIRED FOR IDENTIFICATION.
7. PRODUCT MAINTENANCE MANUALS CONTENT:
   a. ORGANIZE MANUAL INTO A SEPARATE SECTION FOR EACH PRODUCT, MATERIAL, AND FINISH.
   b. INCLUDE SOURCE INFORMATION, PRODUCT INFORMATION, MAINTENANCE PROCEDURES, REPAIR MATERIALS AND SOURCES, AND WARRANTIES AND BONDS,

HVAC SUBMITTAL NOTES

1. SUBMITTAL SHALL BE SUBMITTED BY 9/01/2015.
2. MECHANICAL SUBMITTALS SHALL BE SUBMITTED AS A COMPLETE ELECTRONIC PACKAGE ASSEMBLED BY SPECIFICATION DIVISIONS.
3. ASSEMBLE COMPLETE ELECTRONIC SUBMITTAL PACKAGE INTO A SINGLE INDEXED FILE INCORPORATING SUBMITTAL REQUIREMENTS OF A SINGLE SPECIFICATION SECTION AND TRANSMITTAL FORM WITH LINKS ENABLING NAVIGATION TO EACH ITEM:
   a. LITERATURE SHALL INCLUDE REFERENCE TO EQUIPMENT CALLOUT AND SPECIFICATION SECTION;
   b. FILE NAME SHALL USE PROJECT IDENTIFIER AND SPECIFICATION SECTION NUMBER FOLLOWED BY A DECIMAL POINT AND THEN A SEQUENTIAL NUMBER (E.G., LNHS-061000.01).
   c. RE-SUBMITTALS SHALL INCLUDE AN ALPHABETIC SUFFIX AFTER ANOTHER DECIMAL POINT (E.G., LNHS-061000.01.A);
   d. PROVIDE MANUFACTURER'S CATALOG DATA SHEETS FOR EACH MANUFACTURED ITEM LISTED ON THE DRAWINGS AND SPECIFICATIONS;
4. INCLUDE MANUFACTURER'S CATALOG DATA OF EACH MANUFACTURED ITEM AND ENOUGH INFORMATION TO SHOW COMPLIANCE WITH CONTRACT DOCUMENT REQUIREMENTS;
   a. LITERATURE SHALL SHOW CAPACITIES AND SIZE OF EQUIPMENT USED AND BE MARKED INDICATING EACH SPECIFIC ITEM WITH APPLICABLE DATA UNDERLINED;
   b. INCLUDE NAME, ADDRESS, AND PHONE NUMBER OF EACH SUPPLIER;
   c. DEVIATIONS AND ADDITIONAL INFORMATION:
      i. ON AN ATTACHED SEPARATE SHEET, PREPARED ON CONTRACTOR'S LETTERHEAD, RECORD RELEVANT INFORMATION, REQUESTS FOR DATA, REVISIONS OTHER THAN THOSE REQUESTED BY ENGINEER CONTRACT DOCUMENTS, INCLUDING MINOR VARIATIONS AND LIMITATIONS.
      ii. INCLUDE SAME IDENTIFICATION INFORMATION AS RELATED SUBMITTAL.
5. COLLECT PRODUCT DATA INFORMATION INTO A SINGLE SUBMITTAL FOR EACH ELEMENT OF CONSTRUCTION AND TYPE OF PRODUCT OR EQUIPMENT.
   a. IF INFORMATION MUST BE SPECIALLY PREPARED FOR SUBMITTAL BECAUSE STANDARD PUBLISHED DATA ARE NOT SUITABLE FOR USE, SUBMIT AS SHOP DRAWINGS, NOT AS PRODUCT DATA.
   b. MARK EACH COPY OF EACH SUBMITTAL TO SHOW WHICH PRODUCTS AND OPTIONS ARE APPLICABLE.
6. INCLUDE THE FOLLOWING PRODUCT INFORMATION, AS APPLICABLE:
   a. MANUFACTURER'S CATALOG CUTS;
   b. MANUFACTURER'S PRODUCT SPECIFICATIONS;
   c. STANDARD COLOR CHARTS;
   d. STATEMENT OF COMPLIANCE WITH SPECIFIED REFERENCED STANDARDS;
   e. TESTING BY RECOGNIZED TESTING AGENCY;
   f. APPLICATION OF TESTING AGENCY LABELS AND SEALS;
   g. NOTATION OF COORDINATION REQUIREMENTS;
   h. AVAILABILITY AND DELIVERY TIME INFORMATION;
7. INCLUDE THE FOLLOWING EQUIPMENT INFORMATION:
   a. WIRING DIAGRAMS SHOWING FACTORY-INSTALLED WIRING;
   b. PRINTED PERFORMANCE CURVES;
   c. OPERATIONAL RANGE DIAGRAMS;
   d. CLEARANCES REQUIRED TO OTHER CONSTRUCTION, IF NOT INDICATED ON ACCOMPANYING SHOP DRAWINGS.
8. PREPARE PROJECT-SPECIFIC SHOP DRAWINGS, DRAWN ACCURATELY TO SCALE.
   a. DO NOT BASE SHOP DRAWINGS ON REPRODUCTIONS OF THE CONTRACT DOCUMENTS OR STANDARD PRINTED DATA.
   b. FULLY ILLUSTRATE REQUIREMENTS IN THE CONTRACT DOCUMENTS.
   c. INCLUDE THE FOLLOWING INFORMATION, AS APPLICABLE:
      i. IDENTIFICATION OF PRODUCTS;
      ii. SCHEDULES;
      iii. COMPLIANCE WITH SPECIFIED STANDARDS;
      iv. NOTATION OF COORDINATION REQUIREMENTS;
      v. NOTATION OF DIMENSIONS ESTABLISHED BY FIELD MEASUREMENT;
      vi. RELATIONSHIP AND ATTACHMENT TO ADJOINING CONSTRUCTION CLEARLY INDICATED;
      vii. SEAL AND SIGNATURE OF PROFESSIONAL ENGINEER IF SPECIFIED.
9. ALLOW TIME FOR SUBMITTAL REVIEW, INCLUDING TIME FOR RE-SUBMITTALS. TIME FOR REVIEW SHALL COMMENCE ON ENGINEERS RECEIPT OF SUBMITTAL. NO EXTENSION OF THE CONTRACT TIME WILL BE AUTHORIZED BECAUSE OF FAILURETO TRANSMIT SUBMITTALS ENOUGH IN ADVANCE OF THE WORK TO PERMIT PROCESSING, INCLUDING RE-SUBMITTALS.
   a. ALLOW 10 DAYS FOR INITIAL REVIEW OF MECHANICAL SUBMITTAL.
   b. ALLOW 10 DAYS FOR REVIEW OF EACH RE-SUBMITTAL.
10. PROVIDE DEVIATIONS AND ADDITIONAL INFORMATION ON AN ATTACHED SEPARATE SHEET, PREPARED ON CONTRACTOR'S LETTERHEAD, RECORD RELEVANT INFORMATION, REQUESTS FOR DATA, REVISIONS OTHER THAN THOSE REQUESTEBY DESIGN ENGINEER ON PREVIOUS SUBMITTALS, AND DEVIATIONS FROM REQUIREMENTS IN THE CONTRACT DOCUMENTS, INCLUDING MINOR VARIATIONS AND LIMITATIONS. INCLUDE SAME IDENTIFICATION INFORMATION AS RELATED SUBMITTAL.

HVAC ENERGY CODE NOTES

1. THE MECHANICAL SYSTEMS ARE BASED ON CHAPTERS 1, 2, 3, 6 AND 6 OF THE 2012 INTERNATIONAL ENERGY CONSERVATION CODE PUBLISHED BY THE INTERNATIONAL CODE COUNCIL.
2. THE BUILDING HEATING AND COOLING LOADS ARE BASE ON TRANE "TRACE" PROGRAM WHICH MEETS THE REQUIREMENTS OF ASHARE STANDARD 183.
3. ALL MECHANICAL EQUIPMENT SHALL MEET THE MINIMUM EFFICIENCY REQUIREMENTS SPECIFIED ON THE DRAWING OR THE MINIMUM EFFICIENCY REQUIREMENTS SPECIFIED IN THE ENERGY CONSERVATION CODE, WHICHEVER IS HIGHER.
4. ALL MECHANICAL DUCTWORK AND PLENUMS SHALL BE INSULATED IN ACCORDANCE WITH THE DUCT INSULATION TABLE SHOWN ON THE DRAWINGS OR THE REQUIREMENTS OF THE ENERGY CONSERVATION CODE, WHICHEVER IS HIGHER.
5. ALL LONGITUDINAL SEAMS AND TRANSVERSE JOINTS OF ALL MECHANICAL DUCTWORK SHALL BE SEALED IN ACCORDANCE WITH THE THE ENERGY CODE AND SMACNA DUCT CONSTRUCTION REQUIREMENTS.
6. ALL HEATING AND AIR CONDITIONING EQUIPMENT WITH A CAPACITY OF 54,000 BTUH OR HIGHER SHALL BE PROVIDED WITH AN AIR SIDE ECONOMIZER.

AIR FILTER INSTALLATION NOTES

1. INSTALL FILTERS WITH CLEARANCE FOR NORMAL SERVICE AND MAINTENANCE.
2. INSTALL FILTERS IN POSITION TO PREVENT PASSAGE OF UNFILTERED AIR.
3. DO NOT OPERATE FAN SYSTEMS WITHOUT FILTERS.
4. PROVIDE ONE SET OF FILTERS DURING CONSTRUCTION.
5. PROVIDE AN ADDITIONAL SET OF NEW FILTERS FOR TESTING, ADJUSTING AND BALANCING OF AIR SYSTEMS.
6. AFTER COMPLETING SYSTEM INSTALLATION AND TESTING, ADJUSTING, AND BALANCING OF AIR-HANDLING AND AIR-DISTRIBUTION SYSTEMS, CLEAN FILTER HOUSINGS AND INSTALL NEW FILTER MEDIA.

RADON SYSTEM NOTES

1. TEXT

FIELD VERIFICATION NOTES

1. DESIGN DRAWINGS ARE SCHEMATIC. THIS CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING OR AWARD OF CONTRACTOR TO INSPECT EXISTING FIELD CONDITIONS.
2. THIS CONTRACTOR SHALL INCLUDE ALL LABOR AND MATERIALS NECESSARY FOR FIELD MODIFICATIONS TO TO EXISTING CONDITIONS.
3. THE CONTRACTOR SHALL CONTACT THE ARCHITECT, ENGINEER OR OWNER PRIOR TO BIDDING FOR INTERPRETATIONS AND CLARIFICATIONS OF THE DESIGN AND INCLUDE IN HIS BID ALL COSTS TO MEET THE DESIGN INTENT.
4. CLARIFICATIONS MADE BY THE ARCHITECT, ENGINEER OR OWNER AFTER BIDDING WILL BE FINAL AND SHALL BE IMPLEMENTED AT AT THE CONTRACTOR'S COST.
5. BIDDING CONTRACTORS SHALL HAVE A WORKING KNOWLEDGE OF ALL LOCAL CODES AND ORDINANCES AND SHALL INCLUDE IN THEIR BID THE COSTS FOR ALL WORK INSTALLED IN STRICT ACCORDANCE WITH GOVERNING CODES.
6. THE CONTRACTOR SHALL ALERT THE ARCHITECT, ENGINEER AND OWNER OF ANY APPARENT DISCREPANCIES BETWEEN GOVERNING CODES AND DESIGN INTENT.

REFRIGERATION PIPING NOTES

1. THESE NOTES APPLY TO REFRIGERANT LINE SETS. SEE MECHANICAL SPECIFICATION FOR FIELD ASSEMBLED REFRIGERANT PIPING.
2. REFRIGERATION SYSTEM USES R-410A REFRIGERANT
3. REFRIGERATION PIPING SHALL BE TYPE L REFRIGERANT GRADE, ARC TYPE LINE SETS.
4. REFRIGERATION SUCTION AND REFRIGERANT PIPING SHALL BE INSULATED.
5. REFRIGERANT PIPING SHALL BE SUPPORTED FROM OVERHEAD STRUCTURE WITH PLASTIC COATED OR COPPER PLATED CLEVIS HANGERS
6. ENGINEERED STRUTS AND HANGER RODS ARE PERMITTED TO SUPPORT REFRIGERANT.
7. REFRIGERANT PIPING SHALL NOT COME IN CONTACT WITH HANGERS OR ENGINEERED STRUT. ISOLATE REFRIGERANT PIPING FROM HANGER WITH PIPE INSULATION OR ELASTOMERIC SLEEVE.
8. REFRIGERANT PIPING SHALL BE INSTALLED A MINIMUM OF 12" FROM ANY WATER PIPING OR DUCTWORK
9. LIQUID LINE FILTER-DRIVER SHALL BE INSTALLED AT INDOOR (EVAPORATOR) COIL.
10. REFRIGERANT TUBE AND INDOOR (EVAPORATOR) COIL SHALL BE EVACUATED TO 500 MICRONS.
11. THE REFRIGERANT PIPING SYSTEM SHALL HOLD A VACUUM OF 1000 MICRONS FOR 7 MINUTES.
12. REFRIGERATING COMPRESSOR SHALL NOT BE USES AS A VACUUM PUMP.
13. PROVIDE PROPER PROVISIONS FOR EXPANSION OR MOVEMENT OF ALL PIPING.
14. SERVICE VALVES AND LIQUID LINE FILTER-DRYER SHALL BE WRAPPED WITH A HEAT-SINKING MATERIAL DURING ALL BRAZING PROCESSES.

GENERAL EQUIPMENT NOTES

1. HEATING & AIR CONDITIONING EQUIPMENT IS SIZE IN ACCORDANCE WITH ASHRAE STANDARD 183.
2. ALL MECHANICAL EQUIPMENT SHALL BE LISTED, LABELED AND INSTALLED IN ACCORDANCE THE MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS. AT LEAST ONE COPY OF THE INSTALLATION INSTRUCTIONS SHALL BE ON THE JOB SITE AT ALL TIMES.
3. ALL CAPACITIES ARE AT JOB SITE CONDITIONS AND ARE MINIMUM CAPACITY.
4. ALL AIR CONDITIONING EQUIPMENT SHALL BE AHRI CERTIFIED AND UL LISTED.
5. ALL MECHANICAL EQUIPMENT SHALL BE INSTALLED TO CONFORM TO LOCAL SEISMIC REQUIREMENTS AND THE REQUIREMENTS OF THESE CONSTRUCTION DOCUMENTS.
6. VERIFY ALL REQUIRED SERVICE CONNECTIONS, INCLUDING ELECTRICAL CHARACTERISTICS FOR ALL EQUIPMENT PRIOR TO ORDERING EQUIPMENT.
7. ALL SIMILAR EQUIPMENT SHALL BE OF THE SAME MANUFACTURER.
8. AIR SIMILAR INLETS AND OUTLETS SHALL BE OF THE SAME MANUFACTURER.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE HVAC EQUIPMENT CHECK-IN, SAFEKEEPING, AND DAMAGE.
10. ALL SYSTEM COMPONENTS, WHERE REQUIRED, SHALL BE CERTIFIED AND LISTED BY A THIRD PARTY.
11. PROVIDE VIBRATION ISOLATION FOR ALL MECHANICAL EQUIPMENT TO PREVENT TRANSMISSION OF VIBRATION TO BUILDING STRUCTURE.
12. PROVIDE CONCRETE HOUSEKEEPING PADS FOR ALL MECHANICAL EQUIPMENT SUPPORT FROM THE FLOOR OR GROUND. MINIMUM THICKNESS OF HOUSEKEEPING PAD SHALL BE 4". CONCRETE HOUSEKEEPING PAD SHALL EXTEND BEYOND THE EQUIPMENT A MINIMUM OF 6" ON EACH SIDE. COORDINATE EXACT LOCATION OF CONCRETE HOUSEKEEPING PAD WITH ALL TRADES.
13. CONDENSATE DRAIN FROM AIR CONDITIONING EQUIPMENT SHALL BE PIPED FULL SIZE OF EQUIPMENT OUTLET TO NEAREST DRAIN.

HVAC PROJECT SUBMIT. NOTES

1. MECHANICAL SUBMITTALS SHALL BE SUBMITTED AS A COMPLETE ELECTRONIC PACKAGE ASSEMBLED BY SPECIFICATION DIVISIONS.
2. PROVIDE EQUIPMENT SUBMITTAL INFORMATION FOR THE FOLLOWING EQUIPMENT
   A. FURNACE
   B. CONDENSING UNIT
   C. ROOF EXHAUST FANS
   D. CEILING EXHAUST FANS
   E. CEILING DIFFUSERS (CD)
   F. REGISTERS & GRILLES (CG, SR, WG)
   G. DAMPERS. & AIR DUCT ACCESSORIES
   H. DUCT TAKE-OFF
   I. VIBRATION ISOLATORS
   J. AIR FILTERS
3. PROVIDE MATERIAL SUBMITTAL INFORMATION FOR TH FOLLOWING MATERIAL:
   A. REFRIGERATION PIPING & VALVES
   B. HANGERS AND SUPPORTS
   C. DUCT INSULATION
   D. DUCT LINER
   E. PIPE INSULATION
   F. EQUIPMENT IDENTIFICATION
   G. PIPE IDENTIFICATION
   H. BUILDING AUTOMATION SYSTEM
   I. FIRE SPRINKLER SYSTEM
   J. TESTING ADJUSTING AND BALANCING CONTRACTOR QUALIFICATIONS.

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HVAC NOTES

sheet:
ME002

100% CONSTRUCTION DOCUMENTS

EQUIPMENT LABELING

1. ALL MECHANICAL EQUIPMENT SHALL BE LABELED.
2. PROVIDE 1/16" THICK MULTIPLE LAYERED, MULTIPLE COLORED PLASTIC LABEL WITH MECHANICAL ENGRAVING.
3. LABEL SHALL HAVE BLACK BACKGROUND, 1/2" HIGH WHITE LETTERING.
4. MINIMUM SIZE OF LABEL SHALL BE 2-1/2" X 1"
5. LABEL SHALL BE SECURED TO EQUIPMENT WITH STAINLESS STEEL SELF-TAPPING SCREWS.
6. MINIMUM CONTENT OF LABEL SHALL INCLUDE DRAWING DESIGNATION (UNIQUE NUMBER), AND AREA SERVED,

SEISMIC DUCTWORK NOTES

1. THE TOP OF ALL DUCTWORK SHALL BE INSTALLED WITHIN 12-INCHES OR LESS FROM STRUCTURAL SUPPORT MEMBER. THE 12-INCHES SHALL BE MEASURED FROM THE TOP OF THE DUCT TO THE BOTTOM OF THE SUPPORT WHERE THE HANGER IS ATTACHED. DUCT HANGERS MUST BE ATTACHED WITHIN 2" OF THE TOP OF THE DUCT WITH A MINIMUM OF TWO #10 SHEET METAL SCREWS.
2. IF ANY HANGER IN THE RUN EXCEEDS THE 12 INCH LIMIT, SEISMIC BRACING IS REQUIRED FOR THE RUN.
3. ALL RECTANGULAR AND SQUARE DUCTS 6 SQUARE FEET OR LESS DO NOT REQUIRE SEISMIC BRACING.
4. ALL ROUND DUCTS LESS THAN 28 INCHES IN DIAMETER DO NOT REQUIRE SEISMIC BRACING.
5. DEVICES, WEIGHING 50 POUND OR GRATER, AND MOUNTED IN-LINE AND RIGIDLY ATTACHED TO THE DUCTWORK AT BOTH ENDS MUST BE SUPPORTED AMD BRACED INDEPENDENTLY FROM THE DUCTWORK IF THE UNIT WEIGHT IS 50 LBS. OR GREATER OR THE
6. DEVICES, WEIGHING BETWEEN 20 AND 49 LBS. SHALL BE SEPARATED FROM THE DUCT WITH A FLEXIBLE CONNECTOR.

HVAC PIPE HANGER NOTES

1. ALL PIPING SHALL BE SUPPORT WITH STEEL CLEVIS HANGERS (MSS TYPE 1).
2. PERFORATED METAL STRAPS OR PLASTIC STRAPPING (PLUMBER TAPE) SHALL NOT BE USED TO SUPPORT OR BRACE ANY PIPE.
3. PROVIDE PIPE HANGERS WITHIN 18-INCHES OF ALL CHANGES OF DIRECTION.
4. ALL STEEL CLEVIS HANGERS USED TO SUPPORT COPPER PIPING SHALL BE COPPER PLATED OR PLASTIC COATED
5. ALL STEEL CLEVIS HANGERS USED TO SUPPORT PLASTIC PIPING SHALL BE PLASTIC COATED.
6. PROVIDE ELASTOMERIC CUSHION (COOPER B-LINE B1999 "VIBRA CUSHION") BETWEEN COPPER PIPING AND GALVANIZED CHANNEL SUPPORT CLAMPS. PLASTIC PIPE WRAP TAPE IS NOT ACCEPTABLE.
7. PROVIDE ELASTOMERIC INSERT (COOPER B-LINE BVP "VIBRACLAMPS") BETWEEN PLASTIC PIPE AND GALVANIZED CHANNEL SUPPORT CLAMPS. PLASTIC PIPE WRAP TAPE IS NOT ACCEPTABLE.
8. PROVIDE SWAY BRACING FOR ALL PIPING 4" AND LARGER AT ALL CHANGES IN DIRECTION GREATER THAN 45-DEGREES.

DUCT SUPPORT NOTES

1. SUPPORT ALL METAL DUCTWORK FROM STRUCTURAL MEMBERS.
2. ALL DUCT SUPPORTS SHALL BE GALVANIZED STEEL.
3. DUCT SUPPORTS SHALL NOT BE ATTACHED TO ROOF DECK.
4. DUCT SUPPORTS SHALL NOT BE ATTACHED TO STRUCTURAL CROSS BRACING.
5. HANGER STRAPS AND HANGER ROD SIZES FOR RECTANGULAR DUCTWORK SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," TABLE 5-1 "RECTANGULAR DUCT HANGERS MINIMUM SIZE,"
6. HANGER STRAPS AND HANGER ROD SIZES FOR ROUND DUCTWORK SHALL COMPLY WITH SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," TABLE 5-2, "MINIMUM HANGER SIZES FOR ROUND DUCT."
7. SUSPEND ALL METAL DUCTWORK NOT EXCEEDING 30" LONGEST SIDE AT EVERY JOINT. DO NOT EXCEED 10'-0" HANGER SPACING. USE 1" X 18 GAGE GALVANIZED STRAPS (MINIMUM) ATTACHED TO BOTTOM AND SIDES OF DUCT
8. SUSPEND ALL METAL DUCTWORK EXCEEDING 30" LONGEST SIDE AT MAXIMUM 8'-0" SPACING USING ANGLES AND RODS.

DUCT CONSTRUCTION NOTES

1. DUCTWORK HAS BEEN DESIGNED AND SIZED IN ACCORDANCE WITH AMERICAN SOCIETY OF HEATING REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE) HANDBOOK OF FUNDAMENTALS AND SMACNA'S HVAC DUCT CONSTRUCTION STANDARDS HANDBOOK.
2. ALL RECTANGULAR AND ROUND DUCTWORK SHALL FABRICATED AND CONSTRUCTED TO COMPLY WITH THE SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA'S) "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE".
3. ALL DUCTWORK SHALL BE GALVANIZED SHEET METAL, EXCEPT WHERE INDICATED OTHERWISE.
4. ALL DUCTWORK SHALL BE A MINIMUM OF 26 GAUGE.
5. ALL RECTANGULAR AND ROUND DUCTWORK SHALL BE CONSTRUCTED TO THE FOLLOWING SHEET METAL DUCT STATIC PRESSURE CLASSIFICATION:
   a. SUPPLY AIR DUCT: 2" W.C.
   b. RETURN AIR DUCT: 2" W.C. (NEGATIVE)
   c. EXHAUST AIR DUCT: 2" W.C. (NEGATIVE)
   d. OUTSIDE AIR DUCT: 2" W.C.
6. DUCT SIZES SHALL BE VERIFIED FOR CLEARANCES AT THE JOB SITE PRIOR TO FABRICATION. DIMENSIONS MAY BE CHANGED TO ACCOMMODATE CONSTRUCTION CLEARANCES. FREE AREA OF DUCT SHALL BE MAINTAINED.
7. DUCT TRANSITIONS SHALL BE CONSTRUCTED WITH SLOPE OF 1/4.
8. FLEXIBLE DUCTWORK SHALL BE LIMITED TO A MAXIMUM OF 3'-0" TO AIR INLET OR AIR OUTLET.
9. FLEXIBLE CONNECTORS SHALL NOT BE USED.

HVAC PIPING NOTES

1. CAULK AROUND ALL PIPING THAT PASSES THROUGH FIRE RATED PARTITIONS WITH A NON-HARDENING CAULKING SIMILAR TO 3M "FIRE BARRIER".
2. PROVIDE PROPER PROVISIONS FOR EXPANSION OR MOVEMENT OF ALL PIPING.
3. PROVIDE LARGE ENOUGH PIPE SLEEVES THROUGH WALLS OR FLOORS TO ALLOW FOR ANTICIPATED DEFERENTIAL MOVEMENTS.
4. ALL PIPING SHALL BE INSTALLED IN A NEAT ARRANGEMENT PARALLEL TO BUILDING STRUCTURE.

SEISMIC EQUIP. SUPPORT NOTES

1. ALL EQUIPMENT SHALL BE INSTALLED WITH SEISMIC RESTRAINTS.

   EXEMPTIONS:
   a. FLOOR OR CURB-MOUNTED EQUIPMENT WEIGHING LESS THAN 400 LBS AND NOT RESILIENTLY MOUNTED, WHERE THE IMPORTANCE FACTOR, IP = 1.0 AND THERE IS NO POSSIBILITY OF CONSEQUENTIAL DAMAGE.
   b. EQUIPMENT WEIGHING LESS THAN 20 LBS AND DISTRIBUTION SYSTEMS WEIGHING LESS THAN 5 LBS/LINEAL FOOT, WITH AN IP = 1.0 AND WHERE FLEXIBLE CONNECTIONS EXIST BETWEEN THE COMPONENT AND ASSOCIATED DUCTWORK, PIPING OR CONDUIT.
2. ALL HVAC EQUIPMENT WITH MOTORS, FANS, ETC. SHALL BE INSTALLATION WITH VIBRATION ISOLATORS BETWEEN THE EQUIPMENT AND THE BUILDING STRUCTURE.
3. ALL FLOOR MOUNTED EQUIPMENT SHALL BE INSTALLED A 4" HIGH CONCRETE HOUSEKEEPING PAD. VIBRATION ISOLATOR OR EQUIPMENT ATTACHMENT TO THE CONCRETE HOUSEKEEPING SHALL BE A MINIMUM OF 6-INCHES FROM THE EDGE OF THE HOUSEKEEPING PAD.
4. ALL COMPONENTS SHALL BE INSTALLED ON BLOCKS TO THE OPERATING HEIGHT OF THE ISOLATORS. AFTER THE ENTIRE INSTALLATION IS COMPLETE AND UNDER FULL LOAD INCLUDING WATER, THE ISOLATORS SHALL BE ADJUSTED SO THAT THE LOAD IS TRANSFERRED FROM THE BLOCKS TO THE ISOLATORS. REMOVE ALL DEBRIS FROM BENEATH THE EQUIPMENT AND VERIFY THAT THERE ARE NO SHORT CIRCUITS OF THE ISOLATION. THE EQUIPMENT SHALL BE FREE TO MOVE IN ALL DIRECTIONS, WITHIN THE LIMITS OF THE RESTRAINTS.
5. NO RIGID CONNECTIONS BETWEEN EQUIPMENT AND THE BUILDING STRUCTURE SHALL BE MADE THAT DEGRADES THE NOISE AND VIBRATION CONTROL SYSTEM.
6. OVERSTRESSING OF THE BUILDING STRUCTURE MUST NOT OCCUR DUE TO OVERHEAD SUPPORT OF EQUIPMENT.
7. SEISMIC CABLE RESTRAINTS SHALL BE INSTALLED SLIGHTLY SLACK TO AVOID SHORT CIRCUITING THE ISOLATED SUSPENDED EQUIPMENT OR PIPING.

SMOKE DETECTOR NOTES

1. SMOKE DETECTOR SHALL BE PHOTOELECTRIC TYPE AND SHALL BE EQUIVALENT TO "SYSTEM SENSOR" DH100ACDCLP.
2. SMOKE DETECTOR SHALL BE INSTALLED IN THE RETURN AIR DUCT OF ALL AIR HANDLING UNITS WITH CAPACITY GREATER THAN 2,000 CFM.
3. PROVIDE SMOKE DETECTORS WHERE MULTIPLE AIR-HANDLING SYSTEMS SHARE COMMON SUPPLY OR RETURN AIR DUCTS OR PLENUMS WITH A COMBINED DESIGN CAPACITY GREATER THAN 2,000 CFM.
4. THE SMOKE DETECTORS SHALL BE INSTALLED TO MONITOR THE ENTIRE AIRFLOW CONVEYED BY THE SYSTEM INCLUDING RETURN AIR AND EXHAUST.
5. PROVIDE ACCESS TO ALL SMOKE DETECTORS FOR INSPECTION.
6. SMOKE DETECTOR SHALL BE INTERLOCKED WITH SUPPLY FAN ELECTRICAL STARTER TO SHUT DOWN SUPPLY AIR FAN(S) ON SENSING SMOKE.
7. SMOKE DETECTOR SHALL BE INTERLOCKED WITH EXISTING FIRE ALARM SYSTEM.
8. THE ACTUATION OF A DUCT SMOKE DETECTOR SHALL ACTIVATE A VISIBLE AND AUDIBLE SUPERVISORY SIGNAL AT A CONSTANTLY ATTENDED LOCATION.
9. IN ADDITIONAL TO INTERLOCKING THE SMOKE DETECTOR TO THE FIRE ALARM SYSTEM, THE SMOKE DETECTOR SHALL BE CONNECTED TO A MULTI-SIGNALING ANNUNCIATOR PANEL (SYSTEM SENSOR SSK 451).
10. MULTI-SIGNALING ANNUNCIATOR PANEL (SYSTEM SENSOR SSK 451) SHALL BE INSTALLED AS SHOWN ON DRAWING AND AS REQUIRED BY BUILDING OFFICIAL

DUCT SEALING NOTES

1. ALL TRANSVERSE JOINTS AND LONGITUDINAL SEAMS ON ALL RECTANGULAR AND ROUND DUCTWORK SHALL BE SEAL TO SMACNA SEAL CLASS B.
2. APPROVED METHODS OF SEALING DUCTWORK INCLUDES TAPES, MASTICS, GASKETS OR OTHER APPROVED CLOSURE SYSTEMS.
3. TAPES AND MASTICS USED TO SEAL DUCTWORK MUST BE LISTED AND LABELED IN ACCORDANCE WITH UL 181A AND SHALL BE MARKED " 181A-P FOR PRESSURE-SENSITIVE TAPE, "181A-M" FOR MASTIC OR "181A-H FOR HEAT-SENSITIVE TAPE.
4. TAPES AND MASTICS USED TO SEAL FLEXIBLE AIR DUCTS SHALL COMPLY WITH UL 181B AND SHALL BE MARKED "181B-FX" FOR PRESSURE SENSITIVE TAPE, OR 181B-M FOR MASTIC.
5. MECHANICAL FASTENERS USED WITH FLEXIBLE NON-METALLIC AIR DUCTS SHALL COMPLY WITH UL 181 AND SHALL BE MARKED "181B-".
6. TAPE ALONE CANNOT BE SUBSTITUTED FOR MECHANICAL FASTENERS
7. DO NOT USE GRAY DUCT TAPE, FOIL BACKED TAPE, OIL BASED CAULKING AND GLAZING COMPOUNDS TO SEAL METAL DUCTS.

RECT. DUCT CONSTR. NOTES

1. ALL TRANSVERSE JOINTS SHALL BE FABRICATED & INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 2-1, "RECTANGULAR DUCT/TRANSVERSE JOINTS,","
2. ALL LONGITUDINAL SEAMS SHALL BE FABRICATED AND INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 2-2, "RECTANGULAR DUCT/LONGITUDINAL SEAMS,"
3. ALL ELBOWS, TRANSITIONS, OFFSETS, BRANCH CONNECTIONS, AND OTHER FITTINGS AND COMPONENTS SHALL BE FABRICATED AND INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," CHAPTER 4, "FITTINGS AND OTHER CONSTRUCTION,"
4. CROSS-BREAK ALL DUCT SURFACES 19" THROUGH 60". USE ANGLE REINFORCING FOR DUCTS SURFACES OVER 60".
5. PROVIDE SINGLE VANE TURNING VANES IN ALL ELBOWS AND CHANGES IN DIRECTION.

SEISMIC DESIGN REQUIREMENTS

1. THE SEISMIC REQUIREMENTS FOR THIS PROJECT SHALL BE IN ACCORDANCE WITH CHAPTER 17 OF THE 2012 INTERNATIONAL BUILDING CODE (IBC) AND CHAPTER 13 OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE) 7-10 "MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES".
2. 2012 INTERNATIONAL BUILDING CODE RISK CATEGORY = II
3. BUILDING SEISMIC IMPORTANCE FACTOR (I) = 1.0.
4. BUILDING SEISMIC DESIGN CATEGORY = D
5. 5% DAMPED DESIGN SPECTRAL RESPONSE ACCELERATION
   SDS = 0.95 g
   SD1 = 0.48 G
6. VRF SYSTEM COMPONENT IMPORTANCE FACTOR (I) = 1.0
7. ALL OTHER HVAC SYSTEM COMPONENT IMPORTANCE FACTOR = 1.0

SEISMIC PIPING NOTES

1. THE TOP OF ALL PIPING SHALL BE INSTALLED WITHIN 12-INCHES (OR LESS) FROM STRUCTURAL SUPPORT MEMBER. THE 12-INCHES SHALL BE MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE SUPPORT WHERE THE HANGER IS ATTACHED.
2. IF PIPING IS SUPPORT GREATER THAN 12-INCHES FROM THE SUPPORT MEMBER, ADDITIONAL SEISMIC SUPPORT IS REQUIRED. CONTRACTOR WILL BE REQUIRED TO ENGAGE A STRUCTURAL ENGINEER TO PROVIDE SEISMIC CALCULATIONS.
3. ALL PIPING LESS THAN 1-1/4 INCHES NOMINAL DIAMETER AND LOCATED IN BOILER, MECHANICAL EQUIPMENT AND REFRIGERATION MECHANICAL ROOMS DO NOT REQUIRE SEISMIC SUPPORTS.
4. ALL PIPING LESS THAN 2" INCHES NOMINAL DIAMETER DO NOT REQUIRE SEISMIC SUPPORTS.
5. THE LATERAL MOTION OF PIPING WILL NOT CAUSE DAMAGING IMPACT WITH SURROUNDING SYSTEMS (E.G. OTHER PIPE, DUCT, EQUIPMENT, SPRINKLER HEADS ETC.) OR CAUSE LOSS OF SYSTEM VERTICAL SUPPORT.

FLEXIBLE DUCT NOTES

1. FLEXIBLE DUCT SHALL NOT BE USED ON EXPOSED DUCTWORK.
2. FLEXIBLE DUCTWORK SHALL BE LIMITED TO A MAXIMUM OF 3'-0" FOR CONNECTION OF RIGID DUCTWORK TO AIR INLETS AND AIR OUTLETS.
3. FLEXIBLE AIR DUCTS SHALL BE LISTED AND LABELED AS UL 181 CLASS 0 OR CLASS 1 FLEXIBLE AIR DUCTS.
4. FLEXIBLE CONNECTORS SHALL NOT BE USED.
5. FLEXIBLE AIR DUCTS SHALL BE INSTALLED FULLY EXTENDED.
6. DO NOT BEND FLEXIBLE AIR DUCTS ACROSS SHARP CORNERS OR INCIDENTAL CONTACT WITH METAL FIXTURES, PIPES, OR CONDUITS.
7. RADIUS AT CENTERLINE OF FLEXIBLE DUCT SHALL BE NOT LESS THAN ONE DUCT DIAMETER.
8. DO NOT INSTALL FLEXIBLE AIR DUCTS NEAR HOT EQUIPMENT (I.E. FURNACES, BOILERS, STEAM PIPES, ETC) THAT IS ABOVE THE RECOMMENDED FLEXIBLE DUCT USE TEMPERATURE.
9. DO NOT INSTALL FLEXIBLE AIR DUCT IN CONCRETE, BURIED BELOW GRADE OR IN CONTACT WITH THE GROUND.
10. ALL TAPES, MASTICS AND NON-METALLIC FASTENERS (PLASTIC CLAMPS) SHALL BE LISTED AND LABELED TO UL 181B.

ROUND DUCT CONSTR. NOTES

1. ALL TRANSVERSE JOINTS SHALL BE FABRICATED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-1, "ROUND DUCT TRANSVERSE JOINTS,"
2. ALL LONGITUDINAL SEAMS SHALL BE FABRICATED AND INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-2, "ROUND DUCT LONGITUDINAL SEAMS,"
3. ALL ROUND TEES AND LATERALS SHALL BE FABRICATED AND INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-5, "90 DEGREE TEES AND LATERALS,"
4. ALL CONICAL TEES SHALL BE FABRICATED AND INSTALLED ACCORDING TO SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE," FIGURE 3-6, "CONICAL TEES,"
5. FOR STATIC-PRESSURE CLASS, APPLICABLE SEALING REQUIREMENTS, MATERIALS INVOLVED, DUCT-SUPPORT INTERVALS, AND OTHER PROVISIONS IN SMACNA'S "HVAC DUCT CONSTRUCTION STANDARDS - METAL AND FLEXIBLE."

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Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions :

title:
HVAC NOTES

sheet:
ME003

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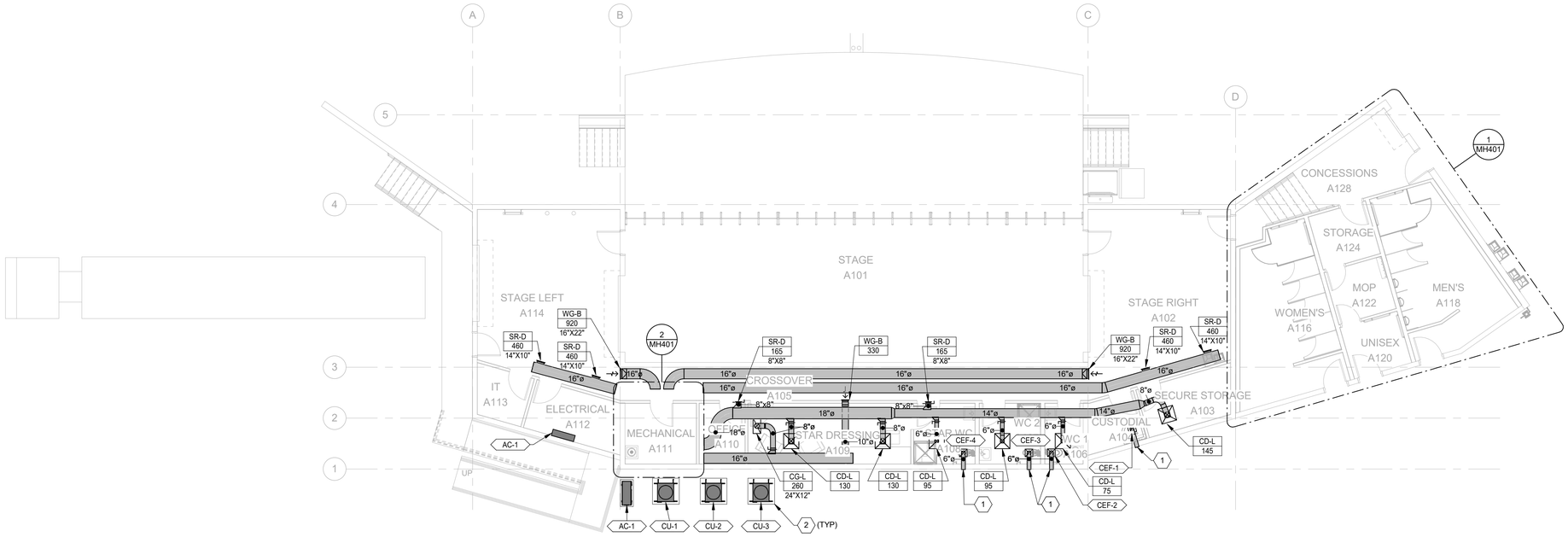
KEYED REFERENCE NOTES

1 WALL CAP.

2 4" HOUSEKEEPING PAD.



1 STAGE LEVEL HVAC PLAN
1/8" = 1'-0"

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STAGE LEVEL HVAC PLAN

sheet:
MH101

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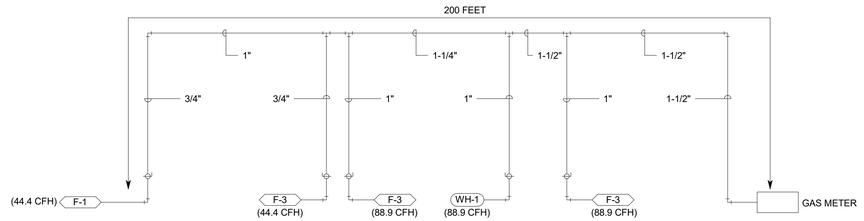
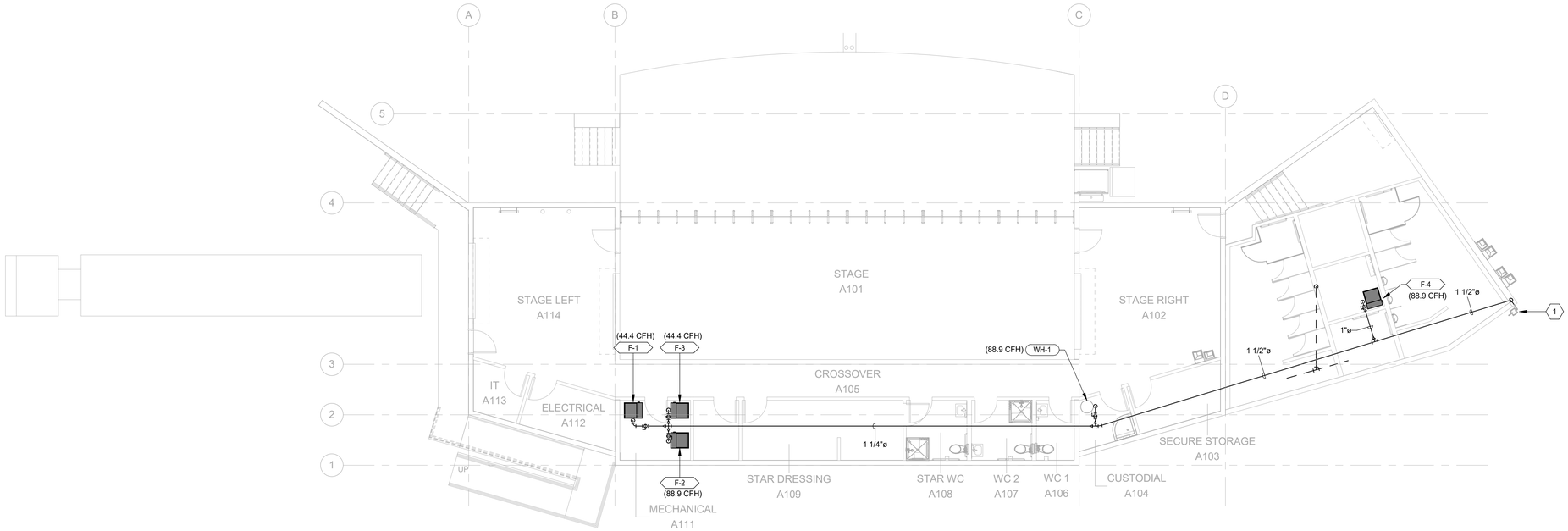


2 GAS PIPING SCHEMATIC

SCALE: NTS



1 STAGE LEVEL NATURAL GAS PIPING PLAN

1/8" = 1'-0"

KEYED REFERENCE NOTES

1 GAS METER

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STAGE LEVEL NATURAL GAS PIPING PLAN

sheet:
MH102

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RADON SYSTEM NOTES

1. RADON SYSTEM SHALL MEET ALL THE REQUIREMENTS OF COLORADO DEPARTMENT OF PUBLIC HEATH – URANIUM MILL TAILINGS MANAGEMENT PLAN (MAY 2015).
2. PROVIDE A 4" LAYER OF 1/2" TO 3/4" CLEAN WASHED GRAVEL UNDER THE FLOOR SLAB.
3. PROVIDE 10 MIL HDPE SHEETING ON TOP OF GRAVEL AND BELOW CONCRETE FLOR SLAB. SHEETING SHALL EXTEND UP THE FOUNDATION WALLS AND SEAL TO WALL.
4. ALL PENETRATIONS THROUGH PLASTIC SHEETING SHALL BE SEALED WITH APPROVE TAPE.
5. UNDERFLOOR PIPING SHALL BE 4" CORRUGATED PERFORATED ADS PIPE. PERFORATED PIPE SHALL HAVE A MINIMUM OF TEN (10) 3/4" DIAMETER PERFORATIONS PER FOOT.
6. VENT PIPE SHALL BE SCHEDULE 40 DWV PVC PIPE.
7. ALL PENETRATIONS THROUGH FLOOR SHALL BE SEALED WITH POLYURETHANE CAULKING.
8. ALL COLD JOINTS IN CONCRETE FLOOR SHALL BE SEALED WITH POLYURETHANE CAULKING.
9. ALL SAWED CUT CONTROL JOINTS SHALL BE SEALED WITH POLYURETHANE CAULKING.
10. EXTEND VENT PIPE A MINIMUM OF 12" ABOVE ROOF. PROVIDE 1/2" BIRD SCREEN OVER OPENING OF PIPE.
11. RADON VENTILATION FAN SHALL BE LOCATE NEAR ROOF.
12. ALL EXPOSED PIPING SHALL BE PROPERLY APPROVED LABELED AS A RADON SYSTEM.
13. INSTALL A RADON U-TUBE MANOMETER ON VERTICAL EXPOSED VENT PIPE.
14. BUILDING SHALL BE RADON TESTED PRIOR TO OCCUPANCY.

KEYED REFERENCE NOTES

1 CORROGATED PERFORATED PVC PIPE BELOW FLOOR.

2 LOCATE EXHAUST FAN BELOW ROOF.

3 DISCHARGE THROUGH ROOF.

4 MOUNT RADON U-TUBE MONITOR ON VENT PIPE.

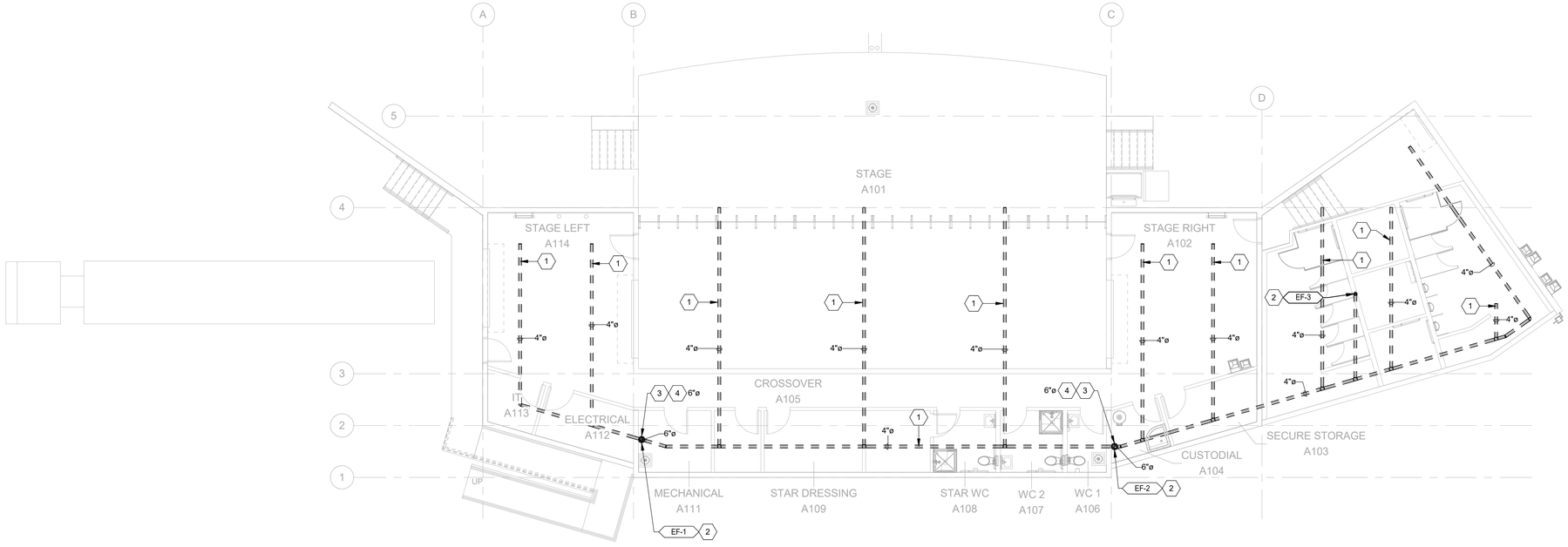
RADON SUBMITTAL

1 CORROGATED PERFORATED PIPE.

2 VENT PIPE.

3 VENTILATION FAN.

4 RADON U-TUBE MONITOR.



1 STAGE LEVEL MECHANICAL RADON SYSTEM
1/8" = 1'-0"

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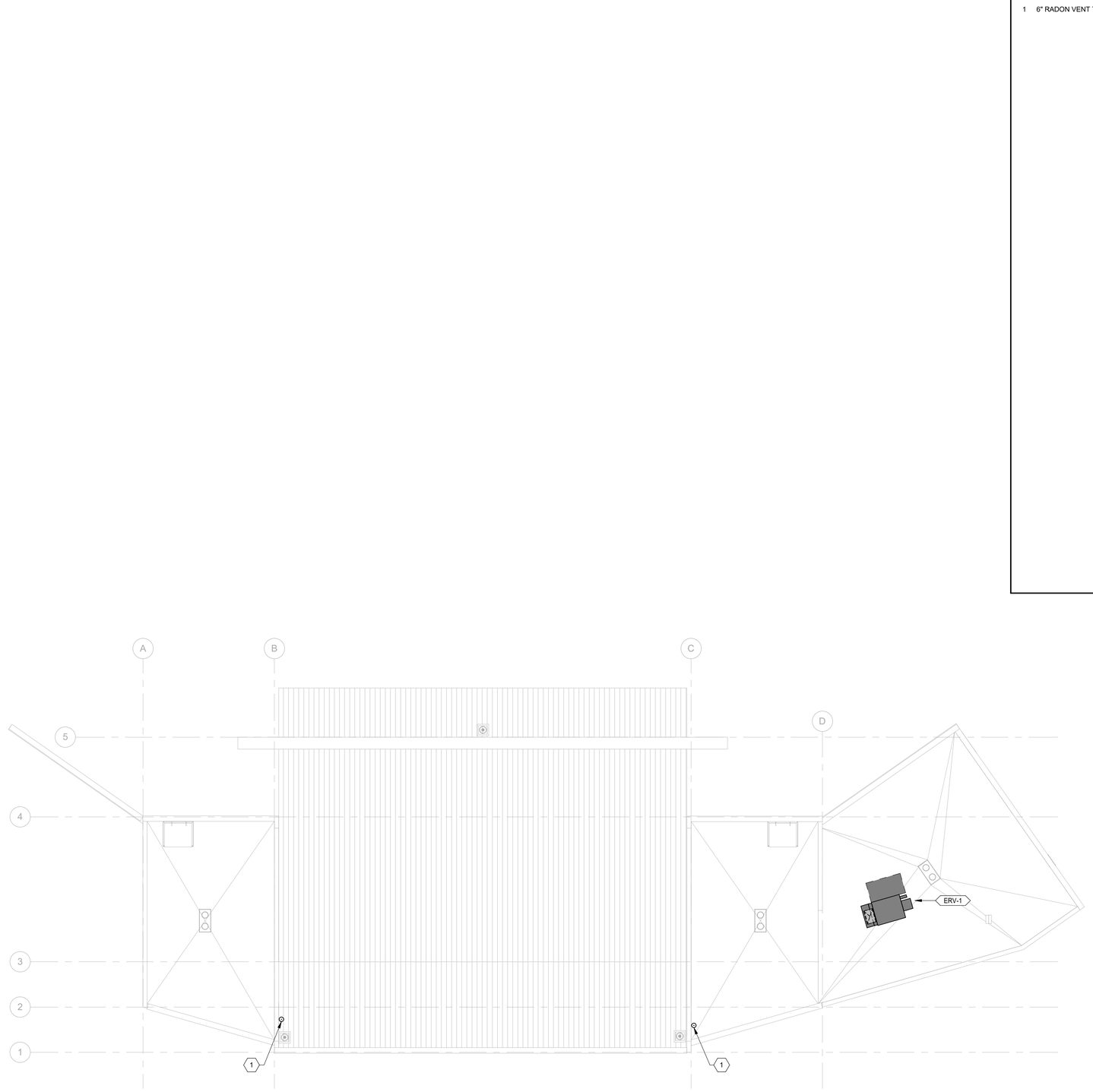
KEYED REFERENCE NOTES

1 6" RADON VENT THROUGH ROOF WITH NON-BACKDRAFT FLUE CAP.



1 ROOF HVAC PLAN
1/8" = 1'-0"

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HVAC ROOF PLAN

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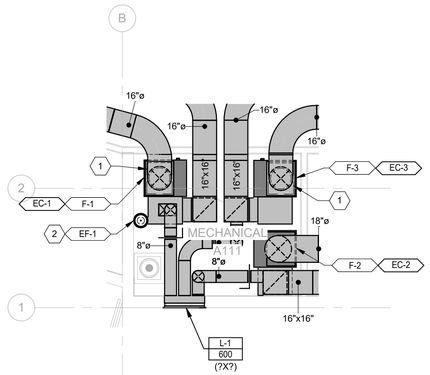
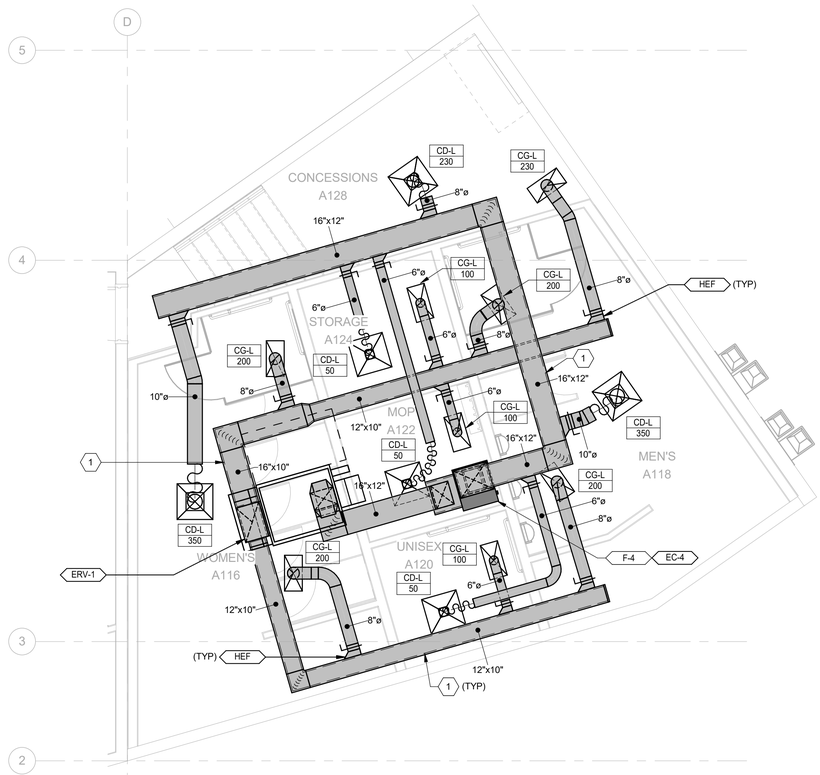


2 ENLARGED HVAC PLAN - MECH. ROOM A111
1/4" = 1'-0"



1 ENLARGED HVAC PLAN - TOILET ROOMS
1/4" = 1'-0"

KEYED REFERENCE NOTES

1 1" THICK, 1.5 PCF ACOUSTICAL DUCT LINER.

2 LOCATE EXHAUST FAN AT 8'-0" ABOVE FINISHED FLOOR.

0' 4' 8' 16' 32'

north

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ENLARGED HVAC PLANS

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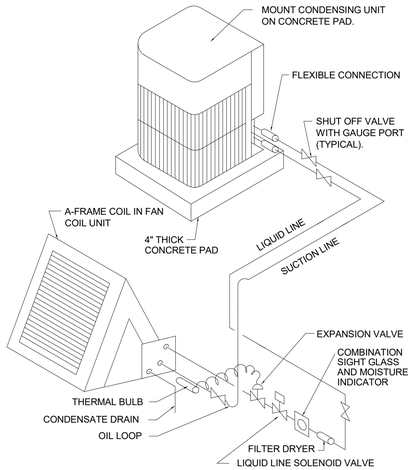
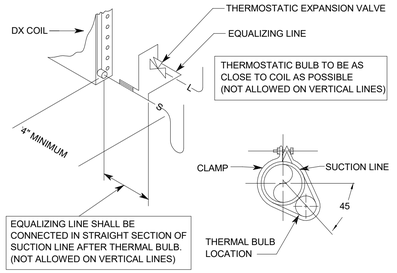
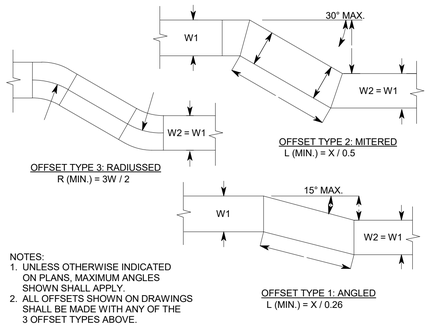


19 REFRIGERANT PIPING
SCALE: NTS



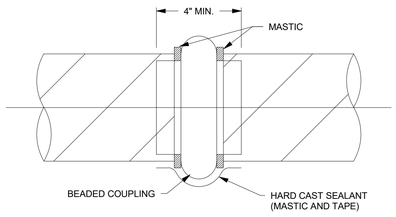
16 THERMOSTATIC BULB
SCALE: NTS



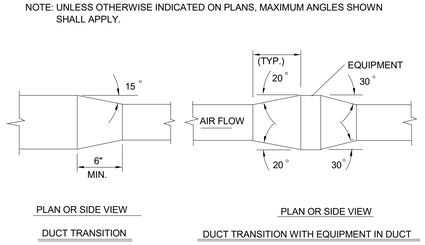
NOTES:
1. UNLESS OTHERWISE INDICATED ON PLANS, MAXIMUM ANGLES SHOWN SHALL APPLY.
2. ALL OFFSETS SHOWN ON DRAWINGS SHALL BE MADE WITH ANY OF THE 3 OFFSET TYPES ABOVE.

15 DUCT OFFSETS
SCALE: NTS

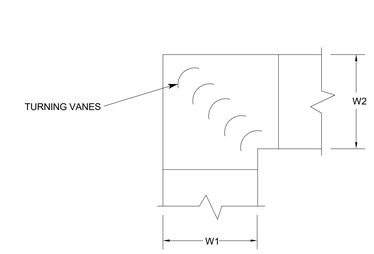
18 GAS PRESS. REG. (INDOOR)
SCALE: NTS



14 ROUND DUCT COUPLER
SCALE: NTS

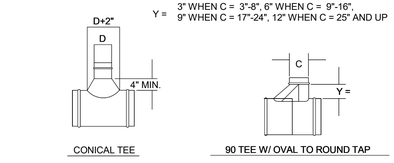


12 DUCT TRANSITIONS
SCALE: NTS

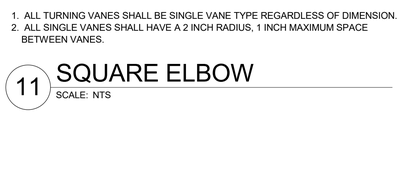


NOTES:
1. ALL TURNING VANES SHALL BE SINGLE VANE TYPE REGARDLESS OF DIMENSION.
2. ALL SINGLE VANES SHALL HAVE A 2 INCH RADIUS, 1 INCH MAXIMUM SPACE BETWEEN VANES.

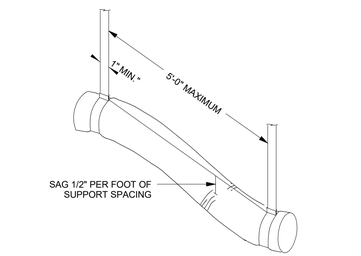
11 SQUARE ELBOW
SCALE: NTS



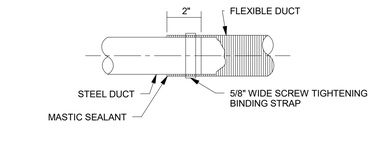
10 ROUND BRANCH FITTINGS
SCALE: NTS



9 DUCT HANGER - ROUND
SCALE: NTS



8 FLEX DUCT SUPPORT
SCALE: NTS



7 FLEX DUCT CONNECTION
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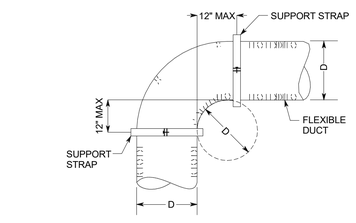

6 FLEX DUCT RADIUS
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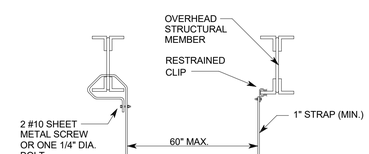
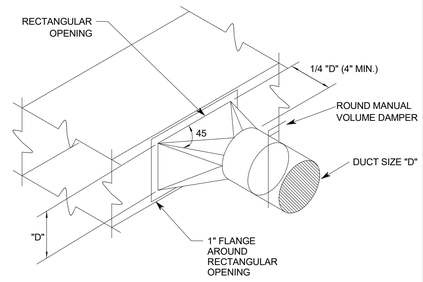


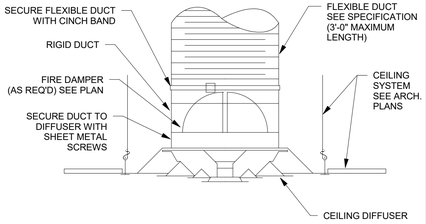
5 DUCT HANGER - RECT.
SCALE: NTS

NOTE:
HIGH EFFICIENCY TAKE-OFF SHALL COMPLY WITH FIGURE 2-6 OF SMACNA DUCT CONSTRUCTION STANDARDS



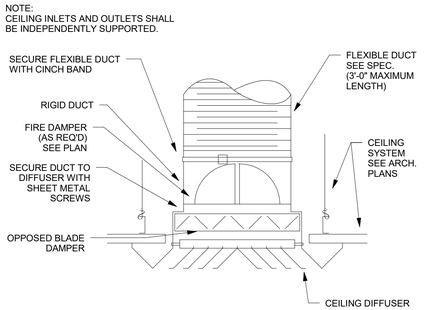
4 HIGH EFFICIENCY TAKE-OFF
SCALE: NTS

NOTE:
CEILING INLETS AND OUTLETS SHALL BE INDEPENDENTLY SUPPORTED.



3 CEILING DIFFUSER(LAY-IN)
SCALE: NTS

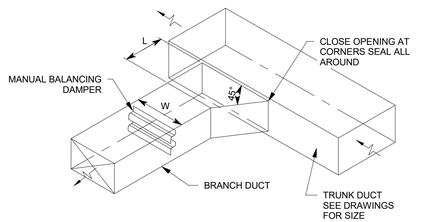
NOTE:
CEILING INLETS AND OUTLETS SHALL BE INDEPENDENTLY SUPPORTED.



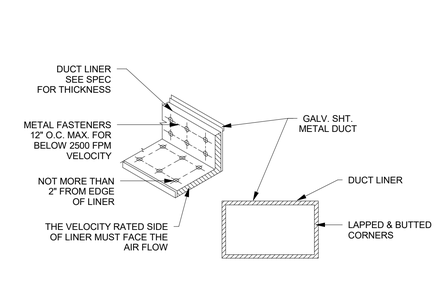
2 CEILING DIFFUSER(SURFACE)
SCALE: NTS

NOTE:
L=1/4 W (6" MIN.)

NOTE: PROVIDE REMOTE OPERATOR FOR INACCESSIBLE DAMPERS.



1 BRANCH DUCT TAKE-OFF
SCALE: NTS



17 FLUE THROUGH ROOF
SCALE: NTS

13 DUCT LINER
SCALE: NTS

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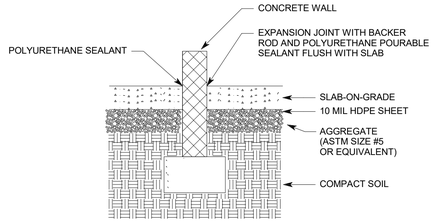
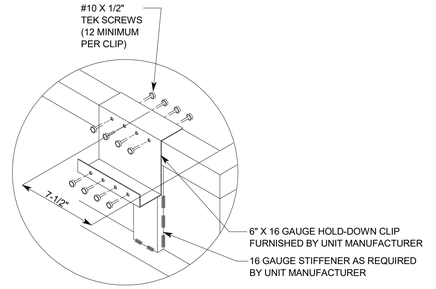


4 RADON HDPE DETAIL

SCALE: NTS

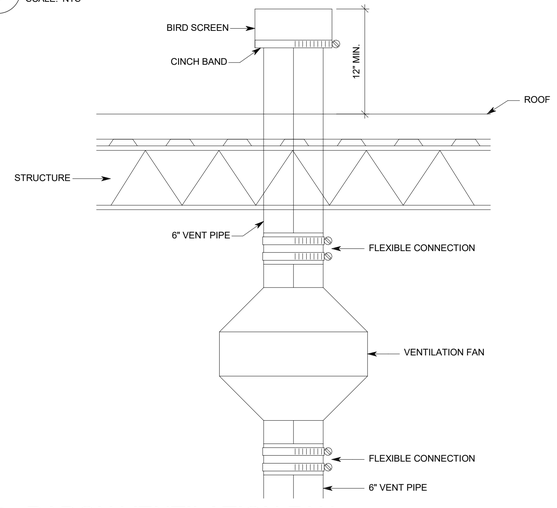


3 HOLD DOWN CLIPS

SCALE: NTS

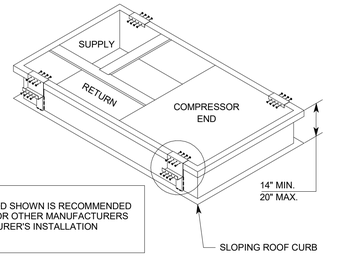
6 RADON PIPING

SCALE: NTS



5 RADON VENTILATION FAN

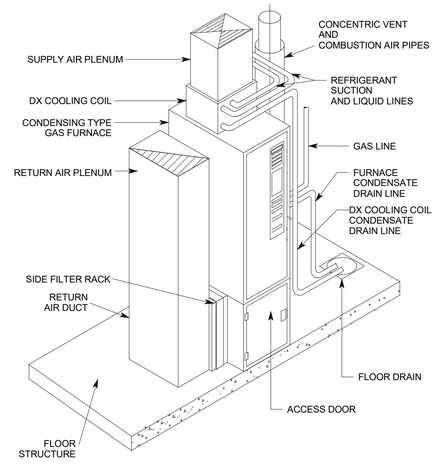
SCALE: NTS



NOTE:
INSTALLATION METHOD SHOWN IS RECOMMENDED BY CARRIER CORP. FOR OTHER MANUFACTURERS CONSULT MANUFACTURER'S INSTALLATION INSTRUCTION.

2 ROOF CURB

SCALE: NTS



1 FURNACE

SCALE: NTS

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GAS FIRED FURNACE SCHEDULE

SYMBOL	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NO.	ARRANGEMENT	HEATING CAPACITY			SUPPLY FAN			MOTOR				WEIGHT (LBS)	OPTIONS AND ACCESSORIES	NOTES
				INPUT (BTUH)	OUTPUT (BTUH)	EFFICIENCY AFUE (%)	AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (INCHES W.C.)	FAN SPEED	H.P.	VOLTS	HERTZ	PHASE			
F-1	CARRIER	58MVC-040-F-100-12	DOWN FLOW	40,000	38,000	95.5	920	0.60	MED-LOW	1/3	115	60	1	175	(11)(12)(13)(14)(16)(17)(18)	(1)(2)(3)
F-2	CARRIER	58MXB-080-F-100-12	DOWN FLOW	80,000	75,000	93.0	1,080	0.60	MED-HIGH	1/3	115	60	1	175	(11)(12)(13)(14)(16)(17)(18)	(1)(2)(3)
F-3	CARRIER	58MVC-040-F-100-12	DOWN FLOW	40,000	38,000	95.5	920	0.60	MED-LOW	1/3	115	60	1	175	(11)(12)(13)(14)(16)(17)(18)	(1)(2)(3)
F-4	CARRIER	58MXB-080-F-100-12	DOWN FLOW	80,000	75,000	93.0	1,080	0.60	MED-HIGH	1/3	115	60	1	175	(11)(12)(13)(14)(16)(17)(18)	(1)(2)(3)

ACCEPTABLE MANUFACTURERS	NOTES	OPTIONS & ACCESSORIES
CARRIER BRYANT TRANE YORK	(1) R-410 REFRIGERANT (2) SCHEDULE 40 ASTM F-411 CPVC VENT VENT PIPE (3) SCHEDULE 40 ASTM D-2241 PVC AIR INTAKE PIPE	(11) MEDIA FILTER CABINET WITH EFFICIENCY MEDIA FILTER (12) CONCENTRIC TENT TERMINATION KIT (13) CONDENSATE NEUTRALIZER KIT (14) DELUXE 7-DAY PROGRAMMABLE THERMOSTAT (15) PERMANENT SPLIT CAPACITOR MOTOR (16) DOWNFLOW SUBBASE (17) CONDENSATE TRAP (18) CONDENSATE NEUTRALIZER KIT (DAYTON 6mc69)

AIR CONDITIONING SUMMARY

SYSTEM	AREA SERVED	AIR FLOW (CFM)	AIR CONDITIONING CAPACITY (TONS)	HEATING CAPACITY (BTUH)	FURNACE	EVAPORATOR COIL	CONDENSING UNIT
AC-1	STAGE LEFT	920	2.0	40,000	F- 1	EC-1	CU-1
AC-2	STAR DRESSING	1,080	3.0	80,000	F-2	EC-2	CU-2
AC-3	STAGE RIGT	920	2.0	40,000	F-3	EC-3	CU-3
AC-4	TOILET ROOMS	1,080	3.0	80,000	F-4	EC-4	CU-4

NATURAL GAS REQUIREMENT S

EQUIPMENT	QUANTITY	SEA LEVEL FUEL GAS INPUT CAPACITY (BTUH)	JOB SITE FUEL GAS REQUIREMENTS (CFH)	TOTAL FUEL GAS CAPACITY (CFH)
FURNACE [F-1, F-3]]	2	40,000	44.4	88.8
FURNACE [F-2, F-4]	2	80,000	88.9	177.8
WATER HEATER (WH-1)	1	80,000	88.9	88.9
TOTAL		----	----	355.6

BASIS OF DESIGN : 2012 INTERNATIONAL FUEL GAS CODE:		NOTES
HEAT CONTENT OF GAS: (BTUH/CU. FT)	900.0	(1) PROVIDE SHUT-OFF VALVE AT EACH PIECE OF EQUIPMENT.
REQUIRED GAS PRESSSURE AT NATURAL GAS METER (PSIG)	0.5	
DISTANCE FROM GAS METER TO MOST REMOTE APPLIANCE (FEET):	200.0	

REFRIGERATION EVAPORATOR COIL SCHEDULE

SYMBOL	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	CAPACITY (NOTE A)		REFRIGERANT PIPING		OPERATING WEIGHT (LBS)	NOTES / COMMENTS
			NOMINAL CAPACITY (TONS)	TOTAL COOLING CAPACITY (BTUH)	REFRIG. LIQUID (IN. O.D.)	REFRIG. SUCTION (IN. O.D.)		
EC-1	CARRIER	CD5AXA 024	2.0	24,000	3/8"	3/4 "	17	(1)(2)(3)(4)
EC-2	CARRIER	CD5AXA 036	3.0	36,000	3/8"	3/4 "	26	(1)(2)(3)(4)
EC-3	CARRIER	CD5AXA 024	2.0	24,000	3/8"	3/4 "	17	(1)(2)(3)(4)
EC-4	CARRIER	CD5AXA 036	3.0	36,000	3/8"	3/4 "	26	(1)(2)(3)(4)

ACCEPTABLE MANUFACTURER	OPTIONS & ACCESSORIES
CARRIER BRYANT TRANE YORK	(1) REFRIGERANT R-410A (2) PAINTED GALVANIZED STEEL CASE (3) FIBERGLASS REINFORCED THEMOSET POLYESTER (FRTP) CONDENSATE DRAIN PAN (4) THERMOSTATIC EXPANSION VALVE

CONDENSING UNIT SCHEDULE

SYMBOL	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	CAPACITY (NOTE A)				ELECTRICAL					REFRIGERANT PIPING		A-WEIGHTED SOUND LEVEL (dBA)	OPERATING WEIGHT (LBS)	NOTES / COMMENTS
			NOMINAL CAPACITY (TONS)	TOTAL COOLING CAPACITY (BTUH)	SEASONAL ENERGY EFFICIENCY RATIO (SEER)	ENERGY EFFICIENCY RATIO (EER)	UNIT MCA	MAXIMUM FUSE OR CKT. BRK. SIZE (AMPS)	VOLTS	HERTZ	PHASE	REFRIG. LIQUID (IN. O.D.)	REFRIG. SUCTION (IN. O.D.)			
CU-1	CARRIER	24APA5 24 - 30	2.0	23,600	15.5	13.0	17.5	25	208/230	60	1	3/8"	5/8 "	66	310	(1)(2)
CU-2	CARRIER	24APA5 36 - 30	3.0	35,600	15.5	13.0	21.9	35	208/230	60	1	3/8"	3/4 "	70	310	(1)(2)
CU-3	CARRIER	24APA5 24 - 30	2.0	23,600	15.5	13.0	17.5	25	208/230	60	1	3/8"	5/8 "	66	310	(1)(2)
CU-4	CARRIER	24APA5 36 - 30	3.0	35,600	15.5	13.0	21.9	35	208/230	60	1	3/8"	3/4 "	70	310	(1)(2)

ACCEPTABLE MANUFACTURER	NOTES:	OPTIONS AND ACCESSORIES
CARRIER BRYANT TRANE YORK	(A) RATED AT 80 F. DB, ENTERING AIR AND 95 F. AMBIENT AIR TEMPERATURE	(1) CRANKCASE HEATER (2) LOW AMBIENT KIT (2) REFRIGERANT LINE SET (FIELD VERIFY EXACT LENGTH) .

ENERGY RECOVERY VENTILATOR SCHEDULE

SYMBOL	AREA SERVED	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL	SUPPLY (VENTILATION) FAN			EXHAUST FAN			UNIT EFFECTIVENESS (WINTER) (%)	ELECTRICAL						UNIT WEIGHT (LBS)	OPTIONS AND ACCESSORIES	NOTES
				AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (INCHES W.C.)	MOTOR (HP)	AIRFLOW (CFM)	EXTERNAL STATIC PRESSURE (INCHES W.C.)	MOTOR H.P.		EACH MOTOR FLA	MINIMUM CIRCUIT AMPACITY (AMPS)	MAXIMUM OVERCURRENT PROTECTION (AMPS)	VOLTS	HERTZ	PHASE			
ERV-1	TOILET ROOMS	RENEWAIRE	HE1.5XRT	1,080	0.50	1.0	1,230	0.50	1.0	0.60	2.2	5.0	15	208	60	3	400	(1)(2)(3)(4)(5)(6)(7)(8)(9)	(A)(B)(C)

ACCEPTABLE MANUFACTURER	OPTIONS & ACCESSORIES	NOTES
RENEWAIRE	(1) DOUBLE WALL CONSTRUCTION (2) 16" HIGH PRE FABRICATED ROOF MOUNTING CURB, SEISMIC TIE DOWN CLIP KIT. (3) TWO (2) ECM MOTORS. (4) SINGLE POINT POWER CONECTION (5) FUSED DISCONNECT SWITCH (6) 2" THICK PLEATED DISPOSABLE FILTERS, MERV 8 (7) MOTORIZED DAMPER ON BOTH AIR STREAMS (8) INDEPENDENT BLOWER CONTROLS (9) BACK DRAFT DAMPERS. . .	(A) CAPACITY AT JOB SITE CONDITIONS. (B) UL 1812 LISTED (C) UNIT TO BE INTERLOCKED WITH FURNACE.

INLINE EXHAUST FAN (RADON) SCHEDULE

SYMBOL	AREA SERVED	BASIS OF DESIGN MANUFACTURER	BASIS OF DESIGN MODEL NO.	AIR FLOW (CFM)	STATIC PRESSURE (INCHES W.G.)	FAN SPEED (RPM)	MOTOR				MAXIMUM NOISE LEVEL (SONES)	OPTIONS AND ACCESSORIES	CONTROLS	NOTES / COMMENTS
							WATTS	VOLTS	PHASE	HERTZ				
EF-1, 2, & 3	RADON SYSTEM	FANTECH	HP 220	166	1.26	2886	152	120	1	60	10.0	(1)(2)	(12)	(A)

ACCEPTABLE MANUFACTURER	OPTIONS & ACCESSORIES	CONTROLS	NOTES & COMMENTS
FANTECH	(1) BACKDRAFT DAMPER (2) INTEGRAL THERMAL OVERLOAD PROTECTION (3) U-TUBE MANOMETER (4) RADON SYSTEM LABELS	(11) FAN TO RUN CONTINUOUSLY	(A) CAPACITY AT JOB SITE ELEVATION.

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MECHANICAL SCHEDULES

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REFRIGERANT PIPE INSULATION SCHEDULE

SERVICE	INSULATON MATERIAL	INSULATION THICKNESS (INCHES) FOR PIPE SIZES:		
		3/4" & LESS	1" & 1-1/4"	1-1/2" TO 3-1/2"
REFRIGERANT PIPING	PREFORMED FLEXIBLE, CLOSED CELL ELASTOMERIC	1-1/2"	1-1/2"	1-1/2"

NOTES:

(1) INSULATION SHALL HAVE A MINIMUM K VALUE OF 0.27 BTU PER INCH/H FT2 °F.
(2) INDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 25 OR LESS WHEN TESTED TO ASTM E 84.
(3) INDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A SMOKE-DEVELOPED INDEX OF 50 OR LESS WHEN TESTED TO ASTM E 84,
(4) OUTDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 75 OR LESS WHEN TESTED TO ASTM 84.
(5) OUTDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A SMOKE-DEVELOPED INDEX OF 150 OR LESS WHEN TESTED TO ASTM 84.
(6) ALL INSULATION COVERINGS AND LININGS SHALL NOT FLAME, GLOW, SMOLDER OR SMOKE WHEN TESTED IN ACCORDANCE WITH ASTM C 411.

MECHANICAL PIPE MATERIAL SCHEDULE

SERVICE	PIPE MATERIAL	FITTINGS	JOINTS	NOTES
REFRIGERANT SUCTION REFRIGERANT LIQUID	ASTM B 280 ACR ANNEALED-COPPER TUBING	FLARED	BRAZED	(1) NITROGEN CHARGED ACR TUBING (2) COPPER CLAD TYPE 1 CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING
NATURAL GAS	ASTM A53 OR ASTM A 106 BLACK STEEL SCHEDULE 40	ASTM B16.3 CLASS 150 MALLEABLE IRON	THREADED TEFLON TAPE	(1) STEEL TYPE 1 CLEVIS PIPE HANGERS. (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING
	ASTM A53 OR ASTM A 106 BLACK STEEL SCHEDULE 40	ASTM B16.9 BUTT WELDED STEEL	BUT WELDED OR SOCKET WELDED	(1) STEEL TYPE 1 CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING

GAS PRESSURE REGULATOR SCHEDULE (INDOOR)

SYMBOL	MANUFACTURER	REGULATOR MODEL NO.	REGULATOR SIZE (INCHES)	VENT LIMITING DEVICE MODEL NO.		CAPACITY (CFH)	NOTES
				MODEL NUMBER	INLET SIZE		
GPR-21	MAXITROL	325-3	1/2 " x 1/2 "	12A09	1/8 " NPT	180	(1) (2) (3) (4) (5)
GPR-22	MAXITROL	325-5	3/4 " x 3/4 "	12A39	3/8 " NPT	410	(1) (2) (3) (4) (5)

ACCEPTABLE MANUFACTURERS	OPTIONS & ACCESSORIES:
MAXITROL	(1) 1.00 PSIG INLET PRESSURE. (2) 4 0Z (7" W.C.) OUTLET PRESSURE. (3) DIE CAST ALUMINNUM BODY, NITRILE DIAPHRAGM. (4) NPT THREADED INLET & OUTLET. (5) BALL CHECK AUTOMATIC TYPE VENT LIMITING DEVICE.

NATURAL GAS VALVE SCHEDULE

VALVE TYPE	PIPE SIZE	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL
BALL VALVE	2 " & SMALLER	BRASS BODY, TWO PIECE, FULL PORT CHROME PLATED BALL, PTFE SEAT, BRASS STEM, LEVER HANDLE, 150 PSIG SWP, 600 PSIG WOG, MSS SP-110, SOLDERED OR THREADED END.	KITZ 58

PIPE HANGER SPACING

NOMINAL PIPE (INCHES) SIZE	FUEL GAS		REFRIGERANT TUBING	
	SCH. 40 STEEL		ARC	
	HANGER SPACING	HANGER ROD SIZE (INCHES)	HANGER SPACING	HANGER ROD SIZE (INCHES)
1/2"	6'-0"	3/8"	5'-0"	1/4"
3/4"	8'-0"	3/8"	5'-0"	1/4 "
1"	8'-0"	3/8"	6'-0"	1/4 "
1-1/4"	8'-0"	3/8"	8'-0"	3/8 "
1-1/2"	10-0"	3/8"	8'-0"	3/8"
2"	10-0"	3/8"	8'-0"	3/8"

NOTES:

1. ALL PIPING SHALL BE SUPPORTED WITH STEEL CLEVIS HANGERS (MSS TYPE 1). 2. STEEL CLEVIS HANGERS USED FOR SUPPORTING COPPER PIPING SHALL BE COPPER COATED . 3. STEEL CLEVIS HANGERS USED FOR SUPPORTING PLASTIC PIPING SHALL BE PLASTIC COATED. 4. PROVIDE PIPE HANGER WITHIN 18" OF ALL CHANGES IN DIRECTION. 5. PERFORATED METAL STRAPS OR PLASTIC STRAPPING (PLUMBERS TAPE) SHALL NOT
BE USED TO SUPPORT ANY PIPING. 6. PROVIDE LSP "ACOUSTO CLAMP" WITH LSP "ACOUSTO LATOR" INSERT FOR ALL PIPE PASSING
THOUGHT METAL OR WOOD FRAMING MEMBER (UNLESS A MINIMU M OF 3" IS MAINTAINED BETWEEN PIPE AND FRAMING MEMBER.).

LOUVER SCHEDULE

SYMBOL	MANUFACTURERS	MODEL	APPLICATION	NOMINAL SIZE	MINIMUM FREE AREA (SQ.FT.)	AIR FLOW (CFM)	OPTIONS & ACCESSORIES
L-1	RUSKIN	ELF375DX	OUTSIDE AIR INTAKE	18" x 18"	0.97	400	(2)(3)(4)

ACCEPTABLE MANUFACTURERS	DESCRIPTION	OPTIONS & ACCESSORIES
RUSKIN AIROLITE SAFEAIRE LOUVERS & DAMPERS GREENHECK	STATIONARY, DRAINABLE, EXTRUDED ALUMINUM, AMCA CERTIFIED, 37-1/2" DEGREE BLADE ANGLE, 3" BLADE SPACING, 4" FRAME DEPTH, 0.10 INCH W.G. PRESSURE DROP AT 1000 FPM (FREE AREA)	(1) CHANNEL FRAME (2) FLANGED FRAME (3) 1/2" ALUMINUM BIRD SCREEN (4) PRIME COATED

CEILING DIFFUSER SCHEDULE (CD)

SYMBOL	BASIS OF DESIGN MANUFACTURER & MODEL	DESCRIPTION	FRAME TYPE (MOUNTING)	PANEL SIZE	PATTERN	FINISH	NOMINAL SIZE	MAXIMUM AIR FLOW (CFM)	MAXIMUM NOISE LEVEL (NC)	OPTIONS & ACCESSORIES	NOTES
CD-L	TITUS TMS	CEILING DIFFUSER: DROP CONE, STEEL CONSTRUCTION, REMOVABLE CORE, ROUND NECK,	LAY-IN T-BAR	24" x 24"	4-WAY	WHITE	6" DIA. 8" DIA. 10" DIA. 12" DIA. 14" DIA. 15" DIA.	200 350 450 575 700 750	NC-30	(2)(3)	(A)(B)
CD-S	TITUS TDC	CEILING DIFFUSER: FULL LOUVER FACE , STEEL CONSTRUCTION, REMOVABLE CORE, ROUND NECK,	SURFACE	----	4-WAY	WHITE	6" DIA (9"x 9") 8" DIA. (9"x 9") 10" DIA. (12"x 12") 12" DIA. (12"x 12")	120 250 420 700	NC-30	(2)(3)	(A)(B)

ACCEPTABLE MANUFACTURERS	OPTIONS & ACCESSORIES	NOTES
KRUEGER TUTTLE & BAILEY TITUS E.H. PRICE	(1) OPPOSED BLADE DAMPER (2) COLOR TO MATCH ADJACENT SURFACE. FIELD PAINT AS DIRECTED BY ARCHITECT. (3) EXACT COLOR SELECTION BY OWNER AND ARCHITECT .	(A) CEILING DIFFUSERS SHALL BE TESTED IN ACCORDANCE WITH ANSI/ASHRAE STANDARD 70. (B) NC VALUES ARE BASED ON OCTAVE BAND SOUND POWER LEVELS MINIMUM ROOM ABSORPTION OF 10dB, RE 10(-12) WATTS .

REGISTER & GRILLE SCHEDULE

SYMBOL	BASIS OF DESIGN MANUFACTURER & MODEL	DESCRIPTION	FRAME TYPE (MOUNTING)	PANEL SIZE	FINISH	NOMINAL SIZE (NECK SIZE)	MAXIMUM AIR FLOW (CFM)	MAXIMUM NOISE LEVEL (NC)	OPTIONS & ACCESSORIES	NOTES
CG-L	TITUS 50F	CEILING GRILLE: SQUARE PATTERN, ALUMINUM CONSTRUCTION, 1/2" X 1/2" X 1/2" SQUARES.	LAY-IN T-BAR	24" x 24"	WHITE (2)	10" x 22" 22" x 22"	1400 2800	NC-30	(2)(3)	(A)(B)
CG-S	TITUS 50F	CEILING GRILLE: SQUARE PATTERN, ALUMINUM CONSTRUCTION, 1/2" X 1/2" X 1/2" SQUARES.	SURFACE	----	WHITE (2)	10"x 10" 12" x 12" 14" x 14" 16" x 16" 18" x 18" 20" x 20" 22" x 22" 24" x 24"	450 700 900 1200 1550 1900 2350 2800	NC-30	(2)(3)	(A)(B)
SR-D	TITUS 300	SUPPLY REGISTER: DOUBLE DEFLECTION, STEEL BLADES, 3/4" BLADE SPACING. STEEL BORDER, HORIZONTAL FRONT BLADES, VERTICAL REAR DEFLECTION BLADES	SURFACE	----	WHITE (2)	SEE DRAWING	SEE DRAWING	NC-30	(1)(2)(3)	(A)(B)
WG-B	TITUS 1700	WALL GRILLE: FIXED, BLADE, REVERSIBLE CORE, EXTRUDED ALUMINUM CONSTRUCTION 1/4" BLADE SPACING, 5-DEG OR 15-DEG DEFLECTION, 1" FLAT FRAME,	SURFACE	----	WHITE (2)	SEE DRAWING	SEE DRAWING	NC-30	(1)(2)(3)	(A)(B)

ACCEPTABLE MANUFACTURERS	OPTIONS & ACCESSORIES	NOTES
KRUEGER TUTTLE & BAILEY TITUS PRICE	(1) OPPOSED BLADE DAMPER (2) COLOR TO MATCH ADJACENT SURFACE. FIELD PAINT AS DIRECTED BY ARCHITECT. (3) EXACT COLOR SELECTION BY OWNER AND ARCHITECT .	(A) REGISTERS AND GRILLES SHALL BE TESTED IN ACCORDANCE WITH ANSI/ASHRAE STD 70. (B) NC VALUES ARE BASED ON OCTAVE BAND SOUND POWER LEVELS MINUS A ROOM ABSORPTION OF 10 dB, RE 10(-12) WATTS.

DUCT INSULATION REQUIREMENTS

(ASHRAE 90.1 - 2010)

DUCT SYSTEM	DUCT LOCATION	INSULATION MATERIAL	MINIMUM THERMAL RESISTANCE ("R")	FIELD APPLIED JACKET	VAPOR RETARDER REQ'D	SPECIFIC NOTES
SUPPLY AIR	BUILDING INTERIOR, CONCEALED	MINERAL-FIBER BLANKET	3.5	NONE	NO	
	BUILDING INTERIOR, CONCEALED , WITH DUCT LINER	----	----	----	----	(11)(12)
	BUILDING INTERIOR, EXPOSED, OUTSIDE CONDITIONED SPACE	MINERAL-FIBER BLANKET	3.5	NONE	NO	
	BUILDING INTERIOR, INSIDE CONDITIONED SPACE	NONE	----	----	----	
	BUILDING EXTERIOR (OUTSIDE BUILDING INSULATION)	MINERAL-FIBER BLANKET	8.0	ALUMINUM	NO	
RETURN AIR	BUILDING INTERIOR, CONCEALED	MINERAL-FIBER BLANKET	3.5	NONE	NO	
	BUILDING INTERIOR, EXPOSED, OUTSIDE CONDITIONED SPACE	MINERAL-FIBER BLANKET	3.5	NONE	NO	
	BUILDING INTERIOR, CONCEALED , WITH DUCT LINER	----	----	----	----	(11)(12)
	BUILDING INTERIOR, EXPOSED, INSIDE CONDITIONED SPACE	NONE	----	----	----	
	BUILDING EXTERIOR (OUTSIDE BUILDING INSULATION)	MINERAL-FIBER BLANKET	8.0	ALUMINUM	NO	
EXHAUST AIR	ALL	NONE	----	----	----	
	BUILDING INTERIOR, CONCEALED OR EXPOSED, WITH DUCT LINER	----	----	----	----	(11)(12)
OUTSIDE AIR	BUILDING INTERIOR, CONCEALED OR EXPOSED	MINERAL-FIBER BLANKET	3.5	NONE	NO	
	BUILDING INTERIOR, CONCEALED , WITH DUCT LINER	----	----	----	----	(11)(12)
FLEXIBLE DUCT	BUILDING INTERIOR, CONCEALED	MINERAL-FIBER BLANKET WITH POLYETHYLENE INNER & OUTER JACKET	3.5	NONE	NO	(13)(14)(15)

GENERAL NOTES (APPLIES TO ALL DUCT INSULATION):

(1) ALL DUCT INSULATION SHALL HAVE ALL SERVICE JACKET MANUFACTURED FROM KRAFT PAPER, REINFORCED SCRIM, ALUMI NUM FOIL OR VINYL FILM.
(2) DUCT INSULATION SHALL BE MECHANICAL FASTENED TO DUCTS WIDER THAN 24" AND SHALL BE AFFIXED TO BOTTOM OF DUCT WITH WELDED METAL PINS AND 2" WAS HERS AT 18" MAXIMUM SPACING.
(3) ALL CHANGES IN DIRECTION OF DUCTWORK SHALL BE MADE WITH RIGID ELBOWS OR OTHER RIGID METAL FITTINGS.
(4) INDOOR DUCT INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 25 OR LESS, AND SMOKE-DEVELOPED INDEX OF 50 OR LESS WHEN TESTED TO ASTM E 84.
(5) OUTDOOR DUCT INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 75 OR LESS, AND SMOKE-DEVELOPED INDEX OF 150 OR LESS WHEN TESTED TO ASTM 84.
(6) ALL DUCT COVERINGS AND LININGS SHALL NOT FLAME, GLOW, SMOLDER OR SMOKE WHEN TESTED IN ACCORDANCE WITH ASTM C 411.
(7) ALL MATERIALS USED AS INTERNAL INSULATION AND EXPOSED TO THE AIR STREAM IN DUCTS SHALL BE SHOWN TO BE DURABLE WHEN TESTED IN ACCORDANCE WITH UL 181.

SPECIFIC NOTES:

(11) DUCT LINER, WHERE SHOWN ON DRAWINGS, SHALL BE A MINIMUM OF 1 -1/2" THICK AND 1.5 PCF DENSITY. DUCT LINER SHALL HAVE A MINIMUM "R" VALUE OF 6.0.
(12) DUCT DIMENSIONS SHOWN ON THE DRAWINGS ARE NET FREE AREA. WHERE DUCT LINER IS SHOWN, INCREASE METAL DUCT SIZE TO ALLOW FOR THICKNESS OF DUCT LINER.
(13) TOTAL LENGTH OF FLEXIBLE DUCT RUN SHALL NOT EXCEE D 3'-0". EXTEND SHEET METAL DUCT TO WITHIN 3'-0" OF THE AIR INLET OR AIR OUTLET DEVICE.
(14) OFFSET OF FLEXIBLE DUCT SHALL NOT EXCEED ONE-HALF (1/2) OF THE DUCT DIAMETER.
(15) FLEXIBLE DUCT SHALL NOT BE USED IN EXPOSED AREAS.
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COLORADO REGISTERED P. E. NO. 20545 07/15/2016

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project#: 14.0650
date: July 15, 2016

revisions :

title:
MECHANICAL SCHEDULES

sheet:
MH602

100% CONSTRUCTION DOCUMENTS

SYMBOL LEGEND

	SYMBOL	DESCRIPTION
01	# / SHEET	DETAIL INDICATOR: # INDICATES DETAIL NUMBER, SHEET INDICATES DRAWING SHEET WHERE DETAIL IS SHOWN.
02	# / SHEET	ELEVATION OR SECTION INDICATOR, EXTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
03	# / SHEET	ELEVATION OR SECTION INDICATOR, INTERIOR: # INDICATES ELEVATION OR SECTION NUMBER, SHEET INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
04	100	SPACE NUMBER
05	1	KEYNOTE INDICATOR
06		REVISION INDICATOR
07		EQUIPMENT INDICATOR
08		PLUMBING FIXTURE INDICATOR
09	TYPE / CFM / SIZE	DIFFUSER/GRILLE INDICATOR
10	TYPE / SIZE	DIFFUSER/GRILLE INDICATOR
11		BREAK, STRAIGHT
12		BREAK, ROUND
13	MATCH LINE SEE XX/X-XXX	MATCHLINE INDICATOR
14		HIDDEN FEATURES LINE: HIDDEN, THIN LINE
15		CONTRACT LIMIT LINE: DASHDOT, WIDE LINE
16		NEW CONNECTION TO EXISTING
17		POINT OF DEMOLITION

PLUMBING PIPING LEGEND

SYMBOL	DESCRIPTION
CWV	COMBINATION WASTE AND VENT
	SOIL, WASTE - ABOVE GRADE (SW)
	SOIL, WASTE - BELOW GRADE (SW)
GW	GREASE WASTE - ABOVE GRADE
GW	GREASE WASTE - BELOW GRADE
	VENT (V)
AV	ACID VENT
AW	ACID WASTE - ABOVE GRADE
AW	ACID WASTE - BELOW GRADE
	DOMESTIC COLD WATER (DCW)
	DOMESTIC HOT WATER (DHW)
	DOMESTIC HOT WATER RECIRC (DHWR)
180	180°F HOT WATER
180R	180° HOT WATER RETURN
160	160° HOT WATER
160R	160° HOT WATER RETURN
RW	RAINWATER - ABOVE GRADE
RW	RAINWATER - BELOW GRADE
SRW	SECONDARY RAINWATER ABOVE GRADE
SRW	SECONDARY RAINWATER BELOW GRADE
SD	STORM DRAIN
VTR	VENT THRU ROOF
#	NON POTABLE WATER
(E)	EXISTING PIPE
(E)	EXISTING PIPE TO BE REMOVED
IW	IRRIGATION WATER
SS	SANITARY SEWER
W	WATER
FP	FIRE PROTECTION

ABBREVIATIONS

NOTE: ALL ABBREVIATIONS MAY NOT BE USED.

(E)	EXISTING
(F)	FUTURE
AD	ACCESS DOOR
AIR COND	AIR CONDITION(-ING,-ED)
APD	AIR PRESSURE DROP
BD	BALANCING DAMPER
BHP	BRAKE HORSE POWER
BTU	BRITISH THERMAL UNIT
BTUH	BTU/HOUR
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CLG	COOLING
COMP	COMPONENT
COND	CONDENS(-ER, -ING, -ATION)
CV	CONTROL VALVE
DB	DRY BULB TEMPERATURE
DCW	DOMESTIC COLD WATER
DHW	DOMESTIC HOT WATER
DHWR	DOMESTIC HOT WATER RECIRC
DIA	DIAMETER
DISCH	DISCHARGE
DP	DEPTH OR DEEP
EA	EXHAUST AIR
EER	ENERGY EFFICIENCY RATIO
EFF	EFFICIENCY
EG	ETHYLENE GLYCOL
ELEC	ELECTRIC
ELEV	ELEVATION
ENT	ENTERING
EVAP	EVAPORAT(-E, -ING, -ED, -OR)
EWT	ENTERING WATER TEMPERATURE
EXT	EXTERNAL
FC	FLEXIBLE CONNECT(-OR, -ION)
FD	FIRE DAMPER
FLA	FULL LOAD AMPS
FPI	FINS PER INCH
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FSD	FIRE SMOKE DAMPER
GAL	GALLON(S)
GE	GREASE EXHAUST
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HD	HEAD
HG	MERCURY
HP	HORSEPOWER
HR	HOUR
HT	HEIGHT
HTG	HEATING
HZ	HERTZ (FREQUENCY)
ID	INSIDE DIAMETER
IN	INCH
KW	KILOWATT
LAT	LEAVING AIR TEMPERATURE
LG	LENGTH
LH	LATENT HEAT
LRA	LOCKED ROTOR AMPS
LVG	LEAVING
LWT	LEAVING WATER TEMPERATURE
MBH	THOUSAND BTU PER HOUR
MCA	MINIMUM CIRCUIT AMPS
MFR	MANUFACTUR(-ER, -ED)
MIN	MINIMUM
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NC	NOISE CRITERIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NPSH	NET POSITIVE SUCTION HEAD
NTS	NOT TO SCALE
OA	OUTSIDE AIR
OD	OUTSIDE DIAMETER
OZ	OUNCE
PD	PRESSURE DROP OR DIFFERENCE
PG	PROPOLENE GLYCOL
PH	PHASE
PPM	PARTS PER MILLION
PRESS	PRESSURE
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	PSI ABSOLUTE
PSIG	PSI GAUGE
R	THERMAL RESISTANCE
RA	RETURN AIR
RECIRC	RECIRCULATE
REFR	REFRIGERATION
REQD	REQUIRED
RLA	RATED LOAD AMPS
RPM	REVOLUTIONS PER MINUTE
SA	SUPPLY AIR
SC	SHADING COEFFICIENT
SCFM	STANDARD CUBIC FEET PER MINUTE
SCW	SOFT COLD WATER
SF	SAFETY FACTOR
SH	SENSIBLE HEAT
SL	SEA LEVEL
SP	STATIC PRESSURE
SPEC(S)	SPECIFICATION(S)
SQ	SQUARE
SW	SOIL, WASTE
TA(R)	TRANSFER AIR (RETURN)
TA(S)	TRANSFER AIR (SUPPLY)
TD	TEMP. DROP OR DIFF.
TEMP	TEMPERATURE
THERM	THERMAL
TSTAT	THERMOSTAT
V	VENT
VAC	VACUUM
VAV	VARIABLE AIR VOLUME
VEL	VELOCITY TEMPERATURE
VEL	VELOCITY
VENT	VENT, VENTILATION
VERT	VERTICAL
VFD	VARIABLE FREQUENCY DRIVE
VOL	VOLUME
WB	WET BULB TEMP
WC	WATER COLUMN
WG	WATER GAUGE
WPD	WATER PRESSURE DROP
WT	WEIGHT
WTR	WATER

SYMBOL LEGEND

	SYMBOL	DESCRIPTION
01		SHUT OFF VALVE
02		GATE VALVE
03		CHECK VALVE
04		AUTO 2-WAY VALVE
05		AUTO 3-WAY VALVE
06		GLOBE VALVE
07		BALL VALVE
08		RELIEF VALVE
09		CHAIN OPERATED GATE VALVE
10		PRESSURE REDUCING VALVE
11		BUTTERFLY VALVE
12		SOLENOID VALVE
13		ANGLE VALVE
14		VENTURI
15		BALANCING OR PLUG COCK
16		FLOW SETTER
17		EXPANSION VALVE (REFRIG.)
18		GAS COCK
19	MAV	MANUAL AIR VENT
20		STRAINER
21		GAUGE COCK
22		FLEXIBLE CONNECTION
23		PRESSURE GAUGE
24		THERMOMETER
25		VICTUALIC COUPLING
26		REDUCER CONCENTRIC
27		REDUCER ECCENTRIC
28		REFRIGERANT SITE GLASS
29		REFRIGERANT STRAINER
30		REFRIGERANT FILTER DRIER
31		90 DEG ELBOW UP
32		90 DEG ELBOW DOWN
33		90 DEG TEE UP
34		90 DEG TEE DOWN
35		UNION
36		CAPPED PIPE
37		ANCHOR
38		FLOAT AND THERMOSTATIC TRAP

PLUMBING SHEET INDEX

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project#: 14.0650
date: July 15, 2016

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title:
PLUMBING COVER SHEET

sheet:
PE001

100% CONSTRUCTION DOCUMENTS

TEST ADJUST & BALANCE NOTES

1. CONTRACTOR SHALL BE RESPONSIBLE TO PROVIDE COMPLETE TESTING ADJUSTING AND BALANCING FOR THIS PROJECT.
2. THE MECHANICAL SYSTEMS SHALL BE TESTED, ADJUSTED AND BALANCED, INCLUDING SUPPLY AIR SYSTEM, RETURN AIR SYSTEM, EXHAUST AIR SYSTEM, OUTSIDE AIR SYSTEM AND ALL ASSOCIATED EQUIPMENT.
3. CONTRACTOR PERFORMING TESTING ADJUSTING AND BALANCING WORK SHALL BE EITHER AABC OR NEBB CERTIFIED.
4. TESTING ADJUSTING AND BALANCING SHALL BE PERFORMED IN ACCORDANCE WITH THE NEBB OR AABC TEST PROCEDURES.
5. TESTING ADJUSTING AND BALANCING REPORT FORMS SHALL BE STANDARD FORMS FROM EITHER AABC OR NEBB.
6. CONTRACTOR SHALL VERIFY QUANTITIES AND LOCATIONS OF ALL BALANCING DEVICES. CONTRACTOR SHALL VERIFY THAT THESE BALANCING DEVICES ARE ACCESSIBLE AN APPROPRIATE FOR BALANCING AND FOR EFFICIENT SYSTEM AND EQUIPMENT OPERATION PRIOR TO COMMENCING WORK.
7. MECHANICAL (HVAC) EQUIPMENT SHALL BE ADJUSTED TO WITHIN ZERO TO PLUS 10 PERCENT OF SPECIFIED VALUES.
8. MECHANICAL AIR INLETS AND OUTLETS SHALL BE ADJUSTED TO WITHIN 10 PERCENT OF SPECIFIED VALUES.
9. WATER SYSTEMS SHALL BE ADJUSTED TO WITHIN 10 PERCENT OF SPECIFIED VALUES.
10. FINAL BALANCE REPORT SHALL INCLUDE THE FOLLOWING: TEST CONDITIONS FOR FANS, SYSTEM DIAGRAMS, AIR CONDITIONING UNIT TEST REPORTS, FAN TEST REPORTS, AIR TERMINAL DEVICE REPORTS.
11. AFTER THE FINAL BALANCING REPORT IS SUBMITTED TO THE DESIGN ENGINEER AND OWNER, CONTRACTOR SHALL REQUEST THAT A FINAL INSPECTION BE MADE BY THE DESIGN ENGINEER. DURING THE FINAL INSPECTION, DESIGN ENGINEER MAY RANDOMLY SELECT MEASUREMENTS DOCUMENTS IN THE FINAL REPORT TO BE RECHECK BY THE CONTRACTOR.
12. APPROXIMATELY 90 DAYS AFTER SUBMISSION OF THE FINAL BALANCING REPORT, CONTRACTOR SHALL PERFORM ADDITIONAL TESTING ADJUSTING AND BALANCING TO VERIFY THAT BALANCED CONDITIONS ARE BEING MAINTAINED THROUGHOUT EACH SYSTEM AND TO CORRECT UNUSUAL CONDITIONS.
13. ADDITIONAL TESTING ADJUSTING AND BALANCING SHALL BE MADE AS DIRECTED BY THE DESIGN ENGINEER TO CORRECT UNUSUAL CONDITIONS. ADDITIONAL TESTING WILL NOT EXCEED THREE (3) DAYS DURING THE FIRST SIX MONTHS OF OPERATION.
14. IF INITIAL TESTING ADJUSTING AND BALANCING PROCEDURES WERE NOT PERFORMED DURING NEAR-PEAK SUMMER AND WINTER CONDITIONS, PERFORM ADDITIONAL TESTING ADJUSTING AND BALANCING DURING NEAR PEAK SUMMER AND WINTER CONDITIONS.
15. ALL AIR SIDE MECHANICAL (HVAC) SYSTEMS SHALL BE TESTED AND ADJUSTED, AND BALANCED.
16. ALL WATER SIDE MECHANICAL (HVAC) AND PLUMBING PIPING SYSTEMS SHALL BE TESTED, ADJUSTED, AND BALANCED INCLUDING DOMESTIC HOT WATER CIRCULATING PUMPS.

OPER. & MAINT. MANUAL NOTES

1. SUBMIT OPERATIONS AND MAINTENANCE MANUALS IN A PDF ELECTRONIC FILE. ASSEMBLE EACH MANUAL INTO A COMPOSITE ELECTRONICALLY INDEXED FILE. SUBMIT ON DIGITAL MEDIA ACCEPTABLE TO ARCHITECT. NAME EACH INDEXED DOCUMENT FILE IN COMPOSITE ELECTRONIC INDEX WITH APPLICABLE ITEM NAME. INCLUDE A COMPLETE ELECTRONICALLY LINKED OPERATION AND MAINTENANCE DIRECTORY. ENABLE INSERTED REVIEWER COMMENTS ON DRAFT SUBMITTALS.
2. ADDITIONALLY, PROVIDE THREE PAPER COPIES. INCLUDE A COMPLETE OPERATION AND MAINTENANCE DIRECTORY. ENCLOSE TITLE PAGES AND DIRECTORIES IN CLEAR PLASTIC SLEEVES. ARCHITECT WILL RETURN TWO COPIES.
3. SUBMIT EACH MANUAL IN FINAL FORM PRIOR TO REQUESTING INSPECTION FOR SUBSTANTIAL COMPLETION AND AT LEAST 15 DAYS BEFORE COMMENCING DEMONSTRATION AND TRAINING. ARCHITECT WILL RETURN COPY WITH COMMENTS. CORRECT OR REVISE EACH MANUAL TO COMPLY WITH ARCHITECT'S COMMENTS. SUBMIT COPIES OF EACH CORRECTED MANUAL WITHIN 15 DAYS OF RECEIPT OF ARCHITECT'S COMMENTS AND PRIOR TO COMMENCING DEMONSTRATION AND TRAINING.
4. OPERATION MANUALS CONTENT: INCLUDE OPERATION DATA REQUIRED IN INDIVIDUAL SPECIFICATION SECTIONS AND THE FOLLOWING INFORMATION:
   a. SYSTEM, SUBSYSTEM, AND EQUIPMENT DESCRIPTIONS. (USE DESIGNATIONS FOR SYSTEMS AND EQUIPMENT INDICATED ON CONTRACT DOCUMENTS);
   b. PERFORMANCE AND DESIGN CRITERIA IF CONTRACTOR IS DELEGATED DESIGN RESPONSIBILITY; OPERATING STANDARDS;
   c. OPERATING PROCEDURES;
   d. OPERATING LOGS;
   e. WIRING DIAGRAMS;
   f. CONTROL DIAGRAMS;
   g. PIPED SYSTEM DIAGRAMS;
   h. PRECAUTIONS AGAINST IMPROPER USE;
   i. LICENSE REQUIREMENTS INCLUDING INSPECTION AND RENEWAL DATES.
5. OPERATION MANUALS DESCRIPTIONS. INCLUDE THE FOLLOWING:
   a. PRODUCT NAME AND MODEL NUMBER. (USE DESIGNATIONS FOR PRODUCTS INDICATED ON CONTRACT DOCUMENTS);
   b. MANUFACTURER'S NAME;
   c. EQUIPMENT IDENTIFICATION WITH SERIAL NUMBER OF EACH COMPONENT;
   d. EQUIPMENT FUNCTION;
   e. OPERATING CHARACTERISTICS;
   f. LIMITING CONDITIONS;
   g. PERFORMANCE CURVES;
   h. ENGINEERING DATA AND TESTS;
   i. COMPLETE NOMENCLATURE AND NUMBER OF REPLACEMENT PARTS.
   j. WARRANTY
6. OPERATING PROCEDURES: INCLUDE THE FOLLOWING, AS APPLICABLE:
   a. STARTUP PROCEDURES;
   b. EQUIPMENT OR SYSTEM BREAK-IN PROCEDURES;
   c. ROUTINE AND NORMAL OPERATING INSTRUCTIONS;
   d. REGULATION AND CONTROL PROCEDURES;
   e. INSTRUCTIONS ON STOPPING;
   f. NORMAL SHUTDOWN INSTRUCTIONS;
   g. SEASONAL AND WEEKEND OPERATING INSTRUCTIONS;
   h. REQUIRED SEQUENCES FOR ELECTRIC OR ELECTRONIC SYSTEMS;
   i. SPECIAL OPERATING INSTRUCTIONS AND PROCEDURES;
   j. SYSTEMS AND EQUIPMENT CONTROLS:
   i. DESCRIBE THE SEQUENCE OF OPERATION, AND DIAGRAM CONTROLS AS INSTALLED;
      ii. PIPED SYSTEMS;
      iii. DIAGRAM PIPING AS INSTALLED, AND IDENTIFY COLOR-CODING WHERE REQUIRED FOR IDENTIFICATION.
7. PRODUCT MAINTENANCE MANUALS CONTENT:
   a. ORGANIZE MANUAL INTO A SEPARATE SECTION FOR EACH PRODUCT, MATERIAL, AND FINISH.
   b. INCLUDE SOURCE INFORMATION, PRODUCT INFORMATION, MAINTENANCE PROCEDURES, REPAIR MATERIALS AND SOURCES, AND WARRANTIES AND BONDS,

DOMESTIC WATER NOTES

1. ALL EXPOSED DOMESTIC WATER PIPING IN OCCUPIED SPACES SHALL BE POLISHED CHROME PLATED.
2. PROVIDE ISOLATION VALVES IN DOMESTIC WATER PIPING TO EACH SET OF RESIDENT ROOMS.
3. INSTALL PIPING SO THAT VALVES, STRAINERS, UNIONS, TRAPS, FLANGES, AND ALL OTHER APPURTENANCES REQUIRING ACCESS ARE ACCESSIBLE.
4. VALVES (EXCEPT CONTROL VALVES) AND STRAINERS SHALL BE FULL SIZE OF PIPE BEFORE REDUCING PIPE SIZE TO MAKE CONNECTIONS TO EQUIPMENT.
5. VALVES SHALL BE INSTALLED SO THAT VALVES REMAINS IN SERVICE WHEN EQUIPMENT OR PIPING ON EQUIPMENT SIDE OF VALVE IS REMOVED.
6. PROVIDE DOMESTIC WATER BOOSTER PUMP IF WATER PRESSURE FROM LOCAL UTILITY IN INADEQUATE TO SERVE BUILDING. BOOSTER PUMP SHALL BE INCLUDED IF REQUIRED.
7. PROVIDE MANIFOLD PIPING AT WATER HEATERS PER MANUFACTURER'S WRITTEN RECOMMENDATIONS. BALANCE WATER FLOW THROUGH WATER HEATERS AFTER INSTALLATION.
8. INSTALL DOMESTIC WATER PIPING ABOVE OR BEHIND WATER HEATERS TO ALLOW FOR WATER HEATER REMOVAL.

PLUMBING PIPING NOTES

1. PROVIDE PROPER PROVISIONS FOR EXPANSION, CONTRACTION, OR MOVEMENT OF ALL PIPING.
2. INSTALL PIPING WITHOUT FORCING OR SPRINGING.
3. INSTALL PIPING TO CLEAR DOORS AND WINDOWS.
4. PROVIDE LARGE ENOUGH PIPE SLEEVES THROUGH WALL OR FLOOR TO ALLOW FOR ANTICIPATED DIFFERENTIAL MOVEMENT.
5. ALL EXPOSED PIPING SHALL BE INSTALLED IN A NEAT ARRANGED PARALLEL TO THE BUILDING TO BUILDING STRUCTURE.
6. COPPER PIPING SHALL NOT COME IN CONTACT WITH FIRE TREATED LUMBER. PROVIDE ½" THICK SLIP-ON CLOSED CELL INSULATION WHERE COPPER PIPING IS ADJACENT TO FIRE TREATED LUMBER. CLOSED CELL INSULATION SHALL EXTEND A MINIMUM OF 1-1/2" PAST LUMBER.
7. INSTALL EXTERIOR WATER PIPING, SEWER AND WASTE PIPING AND ROOF DRAINAGE BELOW FROST LEVEL (4'-0" MINIMUM). VERIFY EXACT LOCAL REQUIREMENTS WITH AND CIVIL ENGINEER AND SITE UTILITY DRAWINGS PRIOR TO INSTALLATION.

PLUMBING GENERAL NOTES

1. THE PLUMBING DRAWINGS SHOW THE GENERAL DESIGN, ARRANGEMENT AND EXTENT OF THE PLUMBING SYSTEM. BECAUSE OF THE SMALL SCALE OF THE DRAWINGS, THESE DRAWINGS DO NOT SHOW ALL OFFSETS, BENDS OR ELBOWS NECESSARY FOR THE COMPLETE INSTALLATION IN THE SPACE PROVIDED. CONTRACTOR SHALL MAKE SUCH MINOR ALTERATIONS AS MAY BE NECESSARY TO MAKE THE SYSTEM COMPLETE AND OPERATIONAL IN ACCORDANCE WITH THE DESIGN INTENT.
2. MAJOR DEVIATIONS SUCH AS CHANGES IN COMPONENT SIZES, WEIGHTS, QUANTITIES OR MATERIAL REQUIRE PRIOR APPROVAL BY THE DESIGN ENGINEER.
3. THE DRAWINGS AND SPECIFICATIONS HAVE BEEN PREPARED TO SUPPLEMENT EACH OTHER AND SHALL BE INTERPRETED AS IN INTEGRAL UNIT WITH THE ITEMS SHOWN ON ONE AND NOT THE OTHER BEING FURNISHED AND INSTALLED AS THOUGHT SHOWN AND CALLOUT IN BOTH.
4. THE ENTIRE PLUMBING INSTALLATION SHALL CONFORM TO THE REQUIREMENTS OF THE MOST RECENTLY ADOPTED BUILDING CODES, MECHANICAL CODE, PLUMBING CODE, ELECTRICAL CODE, AND ALL OTHER APPLICABLE CITY, COUNTY, STATE, AN FEDERAL CODES AN REGULATIONS IN EFFECT.
5. PRIOR TO FABRICATION AND INSTALLATION OF ANY PLUMBING COMPONENT THE CONTRACTOR SHALL COORDINATE THE INSTALLATION OF ALL PLUMBING WORK WALL ALL OTHER BUILDING TRADES, INCLUDING BUILDING TRADES HIRED DIRECTLY BY THE OWNER. WHERE CONFLICTS MAY OCCUR, THEY SHALL BE RESOLVED PRIOR TO INSTALLATION.
6. ALL PLUMBING INFORMATION IS NOT SHOWN ON THE PLUMBING DRAWINGS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL INFORMATION ON ALL OTHER CONSTRUCTION DOCUMENT.
7. THE CONTRACTOR SHALL BE RESPONSIBLE TO REVIEW AND USE, WHERE APPROPRIATE, ALL THE PLUMBING DETAILS SHOWN ON THE DRAWINGS. DETAILS MAY OR MAY NOT BE CALLED OUT ON THE DRAWINGS WITH SYMBOLS OR KEYED NOTES. ANY CHANGES RESULTING FROM FAILURE TO INSTALL THE PLUMBING SYSTEM WITHOUT USING THE INCLUDED DETAILS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
8. THE CONTRACTOR SHALL BE RESPONSIBLE TO REVIEW AND USE THE PIPING SCHEMATICS INCLUDED WITH THE DRAWINGS FOR PIPING CONNECTIONS TO ALL PLUMBING EQUIPMENT. THE PIPING SCHEMATICS SHOW DETAILED CONNECTIONS INCLUDING ALL NECESSARY VALVES, FITTINGS, GAUGES, ETC. ANY CHANGES RESULTING FROM FAILURE TO INSTALL THE PLUMBING SYSTEM WITHOUT USING THE INCLUDED DETAILS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
9. ANY PART OF THE PLUMBING INSTALLATION THAT FAILS, IS UNFIT, OR BECOMES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED OR REPLACES BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.

POTABLE WATER DISINFECTION

1. DOMESTIC COLD WATER AND DOMESTIC HOT WATER SYSTEMS (I.E. ALL POTABLE WATER) SHALL BE PURGED OF ALL DELETERIOUS MATTER AND DISINFECTED PRIOR TO UTILIZATION OF POTABLE WATER SYSTEM..
2. FOLLOW THE METHOD PRESCRIBED BY THE LOCAL HEALTH AUTHORITY OR WATER PURVEYOR HAVING JURISDICTIONS.
3. IN THE ABSENCE OF A PRESCRIBED METHOD, THE PROCEDURE DESCRIBED IN EITHER AWWA C651 OR AWWA C652 OR AS DESCRIBED BELOW SHALL BE FOLLOWED.
4. THESE PROCEDURES SHALL APPLY TO "ON-SITE" OR "IN-PLANT" FABRICATION OF A SYSTEM OR TO A MODULAR PORTION OF A SYSTEM.
5. FOLLOW EITHER METHOD 1 OR METHOD 2
6. DISINFECTION PROCEDURE (METHOD 1):
   a. THE PIPING SYSTEM, INCLUDING FIXTURES AND EQUIPMENT, SHALL BE FLUSHED WITH CLEAR, POTABLE WATER UNTIL DIRTY WATER DOES NOT APPEAR AT THE POINTS OF OUTLET.
   b. THE SYSTEM OR PARTS THEREOF SHALL BE FILLED WITH A WATER/CHLORINE SOLUTION CONTAINING NOT LESS THAN 50 PARTS PER MILLION OF CHLORINE, AND THE SYSTEM OR PART THEREOF SHALL BE VALVES OFF AND ALLOWED TO STAND FOR 24-HOURS;
7. DISINFECTION PROCEDURE (METHOD 2):
   a. THE SYSTEM OR PART THEREOF SHALL BE FILLED WITH A WATER/CHLORINE SOLUTION CONTAINING NOT LESS THAN 200 PARTS PER MILLION OF CHLORINE AND ALLOWED TO STAND FOR 3-HOURS
   b. FOLLOWING THE REQUIRED STANDING TIME, THE SYSTEM SHALL BE FLUSHED WITH CLEAN POTABLE WATER UNTIL THE CHLORINE IS PURGED FROM THE SYSTEM.
   c. THE PROCEDURE SHALL BE REPEATED WHERE SHOWN BY A BACTERIOLOGICAL EXAMINATION THAT CONTAMINATION REMAINS PRESENT IN THE SYSTEM.
   d. DURING THE DISINFECTION PROCEDURE, WARNING SIGNS SHALL BE PLACED AT BUILDING ENTRANCES, ROOM ENTRANCES AND WATER OUTLETS INDICATING THAT POTABLE WATER HAS A HIGH CONCENTRATION OF CHLORINE AND IS NOT SAFE TO DRINK OR USE.

PLUMBING PIPE TESTING

1. DRAIN WASTE AND VENT SYSTEM:
   a. ALL SECTIONS OF THE DRAIN WASTE AND VENT SYSTEM SHALL BE PRESSURE TESTED WITH WATER AT A MINIMUM PRESSURE OF TEN (10) FEET OF HEAD
   b. ALL SECTIONS OF THE DRAIN WASTE AND VENT SYSTEM SHALL BE PRESSURE TESTED WITH WATER FOR A MINIMUM OF 15 MINUTES.
2. ROOF DRAINAGE SYSTEM:
   a. ALL SECTIONS OF ROOF DRAINAGE SYSTEM SHALL BE PRESSURE TESTED WITH WATER AT A MINIMUM PRESSURE OF TEN(10) FEET OF HEAD
   b. ALL SECTIONS OF THE ROOF DRAINAGE SYSTEM SHALL BE PRESSURE TESTED WITH WATER FOR A MINIMUM OF15 MINUTES.
3. DOMESTIC WATER SYSTEM:
   a. ALL SECTIONS OF THE DOMESTIC WATER SYSTEM SHALL BE PRESSURE TESTED WITH POTABLE WATER AT A MINIMUM PRESSURE AT 125 PSIG.
   b. ALL SECTIONS OF THE DOMESTIC WATER SYSTEM SHALL BE PRESSURE TESTED WITH POTABLE WATER FOR A MINIMUM OF 15 MINUTES.

PIPE HANGER NOTES

1. ALL PIPING SHALL BE SUPPORT WITH STEEL CLEVIS HANGERS (MSS TYPE 1).
2. PERFORATED METAL STRAPS OR PLASTIC STRAPPING (PLUMBER TAPE) SHALL NOT BE USED TO SUPPORT OR BRACE ANY PIPE.
3. PROVIDE PIPE HANGERS WITHIN 18-INCHES OF ALL CHANGES OF DIRECTION.
4. ALL STEEL CLEVIS HANGERS USED TO SUPPORT COPPER PIPING SHALL BE COPPER PLATED OR PLASTIC COATED
5. ALL STEEL CLEVIS HANGERS USED TO SUPPORT PLASTIC PIPING SHALL BE PLASTIC COATED.
6. PROVIDE ELASTOMERIC CUSHION (COOPER B-LINE B1999 "VIBRA CUSHION") BETWEEN COPPER PIPING AND GALVANIZED CHANNEL SUPPORT CLAMPS. PLASTIC PIPE WRAP TAPE IS NOT ACCEPTABLE.
7. PROVIDE ELASTOMERIC INSERT (COOPER B-LINE BVP "VIBRACLAMPS") BETWEEN PLASTIC PIPE AND GALVANIZED CHANNEL SUPPORT CLAMPS. PLASTIC PIPE WRAP TAPE IS NOT ACCEPTABLE.
8. PROVIDE SWAY BRACING FOR ALL PIPING 4" AND LARGER AT ALL CHANGES IN DIRECTION GREATER THAN 45-DEGREES.

EQUIPMENT LABELING

1. ALL MECHANICAL EQUIPMENT SHALL BE LABELED.
2. PROVIDE 1/16" THICK MULTIPLE LAYERED, MULTIPLE COLORED PLASTIC LABEL WITH MECHANICAL ENGRAVING.
3. LABEL SHALL HAVE BLACK BACKGROUND, 1/2" HIGH WHITE LETTERING.
4. MINIMUM SIZE OF LABEL SHALL BE 2-1/2" X 1"
5. LABEL SHALL BE SECURED TO EQUIPMENT WITH STAINLESS STEEL SELF-TAPPING SCREWS.
6. MINIMUM CONTENT OF LABEL SHALL INCLUDE DRAWING DESIGNATION (UNIQUE NUMBER), AND AREA SERVED,

PLUMBING FIXTURE NOTES

1. SIMILAR EQUIPMENT SHALL BE OF THE SAME MANUFACTURER.
2. ALL EQUIPMENT SHALL PROVIDE THE SCHEDULED PERFORMANCE AT THE JOB SITE ELEVATION.
3. FIXTURE AND EQUIPMENT MODEL NUMBERS SHOWN IN PLUMBING FIXTURE SCHEDULE AND PLUMBING EQUIPMENT SCHEDULE ARE SHOWN TO ESTABLISH THE TYPE OF PRODUCT THAT SHALL BE USED. THE SELECTED PRODUCT SHALL MEET THE SCHEDULED PERFORMANCE DATA SHOWN ON THE SCHEDULE EVEN IF A DIFFERENT MODEL IS SUPPLIED THAT IS DIFFERENT THAN THAT SCHEDULED.
4. ALL EQUIPMENT SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE EQUIPMENT MANUFACTURERS INSTALLATION INSTRUCTIONS. PROVIDE ALL NECESSARY FITTINGS, TRANSITIONS, VALVES AND OTHER DEVICES AND ACCESSORIES REQUIRED FOR A COMPLETE, WORKABLE INSTALLATION.
5. ALL MOTOR STARTING EQUIPMENT, NOT PROVIDES AS A PART OF THE PLUMBING EQUIPMENT, SHALL BE PROVIDE BY DIVISIONS 16.
6. SEE "PLUMBING FIXTURE SCHEDULE" FOR INDIVIDUAL TRAPS, WASTE, VENT, AND DOMESTIC WATER PIPING FOR INDIVIDUAL FIXTURES.
7. ALL PLUMBING EQUIPMENT SHALL BE LISTED AND LABELED BY AN APPROVED THIRD PARTY TESTING AGENCY.
8. FIXTURES, EQUIPMENT AND PIPING INSTALLATION SHALL MEET NSF STANDARDS.
9. PROVIDE WATER HAMMER ARRESTERS (WHA-A) AT ALL PIPING CONNECTIONS TO PLUMBING FIXTURES AND PLUMBING EQUIPMENT PROVIDED WITH QUICK CLOSING VALVE AND INSTALLATIONS WHICH RESULT IN EXCESS PIPE VIBRATION OR MOVEMENT.
10. ALL OWNER FURNISHED EQUIPMENT WITH DIRECT CONNECTION TO THE DOMESTIC WATER SYSTEM SHALL BE PROVIDED WITH AN APPROVED BACKFLOW DEVICE.
11. INSTALLATION AND FINAL CONNECTION OF ALL OWNER FURNISHED EQUIPMENT SHALL BE BY DIVISION 15.

DEFINITIONS

NOTE: ALL DEFINITIONS MAY NOT BE USED

INDICATED: REFERS TO GRAPHIC REPRESENTATIONS, NOTES, OR SCHEDULES ON THE DRAWINGS, OR OTHER PARAGRAPHS OR SCHEDULES IN THE SPECIFICATIONS, AND SIMILAR REQUIREMENTS IN THE CONTRACT DOCUMENTS.
WHERE TERMS SUCH AS "INDICATED", "SHOWN", "NOTED", "SCHEDULED", AND "SPECIFIED" ARE USED, IT IS TO HELP THE READER LOCATE THE REFERENCE.
NO LIMITATION ON LOCATION IS INTENDED.

DIRECTED: TERMS SUCH A "DIRECTED", "REQUESTED", "AUTHORIZED", "SELECTED", "APPROVED", "REQUIRED", "PERMITTED" MEANS "DIRECTED BY THE ENGINEER", "REQUESTED BY THE ENGINEER", AND SIMILAR PHRASES.

APPROVED: WHERE USED IN CONJUNCTION WITH THE ENGINEER'S ACTION ON THE CONTRACTOR'S SUBMITTALS, APPLICATIONS AND REQUESTS, THE TERM "APPROVED" IS LIMITED TO THE ENGINEER'S DUTIES AND RESPONSIBILITIES AS STATED IN THE GENERAL AND SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION DOCUMENTS.

FURNISHED" REFERS TO SUPPLY AND DELIVERY TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, AND INSTALLATION AND SIMILAR OPERATIONS.

INSTALL: REFERS TO OPERATIONS AT THE PROJECT SITE INCLUDING THE ACTUAL, UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING WORKING TO DIMENSION, FINISHING, CURING, PROTECTION, CLEANING AND SIMILAR OPERATIONS.

PROVIDE: MEANS TO "FURNISH AND INSTALL COMPLETE AND READY FOR THE INTENDED USE".
INSTALLER: IS THE CONTRACTOR OR AN ENTITY ENGAGED BY THE CONTRACTOR, EITHER AS AN EMPLOYEE, SUBCONTRACTOR, SUB-SUBCONTRACTOR FOR PERFORMANCE OF A PARTICULAR CONSTRUCTION ACTIVITY, INCLUDING INSTALLATION, ERECTION, APPLICATIONS, AND SIMILAR OPERATIONS. INSTALLERS ARE REQUIRED TO BE EXPERIENCED IN THE OPERATIONS THEY ARE ENGAGED TO PERFORM.

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07/15/2016

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Grand Junction, CO
CITY OF Grand Junction COLORADO

project#: 14.0650
date: July 15, 2016

revisions:

title:
PLUMBING NOTES

sheet:
PE002

100% CONSTRUCTION DOCUMENTS

PLUMBING SUBMITAL NOTES

1. PLUMBING SUBMITTALS SHALL BE SUBMITTED AS A COMPLETE ELECTRONIC PACKAGE ASSEMBLED BY SPECIFICATION DIVISIONS.

2. ASSEMBLE COMPLETE ELECTRONIC SUBMITTAL PACKAGE INTO A SINGLE INDEXED FILE INCORPORATING SUBMITTAL REQUIREMENTS OF A SINGLE SPECIFICATION SECTION AND TRANSMITTAL FORM WITH LINKS ENABLING NAVIGATION TO EACH ITEM: LITERATURE SHALL INCLUDE REFERENCE TO EQUIPMENT CALLOUT AND SPECIFICATION SECTION; FILE NAME SHALL USE PROJECT IDENTIFIER AND SPECIFICATION SECTION NUMBER FOLLOWED BY A DECIMAL POINT AND THEN A SEQUENTIAL NUMBER (E.G., LNHS-061000.01). RE-SUBMITTALS SHALL INCLUDE AN ALPHABETIC SUFFIX AFTER ANOTHER DECIMAL POINT (E.G., LNHS-061000.01.A); PROVIDE MANUFACTURER'S CATALOG DATA SHEETS FOR EACH MANUFACTURED ITEM LISTED ON THE DRAWINGS AND SPECIFICATIONS;

3. INCLUDE MANUFACTURER'S CATALOG DATA OF EACH MANUFACTURED ITEM AND ENOUGH INFORMATION TO SHOW COMPLIANCE WITH CONTRACT DOCUMENT REQUIREMENTS; LITERATURE SHALL SHOW CAPACITIES AND SIZE OF EQUIPMENT USED AND BE MARKED INDICATING EACH SPECIFIC ITEM WITH APPLICABLE DATA UNDERLINED; INCLUDE NAME, ADDRESS, AND PHONE NUMBER OF EACH SUPPLIER; DEVIATIONS AND ADDITIONAL INFORMATION: ON AN ATTACHED SEPARATE SHEET, PREPARED ON CONTRACTOR'S LETTERHEAD, RECORD RELEVANT INFORMATION, REQUESTS FOR DATA, REVISIONS OTHER THAN THOSE REQUESTED BY ENGINEER CONTRACT DOCUMENTS, INCLUDING MINOR VARIATIONS AND LIMITATIONS. INCLUDE SAME IDENTIFICATION INFORMATION AS RELATED SUBMITTAL.

3. COLLECT PRODUCT DATA INFORMATION INTO A SINGLE SUBMITTAL FOR EACH ELEMENT OF CONSTRUCTION AND TYPE OF PRODUCT OR EQUIPMENT. IF INFORMATION MUST BE SPECIALLY PREPARED FOR SUBMITTAL BECAUSE STANDARD PUBLISHED DATA ARE NOT SUITABLE FOR USE, SUBMIT AS SHOP DRAWINGS, NOT AS PRODUCT DATA. MARK EACH COPY OF EACH SUBMITTAL TO SHOW WHICH PRODUCTS AND OPTIONS ARE APPLICABLE.

4. INCLUDE THE FOLLOWING PRODUCT INFORMATION, AS APPLICABLE: MANUFACTURER'S CATALOG CUTS; MANUFACTURER'S PRODUCT SPECIFICATIONS; STANDARD COLOR CHARTS; STATEMENT OF COMPLIANCE WITH SPECIFIED REFERENCED STANDARDS; TESTING BY RECOGNIZED TESTING AGENCY; APPLICATION OF TESTING AGENCY LABELS AND SEALS; NOTATION OF COORDINATION REQUIREMENTS; AVAILABILITY AND DELIVERY TIME INFORMATION;

5. INCLUDE THE FOLLOWING EQUIPMENT INFORMATION: WIRING DIAGRAMS SHOWING FACTORY-INSTALLED WIRING; PRINTED PERFORMANCE CURVES; OPERATIONAL RANGE DIAGRAMS; CLEARANCES REQUIRED TO OTHER CONSTRUCTION, IF NOT INDICATED ON ACCOMPANYING SHOP DRAWINGS.

4. PREPARE PROJECT-SPECIFIC SHOP DRAWINGS, DRAWN ACCURATELY TO SCALE. DO NOT BASE SHOP DRAWINGS ON REPRODUCTIONS OF THE CONTRACT DOCUMENTS OR STANDARD PRINTED DATA. FULLY ILLUSTRATE REQUIREMENTS IN THE CONTRACT DOCUMENTS. INCLUDE THE FOLLOWING INFORMATION, AS APPLICABLE: IDENTIFICATION OF PRODUCTS; SCHEDULES; COMPLIANCE WITH SPECIFIED STANDARDS; NOTATION OF COORDINATION REQUIREMENTS; NOTATION OF DIMENSIONS ESTABLISHED BY FIELD MEASUREMENT; RELATIONSHIP AND ATTACHMENT TO ADJOINING CONSTRUCTION CLEARLY INDICATED; SEAL AND SIGNATURE OF PROFESSIONAL ENGINEER IF SPECIFIED.

5. ALLOW TIME FOR SUBMITTAL REVIEW, INCLUDING TIME FOR RE-SUBMITTALS. TIME FOR REVIEW SHALL COMMENCE ON ENGINEERS RECEIPT OF SUBMITTAL. NO EXTENSION OF THE CONTRACT TIME WILL BE AUTHORIZED BECAUSE OF FAILURE TO TRANSMIT SUBMITTALS ENOUGH IN ADVANCE OF THE WORK TO PERMIT PROCESSING, INCLUDING RE-SUBMITTALS.
   a. ALLOW 15 DAYS FOR INITIAL REVIEW OF MECHANICAL SUBMITTAL.
   a. ALLOW 15 DAYS FOR REVIEW OF EACH RE-SUBMITTAL.

6. PROVIDE DEVIATIONS AND ADDITIONAL INFORMATION ON AN ATTACHED SEPARATE SHEET, PREPARED ON CONTRACTOR'S LETTERHEAD, RECORD RELEVANT INFORMATION, REQUESTS FOR DATA, REVISIONS OTHER THAN THOSE REQUESTED BY DESIGN ENGINEER ON PREVIOUS SUBMITTALS, AND DEVIATIONS FROM REQUIREMENTS IN THE CONTRACT DOCUMENTS, INCLUDING MINOR VARIATIONS AND LIMITATIONS. INCLUDE SAME IDENTIFICATION INFORMATION AS RELATED SUBMITTAL.

DRAIN WASTE & VENT NOTES

1. ALL EXPOSED DRAINAGE PIPING ON OCCUPIED SPACES INCLUDING TRAPS UNDER SINKS SHALL BE POLISHED CHROME PLATED.

2. DRAWINGS SHOW GENERAL ARRANGEMENT OF THE DRAIN WASTE AND VENT SYSTEM WITH THE REQUIRED CLEANOUTS. CONTRACTOR SHALL PROVIDE ALL ADDITIONAL CLEANOUTS AS REQUIRED BY THE PLUMBING CODE.

3. INVERTS ELEVATION SHOWN ON THE PLUMBING DRAWINGS MAY BE REFERENCED FROM THE FINISHED FLOOR ELEVATION. COORDINATE ALL INVERTS WITH BOTH CIVIL AND ARCHITECTURAL DRAWINGS PRIOR TO INSTALLATION.

4. ALL VENTS THROUGH ROOF SHALL BE A MINIMUM OF 10 FEET FROM ANY AIR INTAKE.

5. SLOPE VENT SYSTEM TOWARDS DRAINAGE SYSTEM.

6. ALL SANITARY DRAINAGE AND GREASE WASTE SYSTEM 3" AND LARGER SHALL BE SLOPED IN DIRECTION OF FLOW AT A MINIMUM OF 1/8" PER FOOT.

7. ALL SANITARY DRAINAGE AND GREASE WASTE SYSTEM SMALLER THAN 3" SHALL BE SLOPED IN DIRECTION OF FLOW AT A MINIMUM OF 1/4" PER FOOT.

8. DRAINAGE PATTERN FITTINGS SHALL BE USED ON ALL VENT PIPING LOCATED BELOW THE FLOOR LEVEL RIM OF THE FIXTURES.

9. SEE 2012 INTERNATIONAL PLUMBING CODE TABLE 706.3 FOR ACCEPTABLE DRAINAGE PATTERN FITTINGS.

PLBG. PROJECT SUBMIT. NOTES

1. MECHANICAL SUBMITTALS SHALL BE SUBMITTED AS A COMPLETE ELECTRONIC PACKAGE ASSEMBLED BY SPECIFICATION DIVISIONS.

2. PROVIDE EQUIPMENT SUBMITTAL INFORMATION FOR THE FOLLOWING EQUIPMENT
   A. PLUMBING FIXTURES(PORCELAIN FIXTURE, FLUSH VALVES, WATER COOLERS, ETC))
   B. SINKS
   C. DRAINS
   D. MISC. VALVES
   E. WATER HEATERS, (WH)
   F. DOMESTIC EXPANSION TANKS (DET)
   G. DOMESTIC CIRCULATING PUMPS (DCP)
   H. WATER HAMMER ARRESTORS (WHA)

3. PROVIDE MATERIAL SUBMITTAL INFORMATION FOR TH FOLLOWING MATERIAL:
   A. PIPING MATERIAL
   B. PIPE INSULATION
   C. HANGER AND SUPPORTS
   D. VALVES
   E. PLUMBING SPECIALTIES (METERS, GAGES, ETC.)
   F. PIPE IDENTIFICATION
   G. EQUIPMENT IDENTIFICATION.

CONDENSATE DRAIN NOTES

1. DRAWINGS SHOW GENERAL ARRANGEMENT OF THE CONDENSATE DRAIN SYSTEM.

2. PROVIDE PIPING VENTS AT ALL TRAPPED CONNECTION TO INDIVIDUAL PIECES OF EQUIPMENT..

3. ALL CONDENSATE DRAINAGE PIPING SHALL BE SLOPED IN DIRECTION OF FLOW AT A MINIMUM OF 1/8" PER FOOT.

4. PROVIDE INDIRECT CONNECTION AT DISCHARGE END OF CONDENSATE DRAIN PIPE.

5. PROVIDE UL508 AUXILIARY WATER LEVEL DETECTION DEVICE FOR ALL EQUIPMENT REQUIRING CONDENSATE DRAIN CONNECTION. INTERLOCK WATER LEVEL DETECTION DEVICE WITH UNIT TO TURN OFF UNIT WHEN CONDENSATE IS DETECTED.

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PE003

100% CONSTRUCTION DOCUMENTS

KEYED REFERENCE NOTES

1 2" SANITARY SEWER VENT THROUGH ROOF.

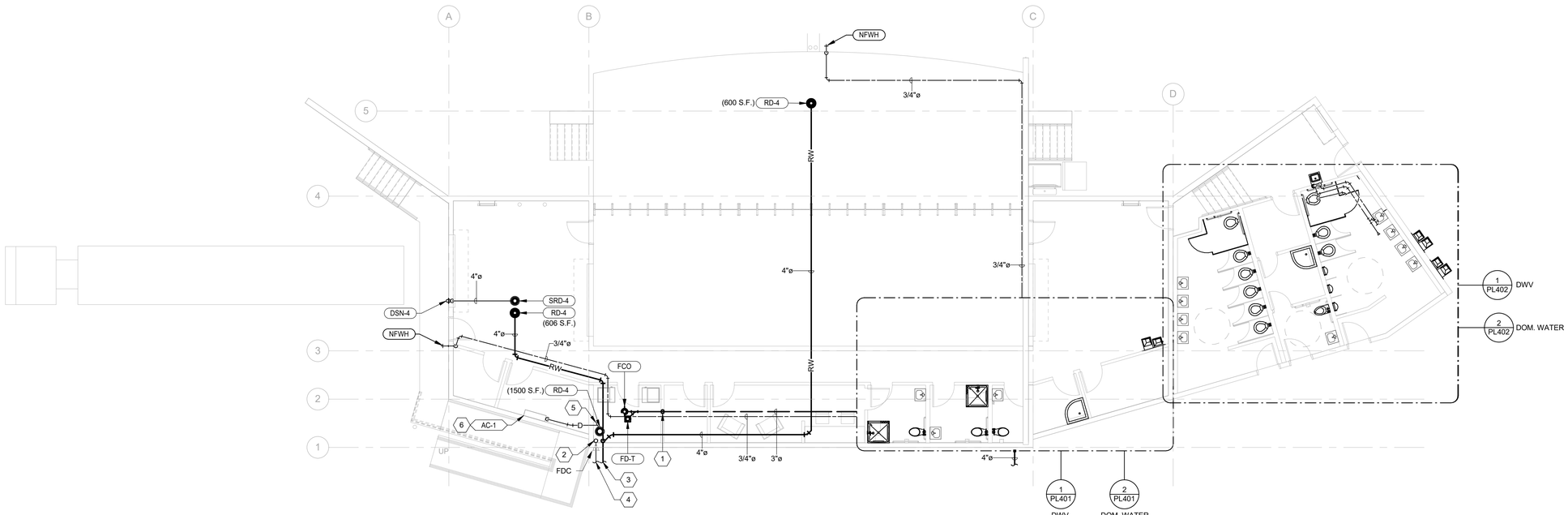
2 FIRE SPRINKLER RISER

3 RUN AND CONNECT TO SITE DRAINAGE. SEE SITE UTILITY DRAWINGS FOR EXACT LOCATION.

4 RUN AND CONNECT TO FIRE LINE. SEE SITE UTILITY DRAWINGS FOR EXACT LOCATION.

5 RUN CONDENSATE DRAIN TO FLOOR DRAIN.

6 MECHANICAL EQUIPMENT. SEE MECHANICAL DRAWINGS.



1 STAGE LEVEL PLUMBING PLAN
1/8" = 1'-0"

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STAGE LEVEL PLUMBING PLAN

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PL101

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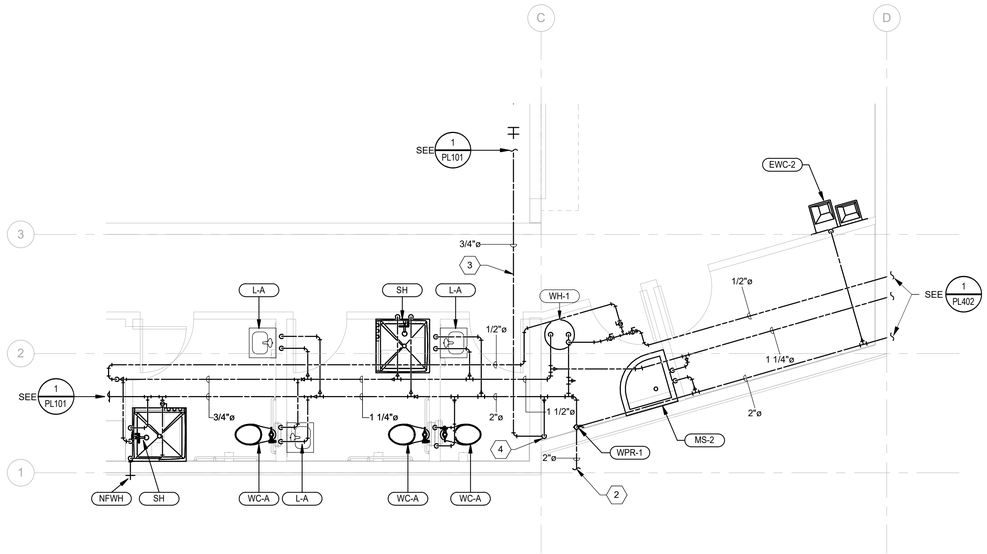
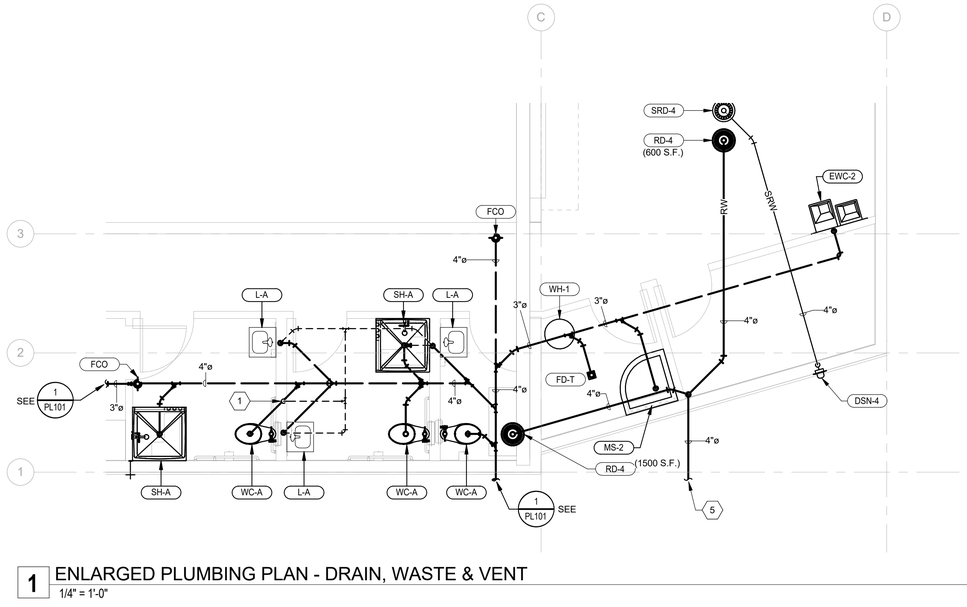


2 ENLARGED PLUMBING PLAN - DOMESTIC WATER
1/4" = 1'-0"



1 ENLARGED PLUMBING PLAN - DRAIN, WASTE & VENT
1/4" = 1'-0"

0' 4' 8' 16' 32'

north

KEYED REFERENCE NOTES

1 3" SANITARY SEWER VENT THROUGH ROOF.

2 RUN AND CONNECT TO DOMESTIC WATER SERVICE. SEE SITE UTILITY DRAWINGS FOR EXACT LOCATION.

3 RUN BELOW FLOOR.

4 PROVIDE SHUT-OFF VALVE IN RISE.

5 RUN AND CONNECT TO SITE DRAINAGE. SEE SITE UTILITY DRAWINGS FOR EXACT LOCATION.

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ENLARGED PLUMBING PLANS

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PL401

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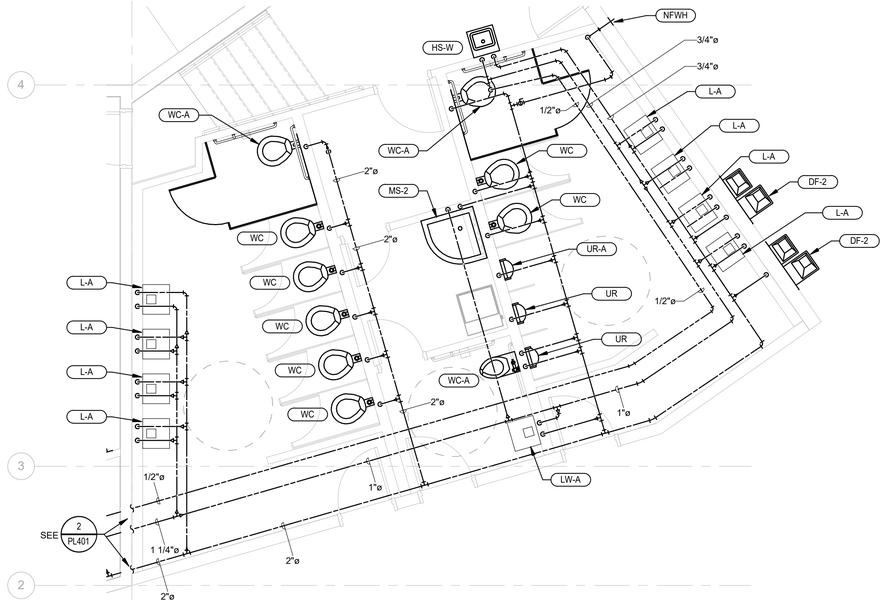
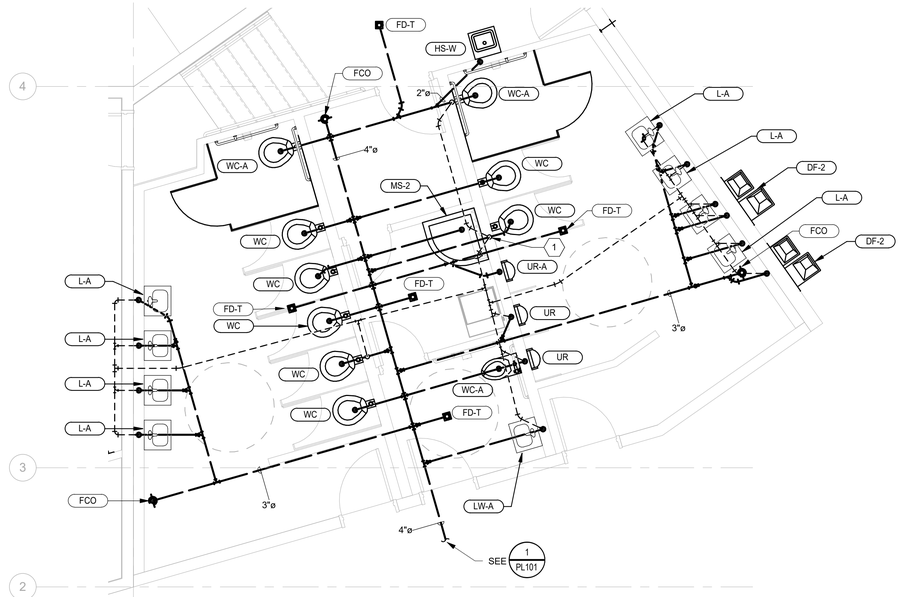


2 ENLARGED TOILET ROOMS - DOMESTIC WATER
1/4" = 1'-0"



1 ENLARGED TOILET ROOMS - DRAIN, WASTE & VENT
1/4" = 1'-0"

0' 4' 8' 16' 32'

north

KEYED REFERENCE NOTES

1 3" SANITARY SEWER VENT THROUGH ROOF.

COLORADO REGISTERED PROFESSIONAL ENGINEER RAY W. MOORE 20545 07/15/2016

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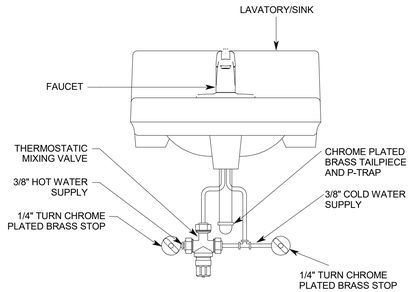
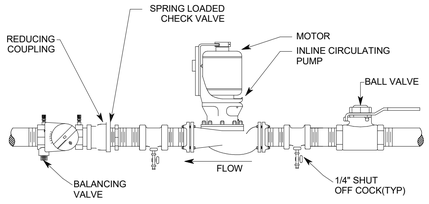


13 THERMOSTATIC MIX VALVE

SCALE: NTS

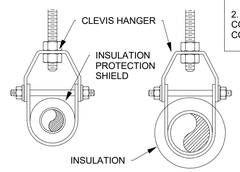


8 CIRCULATING PUMP

SCALE: NTS

NOTES:
1. STEEL PIPE HANGERS FOR PLASTIC PIPE SHALL BE PLASTIC COATED.

2. STEEL PIPE HANGERS FOR COPPER PIPE SHALL BE PLASTIC COATED.

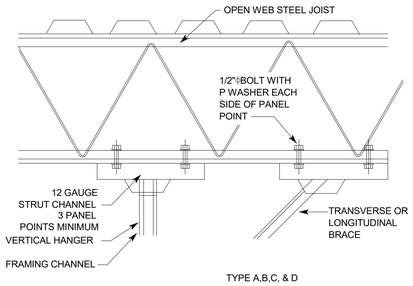


MSS SP-69 TYPE 1 PIPE TEMPERATURE BELOW AMBIENT INSULATED

MSS SP-69 TYPE 1 PIPE TEMPERATURE ABOVE AMBIENT INSULATED OR UNINSULATED

4 PIPE HANGER

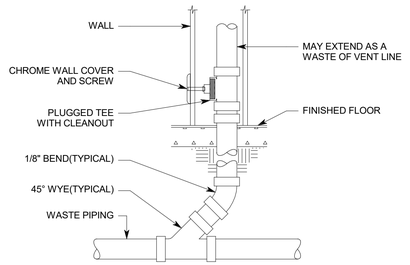
SCALE: NTS



TYPE A,B,C, & D

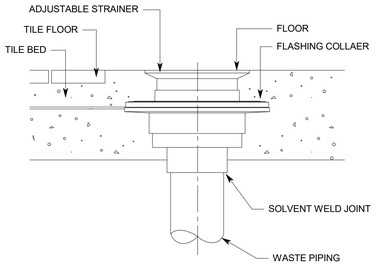
12 CONNECT TO OPEN WEB STEEL JOISTS

SCALE: NTS



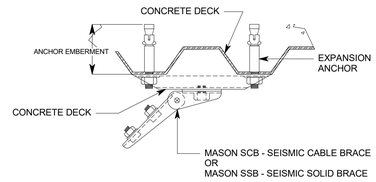
7 WALL CLEANOUT(PVC)

SCALE: NTS



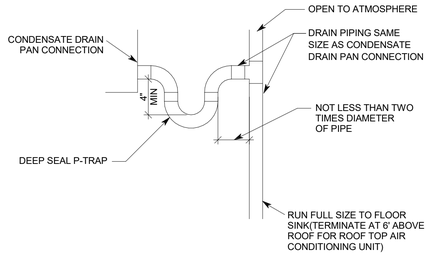
3 FLOOR DRAIN

SCALE: NTS



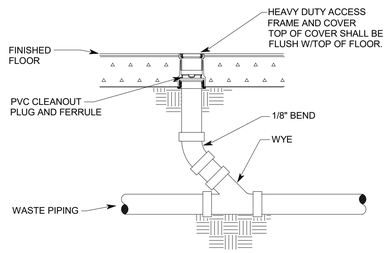
10 ATTACHMENT TO CONCRETE/METAL DECK

SCALE: NTS



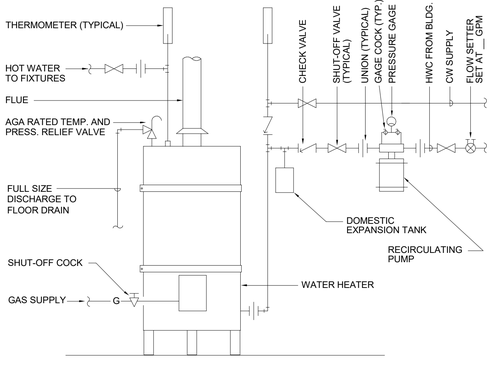
6 CONDENSATE DRAIN

SCALE: NTS



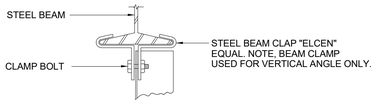
2 FLOOR CLEANOUT

SCALE: NTS



14 WATER HEATER PLATFORM

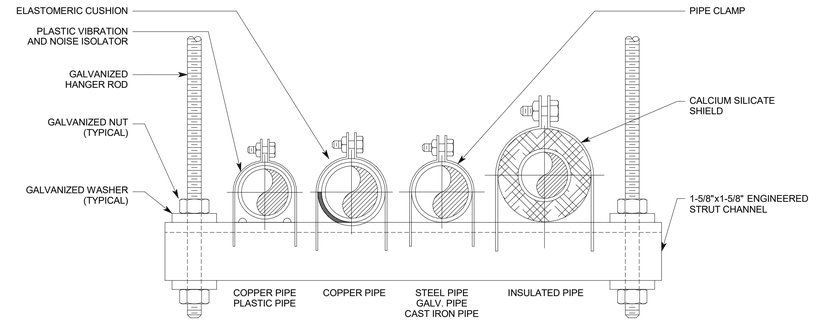
SCALE: NTS



NOTE: SEE SCHEDULE FOR TYPICAL CONNECTIONS TO STRUCTURAL SUPPORTING MEMBERS.

9 ATTACHMENT TO STEEL

SCALE: NTS



5 TRAPEZE HANGER

SCALE: NTS

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PLUMBING FIXTURE SCHEDULE

SYMBOL	FIXTURE	TRAP	WASTE	VENT	DOMESTIC COLD WATER	DOMESTIC HOT WATER	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL	NOTES
WC	WATER CLOSET	INT.	3"	2"	1"	----	FLOOR MOUNTED, FLUSH VALVE, VITREOUS CHINA, ELONGATED, 1-1/2" TOP SPUD, 15" RIM HEIGHT, SIPHON JET, 2-1/8" MINIMUM TRAPWAY. DIAPHRAGM TYPE FLUSH VALVE, SENSOR ACTIVATED, DUAL FLUSH, 1.60/1.10 GALLONS PER FLUSH, POLISHED CHROME PLATED BRASS, BATTERY, COURTESY FLUSH OVERRIDE BUTTON, VACUUM BREAKER. OPEN FRONT SEAT, LESS SEAT, HEAVY DUTY PLASTIC, ELONGATED, STAINLESS STEEL HINGE POSTS..	AMERICAN STANDARD 2234.001 SLOAN 111-1.6/1.1 BEMIS 1955C	MINIMUM MaP RATING = 1,000
WC-A	WATER CLOSET (ACCESSIBLE ROOM)	INT.	3"	2"	1"	----	FLOOR MOUNTED, FLUSH VALVE, VITREOUS CHINA, ELONGATED, 1-1/2" TOP SPUD, 16-1/2" RIM HEIGHT, SIPHON JET, 2-1/8" MINIMUM TRAPWAY. DIAPHRAGM TYPE FLUSH VALVE, SENSOR ACTIVATED, DUAL FLUSH, 1.60/1.10 GALLONS PER FLUSH, POLISHED CHROME PLATED BRASS, BATTERY, COURTESY FLUSH OVERRIDE BUTTON, VACUUM BREAKER. OPEN FRONT SEAT, LESS SEAT, HEAVY DUTY PLASTIC, ELONGATED, STAINLESS STEEL HINGE POSTS..	AMERICAN STANDARD 3043.001 SLOAN 111-1.6/1.1 BEMIS 1955C	MINIMUM MaP RATING = 1,000 INSTALL FLUSH VALVE WITH HANDLE ON ACCESSIBLE SIDE OF WATER CLOSET
WC-A (L)	WATER CLOSET (ACCESSIBLE)	INT.	3"	2"	1/2"	----	FLOOR MOUNTED, TWO PIECE, VITREOUS CHINA, ELONGATED, SIPHON JET, 1.28 GAL PER FLUSH, 17" MINIMUM BOWL HEIGHT, LEFT HAND TRIP LEVER, COLOR WHITE. CLOSED FRONT SEAT, WITH COVER, ELONGATED, MOLDED PLASTIC. ANGLE BALL VALVE STOP, POLISHED CHROME PLATED LEAD FREE BRASS, HEAVY DUTY, 1/2" IPS x 3/8" O.D. COMPRESSION POLISHED CHROME PLATED COPPER TUBING SUPPLY, 3/8" O.D, FORMED NOSEPIECE WITH FLANGE, WATER WASHER OR GASKET, COMPRESSION SLEEVE, ASTM A112.18.6.	AMERICAN STANDARD 215AA.104 BEMIS 170 BRASSCRAFT KTCR19X C BRASSCRAFT 1-15 DL	MINIMUM MaP RATING = 1,000 LEFT HAND TRIP LEVER
WC-A (R)	WATER CLOSET (ACCESSIBLE)	INT.	3"	2"	1/2"	----	FLOOR MOUNTED, TWO PIECE, VITREOUS CHINA, ELONGATED, SIPHON JET, 1.28 GAL PER FLUSH, 17" MINIMUM BOWL HEIGHT, RIGHT HAND TRIP LEVER, COLOR WHITE. OPEN FRONT SEAT, LESS COVER, ELONGATED, STAINLESS STEEL HINGE POSTS, ANGLE BALL VALVE STOP, 1/2" IPS x 3/8" O.D. COMPRESSION, POLISHED CHROME PLATED HEAVY DUTY POLISHED CHROME PLATED COPPER TUBING SUPPLY, 3/8" O.D, FORMED NOSEPIECE WITH FLANGE, WATER WASHER OR GASKET, COMPRESSION SLEEVE, ASTM A112.18.6.	AMERICAN STANDARD 215BA.105 BEMIS 1955CT BRASSCRAFT KTCR19X C BRASSCRAFT 1-15 DL	MINIMUM MaP RATING = 1,000 RIGHT HAND TRIP LEVER
L-A	LAVATORY (ACCESSIBLE)	1-1/4"	1-1/2"	1-1/2"	1/2"	1/2"	WALL MOUNTED, 20" x 18", VITREOUS CHING, ADA ACCEPTABLE, FAUCET LEDGE, 4" CENTER FAUCET HOLES. SINGLE LEVER FAUCET, CHROME PLATED LEAD FREE BRASS, CERAMIC COMPONENTS, DECK PLATE. LAMINAR FLOW AERATOR, POLISHED CHROME PLATED LEAD FREE BRASS, 0.5 GPM. COMBINATION TEMPERATURE & PRESSURE MIXING VALVE, CHROME PLATED LEAD FREE BRASS. INTEGRAL CHECKS, ASSE 1070 LISTED. CHROME PLATED BRASS GRID DRAIN,CHROME PLATED BRASS TAILPIECE, OFFSET TAILPIECE WHITE POLYVINYL CHLORIDE (PVC) TRAP ANGLE BALL VALVE STOP, HEAVY DUTY, POLISHED CHROME PLATED LEAD FREE BRASS, 1/2" IPS x 3/8" O.D. COMPRESSION. POLISHED CHROME PLATED COPPER TUBING SUPPLY, 3/8" O.D, FORMED NOSEPIECE WITH FLANGE, WATER WASHER OR GASKET, COMPRESSION SLEEVE, ASTM A112.18.6. ENCLOSURE: RIGID POLYVINYL CHLORIDE ENCLOSURE, ADA ACCESSIBLE UL LISTED SUPPORT: CONCEALED ARM, FLOOR MOUNTED, NARROW WALL, TUBULAR STEEL VERTICAL SUPPORTS, STEEL FLOOR PLATES.	AMERICAN STANDARD 0355.012 SYMMONS SLS-2010 OMIN A-400-[illegible]ERS LFe480 MCQUIRE 155A DEARBORN 9701-1 BRASSCRAFT KTCR19XC BRASSCRAFT 1-15 C TRUEBRO "LAV SHIELD" 2018 J.R. SMITH 0710-Z	SET DISCHARGE WATER TEMPERATURE AT 110 F.
SH-A	SHOWER	----	----	----	1/2"	1/2"	FIXTURE: MIXING, SINGLE LEVER, PRESSURE BALANCING, BRASS BODY, HAND HELD SHOWER HEAD, 60" METAL HOSE, CHROME PLATED BRASS DIVERTER SPOUT, 30" SLIDE BAR, INLINE VACUUM BREAKER, ASSE 1016, 2.0 GPM FLOW RESTRICTOR.	SYMMONS BP-56-300-B30-V-X	SET DISCHARGE WATER TEMPERATURE AT 110 F.
MS-2	MOP SINK	3"	3"	2"	1/2"	1/2"	FLOOR MOUNTED, 0NE-PIECE, ENAMELED CAST IRON, CORNER MODEL, 28" x 28" REMOVABLE VINYL RIM GUARD POLISHED CHROME PLATED GRID DRAIN MANMUAL FAUCET, WALL MOUNTED, POLISHED CHROME PLATED LEAD-FREE BRASS, ATMOSPHERIC VACUUM BREAKER, INLET STOPS, 3/4" THREADED HOSE CONNECTION. LEVER HANDLE, LAMINAR AERATOR: LEAD-FREE BRASS, PRESSURE COMPENSATING, 2.0 GPM, 3/8" OFFSET INLET SUPPLY AIR WITH INTEGRAL CHECK 48" LONG RUBBER HOSE, THREADED CONNECTION.	AMERICAN STANDARD 7741.000 AMERICAN STANDARD 7745.811 AMERICAN STANDARD 7721.038 CHICAGO FAUCET 540-LD897SWXFABCP OMNI A-810-VR- 2.0-LF CHICAGO FAUCET GCJKABCP	
DF-2	DRINKING FOUNTAIN (EXTERIOR)	2"	2"	2"	1/2"	1/2"	BI-LEVEL WITH RECESSED BOTTLE FILLER, 18 GAUGE, 304 STAINLESS STEEL, STAINLESS STEEL BUBBLER, STAINLESS STEEL MOUNTING PLATE, STAINLESS STEEL BACK PANEL, FREEZE RESISTANT VALVE SYSTEM, INLET STRAINER, 17 GA. TUBULAR CHROME PLATED BRASS P-TRAP ANGLE BALL VALVE STOPS, /2" I.P.S. x 3/8" O.D COMPRESSION, POLISHED CHROME PLATED LEAD FREE BRASS, HEAVY PATTERN RIGID POLISHED CHROME PLATED COPPER TUBING SUPPLIES	MOST DEPENDABLE 10485 WMSS DEARBORN 9704 BRASSCRAFT KTCR19XC	BOTTLE FILLER INCLUDED LOCATE P-TRAP AT INTERIOR OF BUILDING.
EWC-2	ELECTRIC WATER COOLER (INTERIOR)	2"	2"	2"	1/2"	1/2"	BI-LEVEL, ELECTRIC, REFRIGERATED, , ARI 1010, FLEXI-GUARD BUBBLER, BOTTLE FILLING STATION, FILTERED WATER SYSTEM, STAINLESS STEEL CABINET. 8.0 GPH AT 80 F INLET WATER TEMPERATURE, 90 F AMBIENT AIR TEMPERATURE AND 50 F. CHILLED DRINKING WATER. SCHEDULE 40 PVC P-TRAP ANGLE BALL VALVE STOPS, 1/2" I.P.S. x 3/8" O.D COMPRESSION, POLISHED CHROME PLATED LEAD FREE BRASS, HEAVY PATTERN RIGID POLISHED CHROME PLATED COPPER TUBING SUPPLIES FLOOR MOUNTED FIXTURE SUPPORT, TUBULAR STEEL SUPPORTS, FLOOR PLATE, STEEL SUPPORT BRACKETS	ELKAY LZSTL8WSSK DEARBORN P9704 BRASSCRAFT KTCR19XC J.R. SMITH 0832	BOTTLE FILLER INCLUDED
HS-W	HAND SINK (ACCESSIBLE)	1-1/4"	1-1/2"	1-1/2"	1/2"	1/2"	WALL MOUNTED, 20" x 18", VITREOUS CHING, ADA ACCEPTABLE, FAUCET LEDGE, 4" CENTER FAUCET HOLES. SINGLE LEVER FAUCET, CHROME PLATED LEAD FREE BRASS, CERAMIC COMPONENTS, DECK PLATE. LAMINAR FLOW AERATOR, POLISHED CHROME PLATED LEAD FREE BRASS, 0.5 GPM. COMBINATION TEMPERATURE & PRESSURE MIXING VALVE, CHROME PLATED LEAD FREE BRASS. INTEGRAL CHECKS, ASSE 1070 LISTED. CHROME PLATED BRASS GRID DRAIN,CHROME PLATED BRASS TAILPIECE, OFFSET TAILPIECE TRAP: WHITE POLYVINYL CHLORIDE (PVC) ANGLE BALL VALVE STOP, HEAVY DUTY, POLISHED CHROME PLATED LEAD FREE BRASS, 1/2" IPS x 3/8" O.D. COMP[RESSION. POLISHED CHROME PLATED COPPER TUBING SUPPLY, 3/8" O.D, FORMED NOSEPIECE WITH FLANGE, WATER WASHER OR GASKET, COMPRESSION SLEEVE, ASTM A112.18.6. ENCLOSURE: RIGID POLYVINYL CHLORIDE ENCLOSURE, ADA ACCESSIBLE UL LISTED SUPPORT: CONCEALED ARM, FLOOR MOUNTED, NARROW WALL, TUBULAR STEEL VERTICAL SUPPORTS, STEEL FLOOR PLATES.	AMERICAN STANDARD 0355.012 SYMMONS SLS-2010 OMIN A-400-[illegible]ERS LFe480 MCQUIRE 155A DEARBORN 9701-1 BRASSCRAFT KTCR19XC BRASSCRAFT P1-15 C TRUEBRO "LAV SHIELD" 2018 J.R. SMITH 0710-Z	SET DISCHARGE WATER TEMPERATURE AT 110 F.

PLUMBING FIXTURE SCHEDULE (DRAINS)

SYMBOL	FIXTURE	TRAP	WASTE	VENT	DOMESTIC COLD WATER	DOMESTIC HOT WATER	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL	NOTES
FD-T	FLOOR DRAIN	2"	2"	2"	---	---	LACQUER COATED CAST IRON BODY FLOOR DRAIN, FLASHING COLLAR, 5" ROUND NICKEL BRONZE ADJUSTABLE STRAINER 3.5" BARRIER TYPE TRAP PRIMER, ABS, NEOPRENE RUBBER DIAPHRAGM, ASSE STANDARD 1072-AF-GW DEEP SEAL P-TRAP	J. R. SMITH 2010-5A J.R. SMITH 5A SURESEAL SS 3509	INSTALL TRAP SEAL BEHIND STRAINER FACE
RD-4	ROOF DRAIN	----	3"	---	---	---	LACQUER COATED CAST IRON BODY,COMBINED FLASHING CLAMP AND GRAVEL STOP, SUMP RECEIVER, UNDERDECK CLAMP.	J. R. SMITH 1010-AD-R-C	3,760 SQ. FT. CAPACITY AT 2" PER HOUR RAINFALL AND 1/8" PER FOOT SLOPE.
SRD-4	SECONDARY ROOF DRAIN	---	3"	---	---	---	LACQUER COATED CAST IRON BODY,COMBINED FLASHING CLAMP AND GRAVEL STOP, 2" WATER DAM, SUMP RECEIVER, UNDERDECK CLAMP.	J. R. SMITH 1080-AD-R-C	3,760 SQ. FT. CAPACITY AT 2" PER HOUR RAINFALL AND 1/8" PER FOOT SLOPE.
DSN-4	DOWNSPOUT NOZZLE	---	3"	---	---	---	CAST BRONZE NOZZLE AND FLANGE	J.R. SMITH 1771	

PLUMBING FIXTURE SCHEDULE (CLEANOUTS)

SYMBOL	FIXTURE	TRAP	WASTE	VENT	DOMESTIC COLD WATER	DOMESTIC HOT WATER	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL	NOTES
FD-T	FLOOR DRAIN	2"	2"	2"	---	---	LACQUER COATED CAST IRON BODY FLOOR DRAIN, FLASHING COLLAR, 5" ROUND NICKEL BRONZE ADJUSTABLE STRAINER 3.5" BARRIER TYPE TRAP PRIMER, ABS, NEOPRENE RUBBER DIAPHRAGM, ASSE STANDARD 1072-AF-GW DEEP SEAL P-TRAP	J. R. SMITH 2010-5A J.R. SMITH 5A SURESEAL SS 3509	INSTALL TRAP SEAL BEHIND STRAINER FACE
CO	CLEANOUT	---	SAME AS PIPE	---	---	---	CAST IRON BLIND PLUG	CHARLOTTE PIPE NH-50	
FCO	FLOOR CLEANOUT	---	SAME AS PIPE	---	---	---	HEAVY DUTY NICKEL BRONZE TOP, BRASS PLUG	J. R. SMITH 4113S-NB	
COTG	CLEANOUT TO GRADE	---	SAME AS PIPE	---	---	---	HEAVY DUTY NICKEL BRONZE TOP, BRASS PLUG	J. R. SMITH 4113S-NB	
WCO	WALL CLEANOUT	---	SAME AS PIPE	---	---	---	ROUND FLAT STAINLESS STEEL WALL PLATE	J.R. SMITH 4532S	

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PLUMBING FIXTURE SCHEDULE (MISC. VALVES)

SYMBOL	FIXTURE	TRAP	WASTE	VENT	DOMESTIC COLD WATER	DOMESTIC HOT WATER	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL	NOTES
NFWH	NON-FREEZE WALL HYDRANT	---	---	---	3/4"	---	BRONZE BODY, NICKEL PLATED, QUARTER TURN, INTEGRAL VACUUM BREAKER, STAINLESS STEEL WALL BOX	J.R. SMITH 5509QT	
WPR-2	WATER PRESSURE REGULATOR	---	---	---	2"	---	PILOT OPERATED DIAPHRAGM VALVE, HYDRAULICALLY OPERATED, CAST IRON BODY, NSF EPOXY LINED & COATED, STAINLESS STEEL TRIM, EPDM SEALS, LEAD FREE BRASS PRESSURE REDUCING PILOT VALVE. INLET STRAINER, ISOLAITONS COCKS CAPACITY: 210 GPM MAXIMUM CONTINUOUS FLOW. INLET PRESSURE: 100 PSIG OUTLET PRESSURE:55 PSIG	WATTS ACV-LFF115-Y-X	
RPZ-1	BACKFLOW PREVENTER	---	---	---	3"	---	REDUCED PRESSURE ZONE ASSEMBLY, LEAD FREE BRONZE BODY, STAINLESS STEEL SEATS, FDA LISTED QUARTER TURN BALL VALVES, ASSE 1013 LISTED,	WATTS 909-QT-FDA	
BV	BALANCING VALVE	---	---	---	---	1/2"	CALIBRATED, LEAD FREE BRASS BODY, STAINLESS STEEL BALL, TEFLON SEAT RINGS, NSF 61 - G COMPLIANT	BELL & GOSSETT CB-LF	

PLUMBING PIPE HANGER SPACING

NOMINAL PIPE SIZE (INCHES)	DOMESTIC WATER		DRAIN WASTE & VENT		ROOF DRAINAGE	
	TYPE L COPPER		SCH. 40 PVC		SCH. 40 PVC	
	HANGER SPACING	HANGER ROD SIZE (INCHES)	HANGER SPACING	HANGER ROD SIZE (INCHES)	HANGER SPACING	HANGER ROD SIZE (INCHES)
1/2"	5'-0"	3/8"	----	----	----	----
3/4"	5'-0"	3/8"	----	----	----	----
1"	6'-0"	3/8"	----	----	----	----
1-1/4"	6'-0"	3/8"	----	----	----	----
1-1/2"	8'-0"	3/8"	4'-0"	3/8"	4'-0"	3/8"
2"	8' - 0"	3/8"	4'-0"	3/8"	4'-0"	3/8"
2-1/2"	8'-0"	1/2"	4'-0"	0.375	4'-0"	0.375
3"	10'-0"	1/2"	4'-0"	1/2"	4'-0"	1/2"
4"	----	----	4'-0"	5/8"	4'-0"	5/8"
5"	----	----	4'-0"	5/8"	4'-0"	5/8"
6"	----	----	4'-0"	5/8"	4'-0"	5/8"
8"	----	----	----	----	----	----
10"	----	----	----	----	----	----

NOTES:

1. SPACING FOR 10' - 0" LENGTH OF CAST IPIPE MAY BE INCREASED TO 10'-0".
2. ALL PIPING SHALL BE SUPPORTED WITH STEEL CLEVIS HANGERS (MSS TYPE 1).
3. STEEL CLEVIS HANGERS USED FOR SUPPORTING COPPER PIPING SHALL BE COPPER COATED .
4. STEEL CLEVIS HANGERS USED FOR SUPPORTING PLASTIC PIPE SHALL BE PLASTIC COATED.
5. PROVIDE PIPE HANGER WITHIN 18" OF ALL CHANGES IN DIRECTION.
6. PERFORATED METAL STRAPS SHALL NOT BE USED TO SUPPORT ANY PIPING.
7. PLASTIC STRAPPING (PLUMBERS TAPE) SHALL NOT BE USED TO SUPPORT ANY PIPING.

WATER HEATER SCHEDULE

SYMBOL	MANUFACTURER	MODEL NO.	FUEL	STORAGE CAPACITY (GALLONS)	RECOVERY CAPACITY			INPUT CAPACITY (BTUH)	ELECTRICAL				OPERATING WEIGHT (LBS)	OPTIONS & ACCESSORIES	NOTES / REMARKS
					GALLONS PER HOUR (GPH)	INLET WATER TEMP. (DEG. F.)	OUTLET WATER TEMP. (DEG. F.)		AMPS	VOLTS	HERTZ	PHASE			
WH-1	BRADFORD WHITE	LG155H803N	NATURAL GAS	55	78	40	140	80,000	0.0	120	60	1	400	(1)(2)(3)	(11)(12)(13)

ACCEPTABLE MANUFACTURERS	OPTIONS AND ACCESSORIES (FURNISHED AND INSTALLED BY CONTRACTOR)	NOTES:
A.O. SMITH LOCHINVAR STATE BRADFORD WHITE	(1) ATMOSPHERIC BURNER, FVIR SAFETY SYSTEM (2) GLASS LINED STORAGE TANK (3) AGA/ASME TEMPERATURE AND PRESSURE RELIEF VALVE	(11) ASHRAE / IESNA 90.1 CERTIFIED (12) UL CERTIFIES TO ANSI Z21.10.3 (13) SET WATER HEATER OUTPUT TEMPERATURE AT 130 F.

DOMESTIC HOT WATER THERMAL EXPANSION TANK

SYMBOL	BASIS OF DESIGN MANUFACTURER	MODEL NO.	ARRANGEMENT	TOTAL VOLUME (GALLONS)	MINIMUM ACCEPTANCE VOLUME (GALLONS)	STATIC SUPPLY PRESSURE (PSIG)	INLET WATER TEMP. (DEG. F)	MAXIMUM WATER TEMP. (DEG. F)	OPTIONS & ACCESSORIES	COMMENTS
DET-1	AMTROL	ST-5	PIPE MOUNTED	2.0	0.9	60	40	160	(1) (2)(3)(4)	40 GALLON WATER HEATER (MAXIMUM)

ACCEPTABLE MANUFACTURERS	OPTIONS & ACCESSORIES :	NOTES:
AMTROL BELL & GOSSETT WATTS	(1) BUTL DIAPHRAGM (2) RIGID POLYPROPYLENE LINER (3) STAINLESS STEEL SYSTEM CONNECTION (4) 150 PSIG MAXIMUM WORKING PRESSURE (5) ASME SECTION VIII, DIVISION 1 LISTED	

DOMESTIC WATER VALVE SCHEDULE

VALVE TYPE	PIPE SIZE	DESCRIPTION	BASIS OF DESIGN MANUFACTURER AND MODEL
BALL VALVE	2 " & SMALLER	BRASS BODY, TWO-PIECE, FULL PORT, CHROME PLATED BRASS BALL, PTFE SEAT, LEVER HANDLE, 150 PSIG WSP, 600 PSIG WOG, MSS SP-110, SOLDERED OR THREADED END	WATTS LFB6080
CHECK VALVE	2" & SMALLER	LOW LEAD BRASS BODY, STAINLESS STEEL SPRING, NON-SLAM, NSF NON-METALLIC DISK, NSF NON-METALLIC SEAT, 200 PSIG WOG, THREADED ENDS,	RED & WHITE 232AB

DOMESTIC WATER CIRCULATING PUMP SCHEDULE

SYMBOL	MANUFACTURER	MODEL NO.	FLOW RATE (GPM)	HEAD (FEET)	MOTOR SPEED (RPM)	ELECTRICAL				OPTIONS & ACCESSORIES
						WATTS	VOLTS	HERTZ	PHASE	
DCP-1	BELL & GOSSETT	NBF-25	4.0	10.0	3300	125	120	60	1	(1)(2)(3)

ACCEPTABLE MANUFACTURERS	OPTIONS & ACCESSORIES
BELL & GOSSETT ARMSTRONG GRUNDFOS	(1) WET ROTOR; 3-SPEED MOTOR (CAPACITY BASED ON LOW SPEED) LEAD-FREE BRONZE CONSTRUCTION (2) (3) AQUASTAT, SET AT 110 F.

PLUMBING PIPE INSULATION SCHEDULE

SERVICE	TEMPERATURE RANGE (DEGREES F)	INSULATON MATERIAL	INSULATION CONDUCTIVITY (BTUH)(INCH) / (H)(FT2)	INSULATION MEAN RATING TEMPERATURE (F)	INSULATION THICKNESS (INCHES) FOR PIPE SIZES:			
					3/4" & LESS	1" & 1-1/4"	1-1/2" TO 3-1/2"	4" TO 6"
DOMESTIC COLD WATER	40 TO 60	PREFORMED GLASS FIBER WITH ALL-SERVICE JACKET	0.22 - 0.28	100	1"	1"	1"	1"
DOMESTIC COLD WATER (BELOW GRADE TO FIXTURES)	40 TO 60	FLEXIBLE ELASTOMERIC WITH 0.5 GREEN PVC JACKET	0.22 - 0.28	100	1"	1"	1"	1"
DOMESTIC HOT WATER	105 TO 140	PREFORMED GLASS FIBER WITH ALL-SERVICE JACKET	0.22 - 0.28	100	1"	1"	1-1/2"	1-1/2"
DOMESTIC HOT WATER (BELOW GRADE TO FIXTURES)	105 TO 140	FLEXIBLE ELASTOMERIC WITH 0.5 GREEN PVC JACKET	0.22 - 0.28	100	1"	1"	1-1/2"	1-1/2"
ROOF DRAINAGE (HORIZONTAL)	105 TO 140	PREFORMED GLASS FIBER WITH ALL-SERVICE JACKET	0.22 - 0.28	100	1"	1"	1"	1"

NOTES:

(1) INSULATION SHALL HAVE A MINIMUM K VALUE OF 0.27 BTU PER INCH/H FT2 °F.
(2) PIPE INSULATION SHALL HAVE AN ALL-SERVICE JACKET MANUFACTURERED FROM KRAFT PAPER.
(3) FITTING SHALL HAVE PREFORMED FITTING INSULATION WITH PREFORMED PVC FITTING COVERS.
(4) INDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 25 OR LESS WHEN TESTED TO ASTM E 84.
(5) INDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A SMOKE-DEVELOPED INDEX OF 50 OR LESS WHEN TESTED TO ASTM E 84,
(6) OUTDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A FLAME-SPREAD INDEX OF 75 OR LESS WHEN TESTED TO ASTM 84.
(7) OUTDOOR PIPE INSULATION AND RELATED MATERIALS SHALL HAVE A SMOKE-DEVELOPED INDEX OF 150 OR LESS WHEN TESTED TO ASTM 84.
(8) ALL INSULATION COVERINGS AND LININGS SHALL NOT FLAME, GLOW, SMOLDER OR SMOKE WHEN TESTED IN ACCORDANCE WITH ASTM C 411.

PLUMBING PIPE MATERIAL SCHEDULE

SERVICE	PIPE MATERIAL	FITTINGS	JOINTS	NOTES
DOMESTIC WATER DISTRIBUTION	ASTM B88 TYPE 'L' COPPER TUBING	ASME B16.18 CAST COPPER-ALLOY SOLDER JOINT OR ASME B16.22 WROUGHT COPPER SOLDER JOINT	ASTM B32 LEAD FREE SOLDER	(1) COPPER PLATED OR PLASTIC COATED TYPE 1 CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING (3) SEE PIPE INSULATION SCHEDULE FOR INSULATION REQUIREMENTS
DRAIN WASTE AND VENT (BELOW GRADE)	ASTM F 891 SCHEDULE 40 CELLULAR CORE PVC	ASTM A 2665 DRAINAGE PATTERN	ASTM D 2564 SOLVENT CEMENT	
DRAIN WASTE AND VENT (ABOVE GRADE)	ASTM F 891 SCHEDULE 40 CELLULAR CORE PVC	ASTM A 2665 DRAINAGE PATTERN	ASTM D 2564 SOLVENT CEMENT	(1) PLASTIC COATED TYPE 1 STEEL CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING
ROOF DRAINAGE (BELOW GRADE)	ASTM F 891 SCHEDULE 40 CELLULAR CORE PVC	ASTM A 2665 DRAINAGE PATTERN	ASTM D 2564 SOLVENT CEMENT	
ROOF DRAINAGE (ABOVE GRADE)	ASTM F 891 SCHEDULE 40 CELLULAR CORE PVC	ASTM A 2665 DRAINAGE PATTERN	ASTM D 2564 SOLVENT CEMENT	(1) TYPE 1 STEEL CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING (3) SEE PIPE INSULATION SCHEDULE FOR INSULATION REQUIREMENTS
NATURAL GAS	ASTM A53 SCHEDULE 40 BLACK STEEL	ASTM B16.3 CLASS 150 MALLEABLE IRON OR ASTM B16.9 BUTT WELDED STEEL	THREADED TEFLON TAPE	(1) TYPE 1 STEEL CLEVIS PIPE HANGERS (2) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING
	ANSI LC 1 CORRUGATES STAINLESS STEEL TUBING	ASTM B16.3 CLASS 150 MALLEABLE IRON	THREADED TEFLON TAPE	(1) USE ONLY DOWNSTREAM OF PRESSURE REGULATOR. (2) TYPE 1 STEEL CLEVIS PIPE HANGERS (3) SEE PIPE HANGER SCHEDULE FOR HANGER SPACING

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CITY OF Grand Junction COLORADO

project#: 14.0650
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PLUMBING SCHEDULES

sheet:
PL602

100% CONSTRUCTION DOCUMENTS

SYMBOLS LEGEND

SYMBOL	DESCRIPTION
ELECTRICAL POWER AND DISTRIBUTION	
	FUSE WITH RATING (ONE-LINE DIAGRAM).
	DISCONNECT, FUSED (ONE-LINE DIAGRAM).
	DISCONNECT, NONFUSED (ONE-LINE DIAGRAM).
	DISCONNECT WITH FUSE AND MOTOR STARTER COMBINATION (ONE-LINE DIAGRAM).
	STARTER (ONE-LINE DIAGRAM).
	CIRCUIT BREAKER, MOLDED CASE (ONE-LINE DIAGRAM).
	CIRCUIT BREAKER, MOLDED CASE WITH SHUNT TRIP (ONE-LINE DIAGRAM).
	CIRCUIT BREAKER, SOLID STATE (ONE-LINE DIAGRAM).
GFP	CIRCUIT BREAKER, SOLID STATE WITH GROUND FAULT PROTECTION (ONE-LINE DIAGRAM).
	MOTOR.
	TRANSFORMER (ONE-LINE DIAGRAM).
225/3 "1H"	PANELBOARD WITH MAIN LUGS ONLY. BUS SIZE AND PHASE AS SHOWN (ONE-LINE DIAGRAM).
225/3 "1H"	PANELBOARD WITH MAIN CIRCUIT BREAKER. SIZE AND PHASE AS SHOWN (ONE-LINE DIAGRAM).
225/3 "1H" 225/3 "1H"	PANELBOARD WITH SUB FEED LUGS (ONE-LINE DIAGRAM).
225/3 "1H" "1H"	PANELBOARD WITH CIRCUIT BREAKER AND SUB FEED LUGS (ONE-LINE DIAGRAM).
	CT CABINET PER UTILITY'S REQUIREMENTS (ONE-LINE DIAGRAM).
	SERVICE ENTRANCE SURGE PROTECTION (ONE-LINE DIAGRAM).
G	GENERATOR, POWER (ONE-LINE DIAGRAM).
M	METER.
VFC VFD	VARIABLE FREQUENCY MOTOR CONTROLLER (ONE-LINE DIAGRAM).
	DISCONNECT SWITCH, FUSED.
	DISCONNECT SWITCH, UNFUSED.
	STARTER, COMBINATION WITH DISCONNECT SWITCH.
	STARTER OR MOTOR CONTROLLER.
	PUSHBUTTON.
	PANELBOARD CABINET, FLUSH MOUNTED.
	PANELBOARD CABINET, SURFACE MOUNTED, 1 SECTION.
	PANELBOARD CABINET, SURFACE MOUNTED, 2 SECTION.
DP#_	DISTRIBUTION PANEL OR SWITCHBOARD.
LP	LIGHTING RELAY, CONTACTOR PANEL, OR DIMMING ENCLOSURE.
	LIGHTING CONTROL STATION.
$ST	SWITCH, TOGGLE MOTOR STARTER WITH OVERLOAD PROTECTION.
75	TRANSFORMER: NUMBER INDICATES kVA.

SYMBOLS LEGEND

SYMBOL	DESCRIPTION
REFERENCE AND LINE SYMBOLS	
A5 / E-501	DETAIL INDICATOR: A5 INDICATES DETAIL NUMBER, E-501 INDICATES DRAWING SHEET WHERE DETAIL IS SHOWN.
A5 / E-201	ELEVATION OR SECTION INDICATOR, EXTERIOR: A5 INDICATES ELEVATION OR SECTION NUMBER, E-201 INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
A5 / E-201	ELEVATION OR SECTION INDICATOR, INTERIOR: A5 INDICATES ELEVATION OR SECTION NUMBER, E-201 INDICATES DRAWING SHEET WHERE ELEVATION OR SECTION IS SHOWN.
ROOM NAME 100	ROOM IDENTIFIER WITH ROOM NAME AND NUMBER.
1	KEYNOTE INDICATOR.
1	REVISION INDICATOR.
CU-1	EQUIPMENT INDICATOR.
X-X XMDP	MECHANICAL EQUIPMENT INDICATOR. "X-X" INDICATES EQUIPMENT MARK SHOWN ON EQUIPMENT SCHEDULE. "XMDP" IDENTIFIES PANEL EQUIPMENT IS CIRCUITED TO. REFER TO EQUIPMENT SCHEDULE FOR ADDITIONAL INFORMATION.
	BREAK, STRAIGHT: TO BREAK PARTS OF DRAWING
	BREAK, ROUND
MATCH LINE SEE XX/X-XXX	MATCH LINE INDICATOR: CENTER, EXTRA WIDE LINE.
	NEW LINE: MEDIUM LINE.
	HIDDEN FEATURES LINE: HIDDEN, THIN LINE
	EXISTING TO REMAIN LINE: THIN LINE.
	DEMOLITION LINE: DASHED, MEDIUM LINE
	PROPERTY LINE: DASHED, WIDE LINE.
WIRING METHODS	
	WIRING.
	WIRING TURNED UP OR TOWARDS OBSERVER.
	WIRING TURNED DOWN OR AWAY FROM OBSERVER.
A-1,3,5	BRANCH CIRCUIT HOME RUN TO PANELBOARD: NUMBER OF ARROWS INDICATES NUMBER OF CIRCUITS. LETTER AND NUMBER NOTATIONS IDENTIFY PANEL AND CIRCUIT NUMBERS. USE #12 CONDUCTORS, EXCEPT #10 CONDUCTORS SHALL BE INSTALLED IF DISTANCES EXCEED THOSE SPECIFIED IN THE ELECTRICAL SPECIFICATIONS.
1 A-1,3,5	BRANCH CIRCUIT HOME RUN TO PANELBOARD: NUMBER OF ARROWS INDICATES NUMBER OF CIRCUITS. LETTER AND NUMBER NOTATIONS IDENTIFY PANEL AND CIRCUIT NUMBERS. NUMBER IN BOX REFERS TO THE CONDUCTOR AND CONDUIT SCHEDULE. FOR BRANCH WIRING USE #12 CONDUCTORS, EXCEPT #10 CONDUCTORS SHALL BE INSTALLED IF DISTANCES EXCEED THOSE SPECIFIED IN THE ELECTRICAL SPECIFICATIONS.
	FLEXIBLE WIRING.
— X —	WIRING AND/OR RACEWAY: THIN LINE. WHERE "X" = : CATV = CABLE TELEVISION; NC = NURSE CALL CCTV = CLOSED CIRCUIT TELEVISION; P = POWER; RC = RIGID CONDUIT FA = FIRE ALARM; S = SOUND FO = FIBER OPTICS; T = TELEPHONE I = INTERCOM; TV = TELEVISION OTHERS AS NOTED IN OTHER SCHEDULES. RACEWAYS AND WIRING SHALL BE SIZED AS SHOWN AND/OR SPECIFIED.
	LOW VOLTAGE WIRING: DIVIDE, MEDIUM LINE.
	CONDUIT STUB. DIMENSION RECORD DRAWINGS AND MARK.
1	CONDUCTOR & CONDUIT ("CC") SCHEDULE INDICATOR. REFER TO ONE-LINE DIAGRAM.
HC	ADA ACCESS PUSH PLATE
	JUNCTION BOX.
PB	PULL BOX.
	EARTH GROUND (ONE-LINE DIAGRAM).
C	JUNCTION BOX, CEILING.
	MECHANICAL EQUIPMENT CONNECTION. REFER TO EQUIPMENT SCHEDULE FOR REQUIREMENTS.
STRUCTURED CABLING	
	DATA CONNECTION: WIRELESS ACCESS POINT (WAP). REQUIRES (2) DATA DROPS PER DEVICE
W	TELEPHONE, WALL MOUNTED: WALL PHONE.
X	OUTLET, DATA COMMUNICATION ("X" INDICATES QUANTITY OF CABLES).
	OUTLET, BUILDING STANDARD COMBINATION TELEPHONE/ DATA COMMUNICATION.
	TWO-WAY EMERGENCY COMMUNICATION DEVICE PER IBC, WALL MOUNTED IN RECESSED BOX.
	TELEPHONE TERMINAL BOARD, FIRE TREATED PLYWOOD PAINTED.
	LAN RACK, FLOOR STANDING.

ABBREVIATIONS

NOTE: ALL ABBREVIATIONS MAY NOT BE USED.

1P	SINGLE POLE
1PH	SINGLE-PHASE
1WAY	ONE-WAY
2/C	TWO-CONDUCTOR
2WAY	TWO-WAY
3/C	THREE-CONDUCTOR
3WAY	THREE-WAY
4OUT	QUADRUPLE RECEPTACLE OUTLET
4PDT	FOUR-POLE DOUBLE THROW
4PST	FOUR-POLE SINGLE THROW
4W	FOUR-WIRE
4WAY	FOUR-WAY
A	ABOVE COUNTER
AC	ARMORED CABLE
ADA	AMERICANS WITH DISABILITIES ACT
ADJ	ADJACENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AIC	AMPERE INTERRUPTING CAPACITY
ALUM	ALUMINUM
AMP	AMPERE
ANN	ANNUNCIATOR
AP	ACCESS POINT (WIRELESS DATA)
AR	AS REQUIRED
ASC	AMPS SHORT CIRCUIT
ATS	AUTOMATIC TRANSFER SWITCH
AV	AUDIO VISUAL
AWG	AMERICAN WIRE GAGE
BB XFMR	BUCK-BOOST TRANSFORMER
C	CEILING MOUNTED
CATV	COMMUNITY ANTENNA TELEVISION
CB	CIRCUIT BREAKER
CCBA	CUSTOM COLOR AS SELECTED BY ARCHITECT
CCTV	CLOSED CIRCUIT TELEVISION
CF/CI	CONTRACTOR FURNISHED/ CONTRACTOR INSTALLED
CF/OI	CONTRACTOR FURNISHED/ OWNER INSTALLED
CFBA	CUSTOM FINISH AS SELECTED BY ARCHITECT
CKT	CIRCUIT
CM	CONSTRUCTION MANAGER
CND	CONDUIT
CO	CONVENIENCE OUTLET
COR	CONTRACTING OFFICER'S REPRESENTATIVE
CP	CONTROL PANEL
CT	CURRENT TRANSFORMER
CTV	CABLE TELEVISION
CU	COPPER
dBA	UNIT OF SOUND LEVEL
DPDT	DOUBLE POLE, DOUBLE THROW
DS	DISCONNECT SWITCH
EA	EACH
EM	EMERGENCY
EMT	ELECTRICAL METALLIC TUBING
ENT	ELECTRIC NONMETALLIC TUBING
EPO	EMERGENCY POWER OFF
EQUIP	EQUIPMENT
EX	EXISTING
F	FURNITURE MOUNTED
FA	FIRE ALARM
FCP	FIRE ALARM CONTROL PANEL
FLA	FULL LOAD AMPS
FMC	FLEXIBLE METAL CONDUIT
FOB	FREIGHT ON BOARD
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
G	GROUND
GEN	GENERATOR
GFCI	GROUND FAULT INTERRUPTER
GFP	GROUND FAULT PROTECTION
HD	HEAVY DUTY
HID	HIGH INTENSITY DISCHARGE
HOA	HAND-OFF-AUTOMATIC
HP	HORSE POWER
HPF	HIGH POWER FACTOR
HPS	HIGH PRESSURE SODIUM
HV	HIGH VOLTAGE
HZ	HERTZ
I/O	INPUT/ OUTPUT
IG	ISOLATED GROUND
IMC	INTERMEDIATE METAL CONDUIT
IN/IS	INSULATED/ ISOLATED
IR	INFRARED
J-BOX	JUNCTION BOX
kV	KILOVOLT
kVA	KILOVOLT AMPERE
kVAR	KILOVOLT AMPERE REACTIVE
kW	KILOWATT
kWh	KILOWATT HOUR
LED	LIGHT EMITTING DIODE
LFMC	LIQUID TIGHT FLEXIBLE METAL CONDUIT
LFNC	LIQUID TIGHT FLEXIBLE NONMETALLIC CONDUIT
LPS	LOW PRESSURE SODIUM
LRA	LOCKED ROTOR AMPS
LTG	LIGHTING
LV	LOW VOLTAGE
MATV	MASTER ANTENNA TELEVISION SYSTEM
MAX	MAXIMUM
MC	METAL CLAD
MCA	MINIMUM CIRCUIT AMPS
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTION
MDP	MAIN DISTRIBUTION PANEL
MG	MOTOR GENERATOR
MH	MANHOLE
MIN	MINIMUM
MLO	MAIN LUGS ONLY
MOCP	MAXIMUM OVERCURRENT PROTECTION
NA	NOT APPLICABLE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIOANL ELECTRICAL MANUFACTURERS ASSOCIATION
NFC	NATIONAL FIRE CODE
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NIC	NOT IN CONTRACT
NL	NIGHT LIGHT
NO	NORMALLY OPEN
NTS	NOT TO SCALE
OC	ON CENTER
OCP	OVER CURRENT PROTECTION
OF/CI	OWNER FURNISHED/ CONTRACTOR INSTALLED
OF/OI	OWNER FURNISHED/ OWNER INSTALLED
OFP	OBTAIN FROM PLANS
OH DR	OVERHEAD (COILING) DOOR
OL	OVERLOAD
PB	PUSHBUTTON
PF	POWER FACTOR
PH	PHASE
PNL	PANEL
PT	POTENTIAL TRANSFORMER
PTZ	PAN/TILT/ZOOM
QTY	QUANTITY
R	REMOVE
RCP	REFLECTED CEILING PLAN
RMC	RIGID METAL CONDUIT
RNC	RIGID NONMETAL CONDUIT
RPM	REVOLUTIONS PER MINUTE
RR	REMOVE AND RELOCATE
S/S	START/STOP
SCA	SHORT CIRCUIT AMPS
SCBA	STANDARD COLOR AS SELECTED BY ARCHITECT
SF	SQUARE FOOT (FEET)
SFBA	STANDARD FINISH AS SELECTED BY ARCHITECT
SPDT	SINGLE POLE, DOUBLE THROW
SPEC	SPECIFICATION
SPST	SINGLE POLE, SINGLE THROW
ST	SINGLE THROW
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TL	TWIST LOCK
TP	TELEPHONE POLE
TP	TWISTED PAIR
TTB	TELEPHONE TERMINAL BOARD
TV	TELEVISION
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSER
TYP	TYPICAL
UF	UNDERFLOOR
UGND	UNDERGROUND
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLTS
VA	VOLT AMPERE
VFC/VFD	VARIABLE FREQUENCY MOTOR CONTROLLER
W/	WITH
W/O	WITHOUT
WP	WEATHERPROOF
XFMR	TRANSFORMER

GENERAL ELECTRICAL NOTES

1. CLARIFICATION METHODS: AT THE TIME OF BIDDING, BIDDERS SHALL FAMILIARIZE THEMSELVES WITH THE DRAWINGS AND SPECIFICATIONS. ANY QUESTIONS, MISUNDERSTANDINGS, CONFLICTS, DELETIONS, DISCONTINUED PRODUCTS, CATALOG NUMBER DISCREPANCIES, DISCREPANCIES BETWEEN THE EQUIPMENT SUPPLIED AND THE INTENT OR FUNCTION OF THE EQUIPMENT, ETC, SHALL BE SUBMITTED TO THE ARCHITECT/ENGINEER IN WRITING FOR CLARIFICATION PRIOR TO ISSUANCE OF THE FINAL ADDENDUM AND BIDDING OF THE PROJECT. WHERE DISCREPANCIES OR MULTIPLE INTERPRETATIONS OCCUR, THE MOST STRINGENT (WHICH IS GENERALLY RECOGNIZED AS THE MOST COSTLY) THAT MEETS THE INTENT OF THE DOCUMENTS SHALL BE ENFORCED.

2. OWNER FURNISHED ITEMS: THE OWNER WILL FURNISH MATERIAL AND EQUIPMENT AS INDICATED IN THE CONTRACT DOCUMENTS TO BE INCORPORATED INTO THE WORK. THESE ITEMS ARE ASSIGNED TO THE INSTALLER AND COSTS FOR RECEIVING, HANDLING, STORAGE, IF REQUIRED, AND INSTALLATION ARE INCLUDED IN THE CONTRACT SUM.

   A. THE INSTALLER'S RESPONSIBILITIES ARE THE SAME AS IF THE INSTALLER FURNISHED THE MATERIALS OR EQUIPMENT.

   B. THE OWNER WILL ARRANGE AND PAY FOR DELIVERY OF OWNER FURNISHED ITEMS FREIGHT ON BOARD JOB SITE AND THE INSTALLER WILL INSPECT DELIVERIES FOR DAMAGE. IF OWNER FURNISHED ITEMS ARE DAMAGED, DEFECTIVE OR MISSING, DOCUMENT DAMAGED ITEMS WITH THE TRANSPORT COMPANY AND THE OWNER WILL ARRANGE FOR REPLACEMENT. THE OWNER WILL ALSO ARRANGE FOR MANUFACTURER'S FIELD SERVICES, AND THE DELIVERY OF MANUFACTURER'S WARRANTIES AND BONDS TO THE INSTALLER.

   C. THE INSTALLER IS RESPONSIBLE FOR DESIGNATING THE DELIVERY DATES OF OWNER FURNISHED ITEMS AND FOR RECEIVING, UNLOADING AND HANDLING OWNER FURNISHED ITEMS AT THE SITE THE INSTALLER IS RESPONSIBLE FOR PROTECTING OWNER FURNISHED ITEMS FROM DAMAGE, INCLUDING DAMAGE FROM EXPOSURE TO THE ELEMENTS, AND TO REPAIR OR REPLACE ITEMS DAMAGED AS A RESULT OF HIS OPERATIONS.

3. EXPOSED STRUCTURE AREAS (EXCLUDING MECHANICAL, ELECTRICAL, AND COMMUNICATION SPACES): INSTALL RACEWAYS BETWEEN DECK AND STRUCTURE WHEREVER POSSIBLE IN EXPOSED STRUCTURE CEILING AREAS. ROUTE RACEWAYS IN CONCEALED AREAS WHEREVER POSSIBLE. REFER ALL CONDITIONS WHERE RACEWAYS MUST BE INSTALLED WHICH CANNOT COMPLY WITH THESE REQUIREMENTS TO THE ARCHITECT.

4. SUBMITTALS: PROVIDE ORIGINAL ELECTRONIC PDF FORMAT, BOUND, BOOKMARKED (EACH SECTION AND PRODUCT), AND HIGHLIGHTED. JOB NAME AND SUBCONTRACTOR SHALL BE ON THE FRONT COVER. PREPARE INDEX OF EQUIPMENT SUBMITTED IN EACH TAB.

5. REFLECTED CEILING PLANS: COORDINATE THE LOCATION OF LIGHT FIXTURES WITH THE ARCHITECTURAL REFLECTED CEILING PLANS. REFER ALL DISCREPANCIES TO THE ARCHITECT AND ENGINEER.

6. ALL WORK SHALL BE DONE ACCORDING TO THE CURRENT NATIONAL ELECTRIC CODE (NEC), IBC, NFPA, AND IFC. COMPLIANCE AND FINAL APPROVAL IS SUBJECT TO THE ON SITE FIELD INSPECTION OF THE AHJ.

DEFINITIONS

NOTE: ALL DEFINITIONS MAY NOT BE USED.

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.

DIRECTED: TERMS SUCH AS "DIRECTED", "REQUESTED", AUTHORIZED", "SELECTED", "APPROVED", "REQUIRED", AND "PERMITTED" MEAN "DIRECTED BY THE ENGINEER", "REQUESTED BY THE ENGINEER", AND SIMILAR PHRASES.

APPROVED: THE TERM "APPROVED", WHERE USED IN CONJUNCTION WITH THE ENGINEER'S ACTION ON THE CONTRACTOR'S SUBMITTALS, APPLICATIONS, AND REQUESTS, IS LIMITED TO THE ENGINEER'S DUTIES AND RESPONSIBILITIES AS STATED IN GENERAL AND SUPPLEMENTARY CONDITIONS.

FURNISH: THE TERM "FURNISH" IS USED TO MEAN "SUPPLY AND DELIVER TO THE PROJECT SITE, READY FOR UNLOADING, UNPACKING, ASSEMBLY, INSTALLATION, AND SIMILAR OPERATIONS."

INSTALL: THE TERM "INSTALL" IS USED TO DESCRIBE OPERATIONS AT PROJECT SITE INCLUDING THE ACTUAL "UNLOADING, UNPACKING, ASSEMBLY, ERECTION, PLACING, ANCHORING, APPLYING, WORKING TO DIMENSION, FINISHING, CURING, PROTECTING, CLEANING, AND SIMILAR OPERATIONS."

PROVIDE: THE TERM "PROVIDE" MEANS "TO FURNISH AND INSTALL, COMPLETE AND READY FOR THE INTENDED USE."

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.

TECHNOLOGY SYSTEMS: THE TERM "TECHNOLOGY SYSTEMS" IS USED TO DESCRIBE ALL LOW VOLTAGE SYSTEMS GENERALLY REFERRED TO AS "SPECIAL SYSTEMS". THESE SYSTEMS INCLUDE BUT ARE NOT NECESSARILY LIMITED TO ALL SYSTEMS WHICH UTILIZE VOLTAGES OF LESS THAN 71 VOLTS SUCH AS SOUND SYSTEMS, VIDEO SYSTEMS, TV SYSTEMS, SECURITY SYSTEMS, VOICE AND DATA CABLING SYSTEMS, ETC...

ELECTRICAL SHEET INDEX

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SHEET INDEX, ABBREVIATIONS, AND GENERAL NOTES

sheet:

EE001

100% CONSTRUCTION DOCUMENTS

SYMBOLS LEGEND

SYMBOL	DESCRIPTION
LIGHTING (REFER TO FIXTURE SCHEDULE FOR SYMBOLS)	
(W-3)	FIXTURE IDENTIFICATION: (W-3) INDICATES FIXTURE TYPE AS SCHEDULED.
(W-3)	FIXTURE IDENTIFICATION, EMERGENCY WITH BATTERY PACK, CONNECTED TO GENERATOR AS INDICATED: (W-3) INDICATES FIXTURE TYPE AS SCHEDULED.
EM	EMERGENCY.
NL	NIGHT LIGHT: DO NOT SWITCH.
	EGRESS DIRECTION ARROW (EXIT SIGNS).
	EXIT SIGN: SINGLE FACE; CEILING MOUNTED
	EXIT SIGN: SINGLE FACE; WALL MOUNTED
	EXIT SIGN: DOUBLE FACE; CEILING MOUNTED
	EXIT SIGN: DOUBLE FACE; WALL MOUNTED
LIGHTING CONTROL	
	OCCUPANCY SENSOR, DUAL TECHNOLOGY, OMNI-DIRECTIONAL, CEILING.
	OCCUPANCY SENSOR, DUAL TECHNOLOGY, DIRECTIONAL.
	VACANCY SENSOR, DUAL TECHNOLOGY, OMNI-DIRECTIONAL, CEILING.
	VACANCY SENSOR, DUAL TECHNOLOGY, WALL.
P	PHOTOCELL.
SITE ELECTRICAL AND COMMUNICATIONS UTILITIES	
—3ØUP—	ELECTRIC LINE: THIN LINE. 1Ø = SINGLE PHASE, 2Ø = 2-PHASE, 3Ø = 3-PHASE, O = OVERHEAD, U = UNDERGROUND, P = PRIMARY, S = SECONDARY
—○—	UTILITY POLE.
C	UTILITY, COMMUNICATIONS MANHOLE.
E	UTILITY, ELECTRICAL MANHOLE.
T	TRANSFORMER.
WIRING DEVICES	
	RECEPTACLE, DUPLEX: NEMA 5-20R.
A	RECEPTACLE, DUPLEX, ABOVE COUNTER: NEMA 5-20R.
C	RECEPTACLE, DUPLEX, CEILING: NEMA 5-20R.
DF	RECEPTACLE, DUPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER, DRINKING FOUNTAIN: CONCEAL WATER COOLER RECEPTACLE BEHIND WATER COOLER. SEE MECHANICAL/PLUMBING SHOP DRAWINGS FOR INSTALLATION REQUIREMENTS.
W	RECEPTACLE, DUPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER, WET LABEL, "WEATHERPROOF IN USE": NEMA 5-20R.
WP	RECEPTACLE, DUPLEX, WEATHERPROOF: NEMA 5-20R.
	RECEPTACLE, DUPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER: NEMA 5-20R.
WP	RECEPTACLE, DUPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER, WEATHERPROOF: NEMA 5-20R.
	RECEPTACLE, QUADRAPLEX: NEMA 5-20R.
	RECEPTACLE, QUADRAPLEX WITH GROUND FAULT CIRCUIT INTERRUPTER: NEMA 5-20R.
	RECEPTACLE, SPECIAL PURPOSE. PROVIDE RECEPTACLE TO MATCH EQUIPMENT PLUG.
	MULTI-OUTLET ASSEMBLY: NEMA 5-20R.
FB#	FLUSH FLOOR BOX. "#" SHOWN ON DRAWINGS. REFER TO WIRING DEVICE SCHEDULE IN THE ELECTRICAL SPECIFICATIONS FOR CONFIGURATION AND DEVICES.
PT#	FLUSH FIRE RATED POKE THRU. "#" SHOWN ON DRAWINGS. REFER TO WIRING DEVICE SCHEDULE IN THE ELECTRICAL SPECIFICATIONS FOR CONFIGURATION AND DEVICES.
	SWITCH, DIMMER.
X $	SWITCH, SINGLE POLE ("x" INDICATES FIXTURES CONTROLLED).
X $3	SWITCH, THREE-WAY ("x" INDICATES FIXTURES CONTROLLED).
X $4	SWITCH, FOUR-WAY ("x" INDICATES FIXTURES CONTROLLED).
$K	SWITCH, KEY OPERATED.
$T	SWITCH, TIMER OPERATED.
$WP	SWITCH, WEATHERPROOF.
	RECEPTACLE, SINGLE PLEX, WITH USB OUTLET

SYMBOLS LEGEND

SYMBOL	DESCRIPTION
FIRE ALARM	
FSA	FIRE SYSTEM ANNUNCIATOR.
FCP	FIRE ALARM CONTROL PANEL, SEMI-RECESSED.
FPS	FIRE ALARM NOTIFICATION POWER SUPPLY.
FTR	FIRE ALARM TRANSPONDER OR TRANSMITTER.
CM	CONTROL MODULE.
MM	MONITOR MODULE.
P	FIRE ALARM MANUAL PULL STATION.
R	SHUT DOWN RELAY: INSTALL RELAY IN CONTROL CIRCUIT OF EQUIPMENT TO BE CONTROLLED IN THE EVENT OF A FIRE.
	MAGNETIC DOOR HOLDER.
	DETECTOR, SMOKE.
E	DETECTOR, SMOKE, ELEVATOR RECALL DESIGNATION.
	DETECTOR, SMOKE, DUCT WITH HOUSING AND SAMPLING TUBE.
	DETECTOR, HEAT.
75	STROBE. SUBSCRIPT INDICATES CANDELA RATING.
WP	ALARM, HORN/SPEAKER, WEATHERPROOF.
	ALARM, HORN/STROBE, ONE ASSEMBLY.
75	ALARM, HORN/STROBE, ONE ASSEMBLY. SUBSCRIPT INDICATES CANDELA RATING.
	DETECTOR, FLOW SWITCH: FLOW SWITCHES SHALL BE PROVIDED AND INSTALLED WITH FIRE SPRINKLER SYSTEM AND SHALL BE CONNECTED TO LOCATIONS SHOWN ON THE FIRE SPRINKLER SHOP DRAWINGS.
	DETECTOR, TAMPER SWITCH WITH VALVE: TAMPER SWITCHES SHALL BE PROVIDED AND INSTALLED WITH FIRE SPRINKLER SYSTEM AND SHALL BE CONNECTED TO LOCATIONS SHOWN ON THE FIRE SPRINKLER SHOP DRAWINGS.
SD	SMOKE DAMPER.
FSD	FIRE AND SMOKE DAMPER.
	BELL (GONG).
75	ALARM, HORN/STROBE, ONE ASSEMBLY, CEILING MOUNTED. SUBSCRIPT INDICATES CANDELA RATING.
75	ALARM, HORN, CEILING MOUNTED. SUBSCRIPT INDICATES CANDELA RATING.
75	ALARM, STROBE, CEILING MOUNTED. SUBSCRIPT INDICATES CANDELA RATING.

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SYMBOLS LEGEND

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EE002

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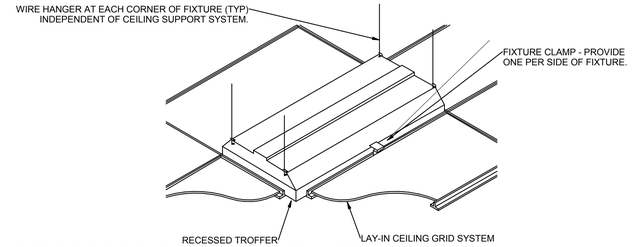
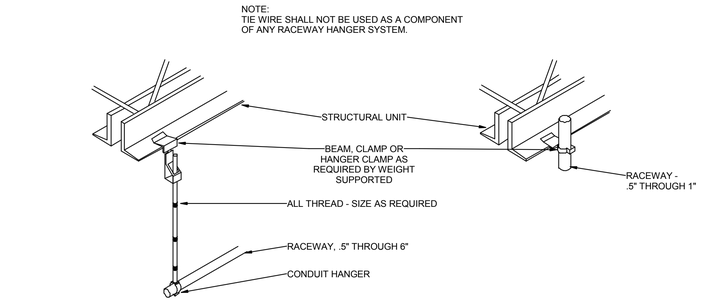


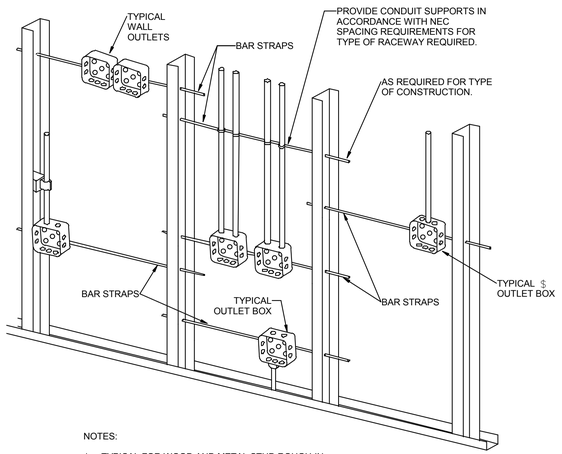
3 RECESSED FIXTURE MOUNTING DETAIL

SCALE: 1/8" = 1'-0"



2 TYPICAL RACEWAY SUPPORT METHODS DETAIL

SCALE: 1/8" = 1'-0"

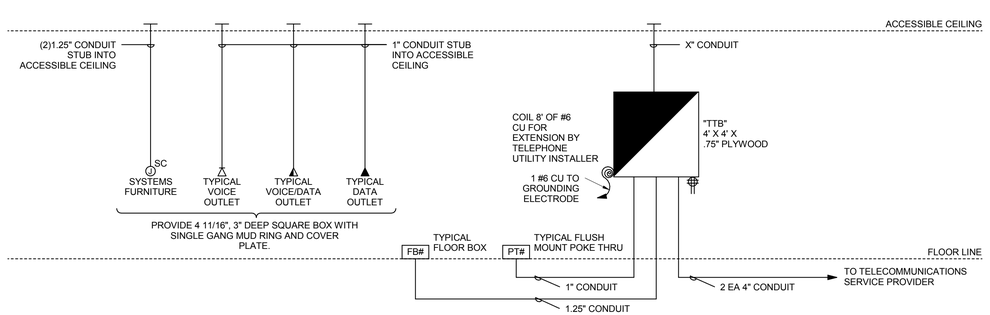


NOTES:

1. TYPICAL FOR WOOD AND METAL STUD ROUGH-IN.
2. PLASTER RINGS NOT SHOWN.
3. LOCATE ALL OUTLET BOXES IN ACCORDANCE WITH ARCHITECTURAL AND MECHANICAL DRAWINGS AND WITH ALL APPLICABLE SHOP DRAWINGS.
4. IN ACCORDANCE WITH IBC 714.3.2 EXCEPTION 1, OUTLETS ON OPPOSITE SIDES OF WALLS OR PARTITIONS IN THE SAME STUD SPACE IN A RATED FIRE SEPARATION WALL MUST BE SEPARATED BY A MINIMUN OF 24" HORIZONTAL DISTANCE.
5. IN NON-RATED WALLS, OUTLETS ON OPPOSITE SIDES OF WALLS OR PARTITIONS MUST BE SEPARATED BY 16" FOR SOUND ATTENUATION.

4 TYPICAL ROUGH-IN REQUIREMENTS DETAIL

SCALE: 1/8" = 1'-0"



1 VOICE/DATA RISER DIAGRAM

SCALE: 1/8" = 1'-0"

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project:

LAS COLONIAS AMPHITHEATER

Grand Junction, CO

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ELECTRICAL DETAILS

sheet:

EE501

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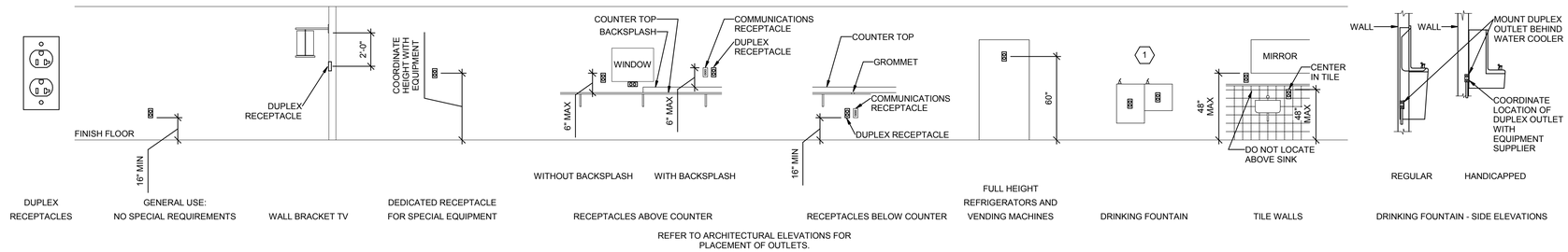
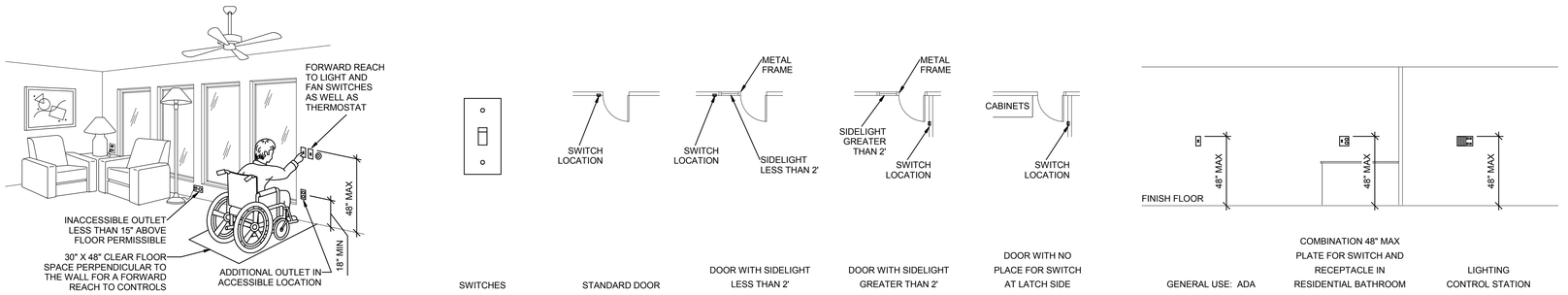


DUPLEX RECEPTACLES | GENERAL USE: NO SPECIAL REQUIREMENTS | WALL BRACKET TV | DEDICATED RECEPTACLE FOR SPECIAL EQUIPMENT | WITHOUT BACKSPLASH | WITH BACKSPLASH | RECEPTACLES ABOVE COUNTER | RECEPTACLES BELOW COUNTER | FULL HEIGHT REFRIGERATORS AND VENDING MACHINES | DRINKING FOUNTAIN | TILE WALLS | REGULAR | HANDICAPPED | DRINKING FOUNTAIN - SIDE ELEVATIONS

REFER TO ARCHITECTURAL ELEVATIONS FOR PLACEMENT OF OUTLETS.

D1 RECEPTACLE MOUNTING DETAILS

SCALE: NTS



SWITCHES | STANDARD DOOR | DOOR WITH SIDELIGHT LESS THAN 2' | DOOR WITH SIDELIGHT GREATER THAN 2' | DOOR WITH NO PLACE FOR SWITCH AT LATCH SIDE | GENERAL USE: ADA | COMBINATION 48" MAX PLATE FOR SWITCH AND RECEPTACLE IN RESIDENTIAL BATHROOM | LIGHTING CONTROL STATION

C2 ADA DETAIL

SCALE: NTS

C1 SWITCH MOUNTING DETAILS

SCALE: NTS

GENERAL SHEET NOTES

1. DETERMINE MOUNTING HEIGHTS OF ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE FOLLOWING ORDER OF PRIORITY:

   1 - ELEVATIONS (ARCHITECTURAL, ELECTRICAL, MECHANICAL, ETC).

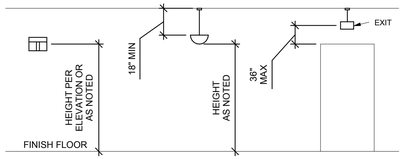
   2 - EQUIPMENT SHOP DRAWINGS.

   3 - FIELD INSTRUCTIONS.

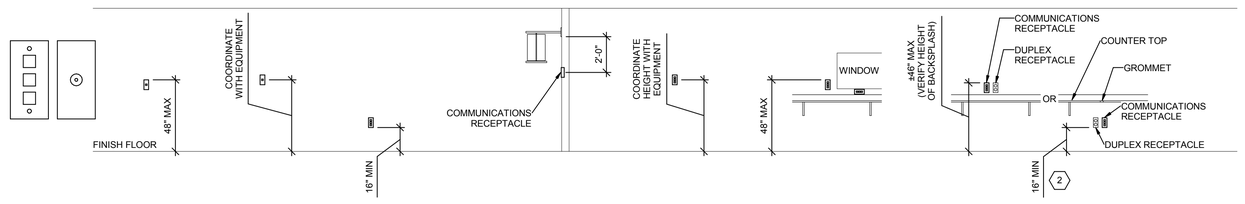
2. LOCATE RECEPTACLES SERVING THE SAME TYPE OF USE AT A UNIFORM HEIGHT UNLESS DIRECTED OTHERWISE.
3. MECHANICAL, ELECTRICAL, AND COMMUNICATION ROOMS: COORDINATE LOCATION OF LIGHTING AND POWER RECEPTACLES WITH EQUIPMENT, PIPING, AND DUCTWORK. DO NOT INSTALL RECEPTACLES BEHIND EQUIPMENT OR WHERE OTHERWISE INACCESSIBLE. POSITION LIGHTING REGARDLESS OF WHERE SHOWN ON DRAWING TO PROVIDE PROPER ILLUMINATION.
4. MOUNT RECEPTACLE BOXES FOR SWITCHES AND RECEPTACLES WITH LONG AXIS OF THE DEVICE VERTICAL UNLESS OTHERWISE INDICATED.
5. SET BOXES WITH PLASTER RINGS FLUSH WITH FINISHED SURFACE.
6. LOCATE BOX COVERS OR DEVICE PLATES SO THEY WILL NOT SPAN DIFFERENT TYPES OF BUILDING FINISHES EITHER VERTICALLY OR HORIZONTALLY.
7. VERIFY ALL DOOR CONDITIONS ON ARCHITECTURAL DRAWINGS PRIOR TO INSTALLING SWITCHES.
8. LOCATE WIREING DEVICES WHICH ARE ADJACENT AND ARE COMPATIBLE VOLTAGES IN ONE PLATE.
9. WHERE DEVICES ARE LOCATED IN CLOSE PROXIMITY OF THE SAME VERTICAL PLANE, ALIGN DEVICES VERTICALLY PER THE TYPICAL WALL MOUNTED DEVICES ALIGNMENT DETAIL, UNLESS OTHERWISE INDICATED.

SHEET KEYNOTES

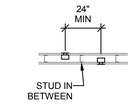
1. LOCATE RECEPTACLES BEHIND DRINKING FOUNTAINS.
2. REFER TO ARCHITECTURAL ELEVATIONS FOR PLACEMENT OF OUTLETS.
3. LOCATE AT BOTTOM OF BEAMS (OR JOISTS) OR AT CEILING. (REDUCE SPACING BY .5 PERPENDICULAR TO BEAM OR JOIST DIRECTION.) FOR OTHER CONDITIONS, REFER TO NFPA 72.
4. LOCATE DETECTOR ANYWHERE IN SHADED AREA BUT NOT IN TOP 4" OF PEAK.
5. LOCATE AT BOTTOM OF BEAMS IF D/H < .1 OR W/H < .4; OTHERWISE, LOCATE IN BEAM POCKET. FOR D > 4 REDUCE SPACING .33 PERPENDICULAR TO BEAMS.



WALL MOUNTED LIGHT FIXTURE | PENDANT LIGHT FIXTURE | PENDANT EXIT SIGNS



COMMUNICATION RECEPTACLES | WALL PHONE | PAY PHONE | GENERAL USE: NO SPECIAL REQUIREMENTS | WALL BRACKET TV | DEDICATED RECEPTACLE FOR SPECIAL EQUIPMENT | ABOVE COUNTER - TYPICAL | RECEPTACLES ABOVE OR BELOW COUNTER



BOXES ON OPPOSITE SIDES OF WALL

B3 LIGHTING MOUNTING DETAILS

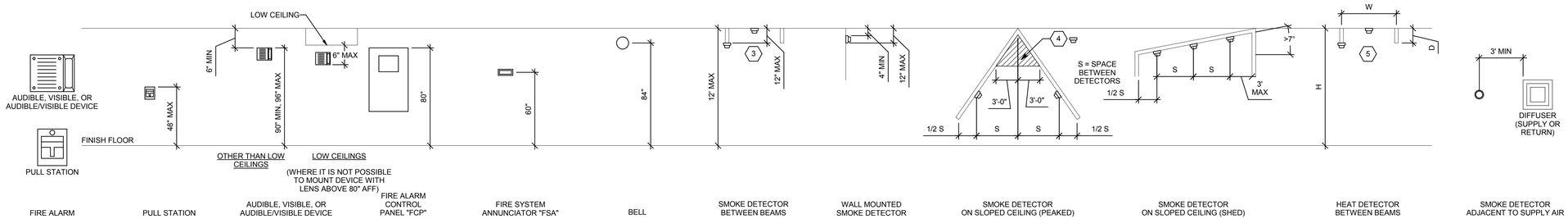
SCALE: NTS

B2 COMMUNICATIONS MOUNTING DETAILS

SCALE: NTS

B1 BOX MOUNTING DETAILS

SCALE: NTS



FIRE ALARM | PULL STATION | AUDIBLE, VISIBLE, OR AUDIBLE/VISIBLE DEVICE | FIRE ALARM CONTROL PANEL "FCP" | FIRE SYSTEM ANNUNCIATOR "FSA" | BELL | SMOKE DETECTOR BETWEEN BEAMS | WALL MOUNTED SMOKE DETECTOR | SMOKE DETECTOR ON SLOPED CEILING (PEAKED) | SMOKE DETECTOR ON SLOPED CEILING (SHED) | HEAT DETECTOR BETWEEN BEAMS | SMOKE DETECTOR ADJACENT TO SUPPLY AIR

A1 FIRE ALARM MOUNTING DETAILS

SCALE: NTS

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project#: 14.0650
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title:

TYPICAL MOUNTING HEIGHT DETAILS

sheet:

EE701

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GENERAL SHEET NOTES

1. DETERMINE MOUNTING HEIGHTS OF ELECTRICAL AND ELECTRONIC EQUIPMENT IN THE FOLLOWING ORDER OF PRIORITY:

   1 - ELEVATIONS (ARCHITECTURAL, ELECTRICAL, MECHANICAL, ETC).

   2 - EQUIPMENT SHOP DRAWINGS.

   3 - FIELD INSTRUCTIONS.

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5. SET BOXES WITH PLASTER RINGS FLUSH WITH FINISHED SURFACE.

6. LOCATE BOX COVERS OR DEVICE PLATES SO THEY WILL NOT SPAN DIFFERENT TYPES OF BUILDING FINISHES EITHER VERTICALLY OR HORIZONTALLY.

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8. LOCATE WIREING DEVICES WHICH ARE ADJACENT AND ARE COMPATIBLE VOLTAGES IN ONE PLATE.

9. WHERE DEVICES ARE LOCATED IN CLOSE PROXIMITY OF THE SAME VERTICAL PLANE, ALIGN DEVICES VERTICALLY PER THE TYPICAL WALL MOUNTED DEVICES ALIGNMENT DETAIL, UNLESS OTHERWISE INDICATED.

SHEET KEYNOTES

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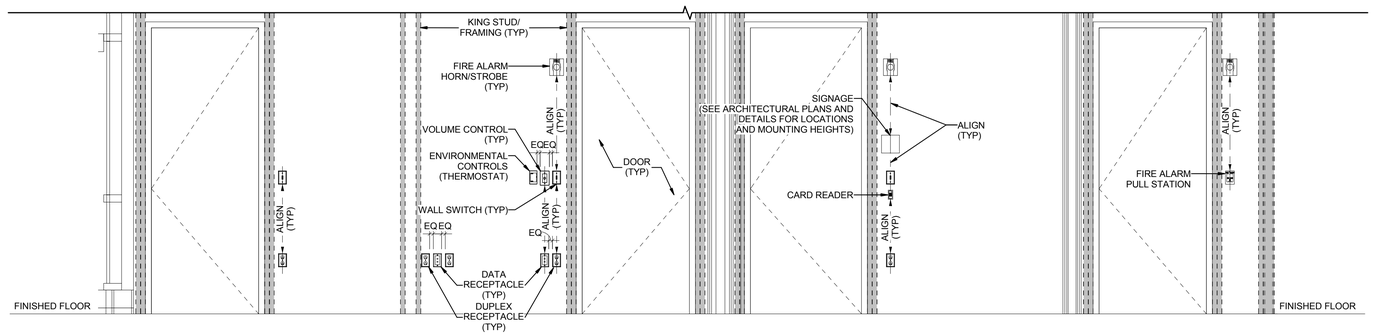

A2 TYPICAL WALL MOUNTED DEVICES ALIGNMENT DETAIL
SCALE: NTS

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TYPICAL MOUNTING HEIGHT DETAILS

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EE702

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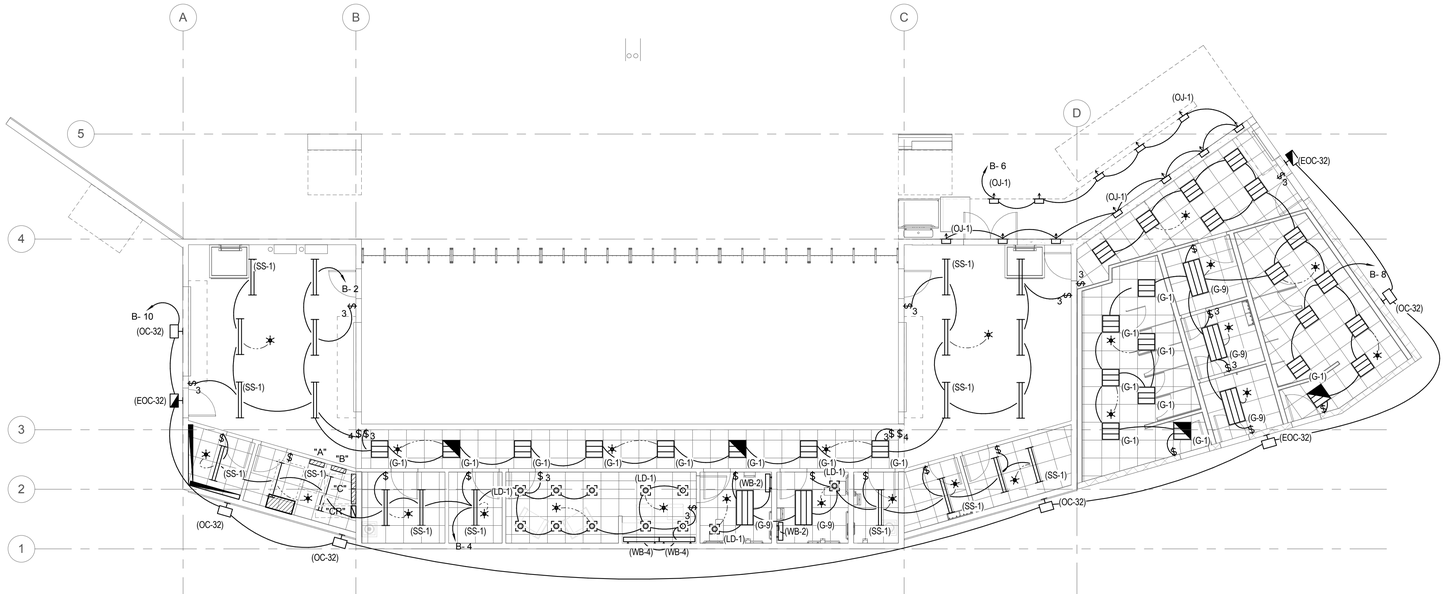
GENERAL SHEET NOTES

⎔ SHEET KEYNOTES



1 STAGE LEVEL LIGHTING PLAN

SCALE: 1/8" = 1'-0"

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Grand Junction, CO

project#: 14.0650
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STAGE LEVEL LIGHTING PLAN

sheet:

EL101

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INTERIOR LIGHTING FIXTURE SCHEDULE

ABBREVIATIONS

LUMINAIRE OPTIONS

ARHR - AIR RETURN AND HEAT REJECTION
DL - DAMP LOCATION
EQC - EARTHQUAKE CLIPS
F - FUSING
HLD - HINGED AND LATCHED DOOR
HS - HOUSE SIDE SHIELD
PS - PHOTOCELL SWITCH
QRS - QUARTZ RESTRIKE
ST - STATIC
WG - WIRE GUARD
WL - WET LOCATION

MOUNTING

B - BASE
C - CEILING
F - FLANGE
G - GRID
P - PENDANT
PL - POLE
R - RECESSED
S - SURFACE
W - WALL

EMERGENCY

NE - NORMAL AND EMERGENCY CONNECTIONS
EB - EMERGENCY BATTERY PACK
ET - EMERGENCY TRANSFER DEVICE

BALLAST

IS - INSTANT START
RS - RAPID START
PS - PROGRAM START, PARALLEL LAMP OPERATION
PSMH - PULSE START METAL HALLIDE (CWA OR ELECTRONIC)
PPLF - PROVIDE POWER LINE FILTER
LVTM - LOW VOLTAGE TRANSFORMER (MAGNETIC)
LVTE - LOW VOLTAGE TRANSFORMER (ELECTRONIC)

DIMMING BALLAST

D2 - 2 WIRE DIMMER
D3 - 3 WIRE DIMMER
D4 - 4 WIRE DIMMER
DD - DIGITAL DIMMER
SDP - STEP DIMMER BALLAST

BALLAST NOTATION

ANSI WATTS = Maximum Wattage at Connected Voltage
BB-#L: BB = Ballast Type, #L = Number of Lamps
Example: PS-2L = (2) Lamp, Program Start Ballast

FINISH

MW - MATTE WHITE
BL - BLACK
SL - SILVER
GL - GOLD
CL - CLEAR
PW - PAINTED WHITE
EA - EXTRUDED ALUMINUM
S - STEEL
GS - GALVANIZED STEEL
C - CAST
CBA - COLOR BY ARCHITECT
SCBA - STANDARD COLOR BY ARCHITECT
CCA - CUSTOM COLOR BY ARCHITECT
FS 209D - MEETS FEDERAL STANDARD 209D
TP - THERMALLY PROTECTED
FL - FLUSH
R - REGRESS
M - MITERED

LENS

#A - ACRYLIC #THICK
#OA - ACRYLIC #THICK (OPAL)
GC - GLASS (CLEAR)
GO - GLASS (OPAL)
GF - GLASS (FROSTED)
SGL - SOFT GLOW LENS
HPL - HIGH PERFORMANCE LENS
DO - DROP OPAL
CGL - CONVEX GLASS LENS
S - SATIN LENS

OPTICS

PRF - PERFORATED DIFFUSER
DT - DETENTION
BC - BLACK CONE
BB - BLACK BAFFLE
WB - WHITE BAFFLE
VGL - VERTICAL GRAIN LOUVERS
PPL - LOUVERS IN PLASTIC PROTECTOR
WW - WALL WASH
ESL - ELECTROSTATIC SHIELDED LENS

REFLECTOR

OP - NONE/OPEN
SP - SPECULAR
SS - SEMI-SPECULAR
D - DIFFUSE (WHITE ENAMEL)
SC - SPECULAR (COLORED)
PR - PRISMATIC
FDR - FULL DEPTH REFLECTOR
DS - DIFFUSE (SEMI SPECULAR) SILVER
LI - LOW IRIDESCENT
IR - IRIDESCENT
SL - SILVER
GL - GOLD
CA - CLEAR ALZAK

CIE CLASSIFICATIONS

DIR - DIRECT LIGHTING
SD - SEMIDIRECT LIGHTING
GEN - GENERAL DIFFUSE
SI - SEMI-INDIRECT LIGHTING
IND - INDIRECT LIGHTING
ADJ - ADJUSTABLE

NOTES

1. PROVIDE UNIT PRICES AND FIXTURE BRAND SELECTED FOR ADD/DELETE CHANGES FOR EACH FIXTURE TYPES SHOWN WITHIN 48 BUSINESS HOURS OF THE BID DATE. FAILURE TO COMPLY WITH THIS REQUIREMENT MAY DISQUALIFY THE PRODUCTS AND EMPOWER THE ENGINEER TO DETERMINE FAIR VALUE FOR FIXTURE AND INSTALLATION CHANGES, WITHOUT FURTHER INPUT FROM THE CONTRACTOR OR INSTALLER.
2. CONTRACTOR ALLOWANCE PRICES ARE ACCURATE WHEN THIS JOB WAS SPECIFIED, CONTRACTOR AND ELECTRICAL DISTRIBUTOR SHALL VERIFY THIS ALLOWANCE AND REPORT ANY PROBLEMS TO THE ENGINEER BEFORE THE BID. ALLOWANCE PRICE MAY OR MAY NOT INCLUDE LAMP(S) OR FREIGHT AS NOTED, AND DO NOT INCLUDE ANY TAXES.

1. VERIFY THE PROPER MOUNTING KITS OR ACCESSORIES TO FACILITATE INSTALLATION AS SHOWN AT EACH LOCATION ON THE DRAWINGS.
2. COMPLY WITH THE "INTERIOR LIGHTING" SECTION OF THE SPECIFICATIONS.
3. REFER TO SPECIFICATIONS FOR IMPORTANT TECHNICAL REQUIREMENTS FOR LIGHTING FIXTURES, BALLASTS, AND LAMPS.
4. ALL FIXTURES SHALL BE APPROVED BY UL OR ANOTHER ACCEPTABLE TESTING LAB FOR THE PURPOSE INTENDED AND WITH THE LAMP AND BALLAST PROPOSED.

LIGHTING FIXTURE SCHEDULE - INTERIOR

	LUMINAIRE							LAMP				BALLAST						FINISH			OPTICS						MANUFACTURER (CATALOG SERIES)					
		NOMINAL SIZE											CONNECTED																			
ID	TYPE	LENGTH	WIDTH	MAX DEPTH	DIAMETER/ APERTURE	MOUNTING	OPTIONS	TYPE	LAMP COLOR	QUANTITY	LAMP LUMENS	CONFIGURATION	VOLTAGE	VOLTS	WATTS	BALLAST FACTOR	HARMONICS (THD)	OPTIONS	HOUSING	TRIM	OTHER	CIE TYPE	FINISH	DIFFUSER	REFLECTOR	LUMINAIRE LUMENS	OPTIONS	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5	OPTION 6
(G-1)	2' X 2' LED INDIRECT LAY-IN TROFFER, 4000 LUMENS, 4000K	24"	24"	6"	-	CRG	EQC,HLD,ST	LED	4000K	1	4000	LED DRIVER	120/277	120	35	0.00	-									4000		LITHONIA (2ALL2-40L-EZ1-LP840)	METALUX (22GZ-LD4-39-UNV-L840-CD1-U/EQ-CLIP-U)	LUMENWERX (VEGR22-MTO-HLO-LED-80-4200-40-277-1-TBX-SCBA)	H.E. WILLIAMS (AT1-22-L40/840-D-DRV-UNV)		
(G-9)	2' X 4' LED INDIRECT LAY-IN TROFFER, 4800 LUMENS, 3500K	48"	24"	6"	-	C,R,G	EQC,HLD,ST	LED	3500K	1	4800	LED DRIVER	120/277	120	49	1.00										4800		COLUMBIA (LCAT-24-35-HL-G-ES-D-U)					
(LD-1)	LED DOWNLIGHT, 6" OPEN.	15"	15"	12"	6"	C,R	ST	LED	3500K	1	1500	LED DRIVER (0-10V DIMMING)	120V	120	25	1.00										1500		PORTFOLIIO (LD6A15DE010 ERM6A15840 6LM1LI-HB26)	VANTAGE	PRESCOLITE	BRUCK	GOTHAM	OMEGA
(SS-1)	GENERAL PURPOSE LED STRIP	48"	9"	5"	-	CS,P	ST	LED	4000K	1	3800	LED DRIVER	120/277	120	64	1.00										2926		DAY-BRITE (LF-4-EZ-38-40-U-LAG)					
(WB-2)	DECORATIVE WALL MOUNT VANITY LIGHT	2'						LED	3000K	1	1400	LED DRIVER	120V	120	20	1.00										1400		ALW (TRPSMBINT-2'-LOW-0/10V-SCBA-UNV)					
(WB-4)	DECORATIVE WALL MOUNT VANITY LIGHT	4'						LED	3000K	1	2800	LED DRIVER	120V	120	40	1.00										2800		ALW (TRPSMBINT-4'-LOW-0/10V-SCBA-UNV)					

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INTERIOR LIGHTING FIXTURE SCHEDULE

sheet:
EL601

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EXTERIOR LIGHTING FIXTURE SCHEDULE

ABBREVIATIONS

LUMINAIRE

ARHR - AIR RETURN AND HEAT REJECTION
DL - DAMP LOCATION
EQC - EARTHQUAKE CLIPS
F - FUSING
HLD - HINGED AND LATCHED DOOR
HS - HOUSE SIDE SHIELD
PS - PHOTOCELL SWITCH
QRS - QUARTZ RESTRIKE
ST - STATIC
WG - WIRE GUARD
WL - WET LOCATION

EMERGENCY

NE - NORMAL AND EMERGENCY CONNECTIONS
EB - EMERGENCY BATTERY PACK
ET - EMERGENCY TRANSFER DEVICE

BALLAST

IS - INSTANT START
RS - RAPID START
PS - PROGRAM START, PARALLEL LAMP OPERATION
PSMH - PULSE START METAL HALLIDE (CWA OR ELECTRONIC)
PPLF - PROVIDE POWER LINE FILTER
LVTM - LOW VOLTAGE TRANSFORMER (MAGNETIC)
LVTE - LOW VOLTAGE TRANSFORMER (ELECTRONIC)

DIMMING BALLAST

D2 - 2 WIRE DIMMER
D3 - 3 WIRE DIMMER
D4 - 4 WIRE DIMMER
DD - DIGITAL DIMMER
SDP - STEP DIMMER BALLAST

FINISH

MW - MATTE WHITE
BL - BLACK
SL - SILVER
GL - GOLD
CL - CLEAR
PW - PAINTED WHITE
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SCBA - STANDARD COLOR BY ARCHITECT
CCA - CUSTOM COLOR BY ARCHITECT
FS 209D - MEETS FEDERAL STANDARD 209D
TP - THERMALLY PROTECTED
FL - FLUSH
R - REGRESS
M - MITERED

LENS

#A - ACRYLIC #THICK
#OA - ACRYLIC #THICK (OPAL)
GC - GLASS (CLEAR)
GO - GLASS (OPAL)
GF - GLASS (FROSTED)
SGL - SOFT GLOW LENS
HPL - HIGH PERFORMANCE LENS
DO - DROP OPAL
CGL - CONVEX GLASS LENS
S - SATIN LENS

REFLECTOR AND DISTRIBUTION

I - TYPE I
II - TYPE II
III - TYPE III
IV - TYPE IV
V - TYPE V
VSQ - TYPE V SQUARE
SA - SPUN ALLUMINUM
SR - SEGMENTED REFLECTOR
BW# - NEMA BEAM WIDTH 1 THRU 7

CUTOFF CLASSIFICATION

FC - FULL CUTOFF
CO - CUTTOFF
SC - SEMI CUTOFF
NC - NONCUTOFF

MOUNTING

B - BASE
C - CEILING
F - FLANGE
G - GRID
P - PENDANT
PL - POLE
R - RECESSED
S - SURFACE
W - WALL

POLE

RS - ROUND STRAIGHT
RT - ROUND TAPERED
SS - SQUARE STRAIGHT
ST - SQUARE TAPERED

CONFIGURATION

BA - BANNER ARMS
BH - BULL HORN
DL - 2 "L" SHAPE
DS - 2 @ 180
PT - INLINE POST TOP
Q - QUAD
SH - SHEPHERDS HOOK
SL - SINGLE
T - 3 "T" SHAPE

NOTES

1. PROVIDE UNIT PRICES AND FIXTURE BRAND SELECTED FOR ADD/DELETE CHANGES FOR EACH FIXTURE TYPES SHOWN WITHIN 48 BUSINESS HOURS OF THE BID DATE. FAILURE TO COMPLY WITH THIS REQUIREMENT MAY DISQUALIFY THE PRODUCTS AND EMPOWER THE ENGINEER TO DETERMINE FAIR VALUE FOR FIXTURE AND INSTALLATION CHANGES, WITHOUT FURTHER INPUT FROM THE CONTRACTOR OR INSTALLER.
2. CONTRACTOR ALLOWANCE PRICES ARE ACCURATE WHEN THIS JOB WAS SPECIFIED, CONTRACTOR AND ELECTRICAL DISTRIBUTOR SHALL VERIFY THIS ALLOWANCE AND REPORT ANY PROBLEMS TO THE ENGINEER BEFORE THE BID. ALLOWANCE PRICE MAY OR MAY NOT INCLUDE LAMP(S) OR FREIGHT AS NOTED, AND DO NOT INCLUDE ANY TAXES.

1. VERIFY THE PROPER MOUNTING KITS OR ACCESSORIES TO FACILITATE INSTALLATION AS SHOWN AT EACH LOCATION ON THE DRAWINGS.
2. COMPLY WITH THE "EXTERIOR LIGHTING" SECTION OF THE SPECIFICATIONS.
3. REFER TO SPECIFICATIONS FOR IMPORTANT TECHNICAL REQUIREMENTS FOR LIGHTING FIXTURES, BALLASTS, AND LAMPS.
4. ALL FIXTURES SHALL BE APPROVED BY UL OR ANOTHER ACCEPTABLE TESTING LAB FOR THE PURPOSE INTENDED AND WITH THE LAMP AND BALLAST PROPOSED.

		LUMINAIRE								LAMP					BALLAST					FINISH			DIFFUSER				REFLECTOR			MOUNTING						MANUFACTURER (CATALOG SERIES)			
		BUG RATING			SIZE (NOMINAL)																																		
ID	TYPE	BACK	UP	GLARE	LENGTH	WIDTH	DEPTH	DIAMETER/ APERTURE	OPTIONS	COLOR	TYPE	INITIAL LUMENS @ 1.0BF	QUANTITY	LUMENAIRE LUMENS	INPUT VOLTS	ANSI WATTS	BALLAST FACTOR	HARMONICS	OPTIONS	HOUSING	TRIM	OTHER	TYPE	FINISH	CONFIGUARTION	OPTIONS	DISTRIBUTION TYPE	FINISH	EFFICIENCY	TYPE	CONFIGURATION	POLE BASE HEIGHT	POLE HEIGHT	WIND RATING	OPTIONS	OPTION 1	OPTION_2	OPTION 3	ALLOWANCE
(EOC-32)	EXTERIOR EGRESS WALL PACK, WITH REMOTE BATTERY PACK.				11"	9"	7"			4000K		4400	1	4400	120	41	1.00												0			0' - 0"	0' - 0"			EATON (XTOR5A-PC1-CBP-REMOTE BATTERY)			
(OC-32)	EXTERIOR EGRESS WALL PACK.				11"	9"	7"			4000K		4400	1	4400	120	41	1.00												0			0' - 0"	0' - 0"			EATON (XTOR5A-PC1-CBP)			
(OJ-1)	RECESSED DIE-CAST OR EXTRUDED ALUMINUM STEPLIGHT.				16"	5"	4"			4000K	LED	36	1	36	120	15	1.00												0			0' - 0"	0' - 0"			BEGA (22-039-K4)			
(ZX-1)	SHOE-BOX STYLE, CUTOFF SINGLE HEAD				32"	18"	7"			4000K	LED	13042	1	13042	208	200	1.00	-										III		0			3' - 0"	27' - 0"			GARDCO (GL18-2-4-200LA-CW-UNV-SCBA) - POLE GARDCO (SRS-30H-5.0-BRP)			
(ZX-1D)	SHOE-BOX STYLE, CUTOFF SINGLE HEAD				32"	18"	7"			4000K	LED	13042	1	13042	208	200	1.00	-										III		0			3' - 0"	27' - 0"			GARDCO (GL18-2-4-200LA-CW-UNV-SCBA) - POLE GARDCO (SRS-30H-5.0-BRP)			
(ZX-4)	SHOE-BOX STYLE, CUTOFF SINGLE HEAD				32"	18"	7"			4000K	LED	13042	1	13042	208	200	1.00	-										III		0			3' - 0"	27' - 0"			GARDCO (GL18-2-4-200LA-CW-UNV-SCBA) - POLE GARDCO (SRS-30H-5.0-BRP)			
(ZX-4D)	SHOE-BOX STYLE, CUTOFF DUAL HEAD				32"	18"	7"			4000K	LED	26084	2	26084	208	400	1.00	-										III		0			3' - 0"	27' - 0"			GARDCO (GL18-2-4-200LA-CW-UNV-SCBA) - POLE GARDCO (SRS-30H-5.0-BRP)			

RELAY PANEL: CR

LOCATION: ELECTRICAL A112

CONTROL SCHEDULE

UL 1008 RELAY PANEL

RELAY #	DESCRIPTION	LOCATION	BRANCH CIRCUIT	LOAD (WATTS)	CNTL SWITCH	OCC SENSOR	TIME CLOCK	PHOTOCELL
1	CR1	SOUTH AMPHITHEATER	**C- 2,4**	800	X		X	X
2	CR2	SOUTH AMPHITHEATER	**C- 6,8**	800	X		X	X
3	CR3	SOUTH AMPHITHEATER	**C- 10,12**	400	X		X	X
4	CR4	EAST AMPHITHEATER	**C- 14,16**	1200	X		X	X
5	SPARE	--	**--**	--	--	--	--	--
6	CR6	NORTH WEST AMPHITHEATER	**C- 22,24**	600	X		X	X
7	CR7	NORTH AMPHITHEATER	**C- 26,28**	1000	X		X	X
8	CR8	SOUTH PARKING LOT	**C- 30,32**	1800	X		X	X
9	CR9	NORTH PARKING LOT	**C- 34,36**	1800	X		X	X
10	CR10	SOUTH MIDDLE PARKING LOT	**C- 38,40**	2400	X		X	X
11	CR11	NORTH MIDDLE PARKING LOT	**C- 42,44**	2400	X		X	X
12	SPARE	--	**--**	--	--	--	--	--
13	SPARE	--	**--**	--	--	--	--	--
14	SPARE	--	**--**	--	--	--	--	--
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

Notes:

COLORADO REGISTERED DAVID E. WESEMANN 38706 PROFESSIONAL ENGINEER 7/15/2016

METHOD STUDIO INC.
925 south west temple
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LAS COLONIAS AMPHITHEATER

Grand Junction, CO

project#: 14.0650
date: July 15, 2016

revisions :

title:

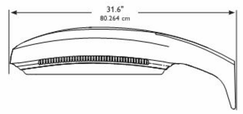
EXTERIOR LIGHTING FIXTURE SCHEDULE

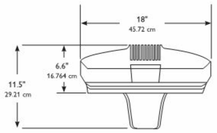
sheet:

EL602

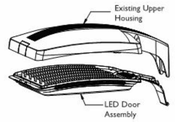
100% CONSTRUCTION DOCUMENTS

DIMENSIONS AND EPA





GL18-RK LED Retrofit Kit



Note: Removal of all components of existing G18 Gullwing luminaires, except the upper housing, is required to perform a retrofit.

GL18-RK includes all necessary retrofit components.

Note: TGIC polyester powdercoat will fade somewhat in exterior environments over time. Once the retrofit kit is installed, there is a possibility that the upper housing may have faded to a point where there is a noticeable paint difference between the upper housing (existing) and the new retrofit kit door frame.

EPA Data		
1	2	3≤1
1.2 ft²	2.4 ft²	3.2 ft²
.12 m²	.24 m²	.30 m²

Approximate Weight Single Luminaire
40 lbs / 18.144 kg

LED WATTAGE AND LUMEN VALUES

Ordering Code	Average System Watts[6]	LED Current (mA)	LED Selection	Luminaire Initial Absolute Lumens[7,8] TYPE 2	TYPE 3	TYPE 4	TYPE 5	BLC
Single LED Arrays								
65LA	65	350	CW	5,211	4,988 (s)	4,986	6,025	3,433 (s)
95LA	95	530	CW	7,437	7,025	6,973	8,258	4,640 (s)
130LA	130	700	CW	8,868	8,658	8,478	10,223	5,614 (s)
Dual LED Arrays								
125LA	125	350	CW	9,953	9,550	9,360	11,241	5,917 (s)
200LA	200	530	CW	13,432	13,042	12,942	15,271	7,996 (s)
255LA	255	700	CW	16,209	15,740	15,529	18,254	9,436 (s)

6. Wattage may vary by +/- 8% due to LED manufacturer forward volt specification and ambient temperature. Wattage shown is average for 120V through 277V input. Actual wattage may vary by an additional +/- 10% due to actual input voltage.
7. Values shown are for luminaires without the HS or IS shield options. Tests are in process for many NW and all WW, as well as luminaires with the HS and IS options.
8. Lumen values based on tests performed in compliance with IESNA LM-79 -"(s)" following value indicates that the value is scaled from tests on a similar, but not identical luminaire configuration. Contact Gardco.applications@ philips.com if any approximate estimates are required for design purposes.

LED SELECTION

CW	Cool White - 6000°K - 75 CRI
NW	Neutral White - 4000°K - 70 CRI
WW	Warm White - 3000°K - 80 CRI

VOLTAGE

120	
208	
240	
277	
347	
480	
UNIV	120V through 277V, 50hz or 60hz
HVU	347V through 480V, 50hz or 60hz (High Voltage Universal)

FINISH

BRP	Bronze Paint
BLP	Black Paint
WP	White Paint
NP	Natural Aluminum Paint
OC	Optional Color Paint *Specify Optional Color or RAL ex: OC-LGP or OCRAL7024.*
SC	Special Paint *Specify. Must supply color chip.*

OPTIONS *(Options are not available in GL18-RK retrofit kits, except as specifically noted below. See Note 16)*

LF[9]	In-Line/In-Pole Fusing
PC[9,11]	Photocontrol and Receptacle
PCR[11]	Photocontrol Receptacle only
HS[16]	External Housesside Shield
IS[9,16]	Internal Housesside Shield
RPA1[15]	3" Round Pole Adapter
RPA2[15]	4" and 5" Round Pole Adapter
MF[12]	Mast Arm Fitter
TR1[13]	Single Transition
TR2[13]	Twin Transition
PTF2[14]	Pole Top Fitter - 2 3/8" - 3" Dia. Tenon
PTF3[14]	Pole Top Fitter - 3" - 3 1/2" Dia.Tenon
PTF4[14]	Pole Top Fitter - 3 1/2" - 4" Dia. Tenon
SQPTF[15]	Square Pole Top Fitter
DL[16]	Diffusing Lens *(reduces performance significantly)*
CLR[16]	Clear Glass Lens *(reduces performance)*

9. Not available above 277V. Provide specific input voltage.
10. Required for 3" O.D. round or tapered round poles where top O.D. is less than 4".
11. Required for 4", 5" O.D. round poles.
12. Mounts to a 2-3/8" O.D. mast arm.
13. Mounts to a 2-3/8" Top Tenon. Specify a round pole with a 4.50" O.D. for a smooth transition.
14. Not available in 120° mounting configurations.
15. Requires a 2-3/8"O.D. x 4" tenon or a 2-4" round pole top O.D. Specify Drilling (1, 2, 2@90, 3 or 4 only.)
16. Available with GL18-RK retrofit kits (as well as other configurations.)
17. Available in GL18 Constant Wattage only.
18. Available with Type 2, Type 3 or Type 4 distributions only.

ACCESSORIES *(Ordered separately)*

MS-P	120V or 277V Input - Pedestrian Motion Sensor for GL18-MR (Motion Response) or GL18-APD-MRO (Automatic Profile Dimming with Motion Response Override)
MS-A-120V	120V Input - Area Motion Sensor for GL18-MR (Motion Response) or GL18-APD-MRO (Automatic Profile Dimming with Motion Response Override)
MS-A-277V	277V Input - Area Motion Sensor for GL18-MR (Motion Response) or GL18-APD-MRO (Automatic Profile Dimming with Motion Response Override)

Motion Sensors are ordered separately, with one (1) motion sensor required per pole location for GL18-MR or GL18-APD-MRO luminaires. See Luminaire Configuration Information on pages 4-5 for more details. Pedestrian sensor color is white. Area motion sensor color is Arctic White.

Job:
Type:
Notes:

Philips Gardco Gullwing LED luminaires combine LED performance excellence and advanced Gardco LED thermal management technology with the distinct Gullwing style to provide outdoor area lighting that is both energy efficient and aesthetically pleasing. The Philips Gardco Gullwing LED is defined by its high performance, sleek profile and rugged construction. The housing is one-piece, die cast aluminum and mounts directly to a pole or wall without the need of a separate support arm. The advanced LED optical systems provide IES Types II, III, IV and V distributions. The luminaire features a state of the art integral thermal control system to maximize LED performance and life, and to extend component life. All LED wattages utilize high performance Class 1 LED systems. The door frame is single-piece die cast aluminum. Luminaires are finished with a fade and abrasion resistant TGIC powdercoat. Gullwing LED luminaires provide full cutoff performance. Existing Philips Gardco Gullwing HID luminaires are suitable for field retrofit with the Gullwing LED retrofit kit.

PREFIX	MOUNTING	OPTICAL SYSTEM	LED WATTAGE	LED SELECTION	VOLTAGE	FINISH	OPTIONS

Enter the order code into the appropriate box above. Note: Philips Gardco reserves the right to refuse a configuration. Not all combinations and configurations are valid. Refer to notes below for exclusions and limitations. For questions or concerns, please consult the factory.

PREFIX

Complete Luminaires	*(See page 3 and page 4 for details on luminaire configurations.)*
GL18	18" Gullwing LED Luminaire - Constant Wattage
GL18-DCC	18" Gullwing LED with Dual Circuit Control
GL18-DIM	18" Gullwing LED with 0-10V Dimming
GL18-MRS0[1]	18" Gullwing LED with Motion Response - 50% Low
GL18-APD[2]	18" Gullwing LED with Automatic Profile Dimming
GL18-APD-MRO[1]	18" Gullwing LED - APD with Motion Response Override
Retrofit Kit	*(See page 4 for details on retrofit kit configurations.)*
GL18-RK	18" Gullwing LED Retrofit Kit - Constant Wattage

*1. Motion Response luminaires require one motion sensor per pole, ordered separately. See **Accessories** on page 2. Motion Response luminaires available 120V or 277V only.*
2. Available 120V through 277V only.

MOUNTING

1	Single Pole Mount
2	Twin Pole Mount at 180°
2@90	Twin Pole Mount at 90°
3	3-way Pole Mount at 90°
3@120°	3-way Pole Mount at 120°
4	4-way Pole Mount
W	Wall Mount, Recessed J-Box
WS	Wall Mount, Surface Conduit

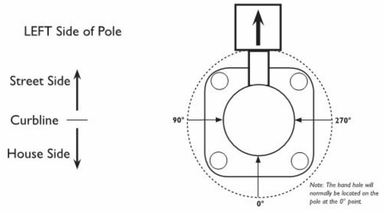
OPTICAL SYSTEM[3]

Optic Type	Standard Optic Position	Optic Rotated Left[4] (90°)	Optic Rotated Right[5] (270°)
Type II	2	2-90	2-270
Type III	3	3-90	3-270
Type IV	4	4-90	4-270
Type V	5[5]		
Backlight Control	BLC	BLC-90	BLC-270

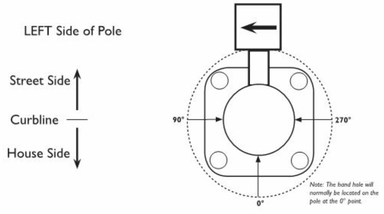
*3. Luminaire door frame and optic assembly provided standard without glass lens. Specify CLR option for clear glass lens. See **Options** on page 2.*
4. See pages 6 and 7 for information on optical rotation prior to ordering.
5. Features unitized lens.

ASYMMETRIC OPTICAL ORIENTATION INFORMATION *(CONTINUED ON PAGE 7)*

STANDARD OPTIC POSITION:
Luminaires ordered with asymmetric optical systems in the standard optic position will have the optical system oriented as shown below:



OPTIC ROTATED LEFT (90°) OPTIC POSITION:
Luminaires ordered with asymmetric optical systems in the **OPTIC ROTATED LEFT (90°)** optic position will have the optical system oriented as shown below:



LUMINAIRE CONFIGURATION INFORMATION *(CONTINUED FROM PAGE 4)*

GL18-APD is available in 120V through 277V input only.

The GL18-APD offers many of the advantages of a sophisticated control system, including an average energy savings of at least 33% versus constant wattage, constant light output systems, without the need for a control system.

GL18-APD-MRO: Philips Gardco Gullwing LED luminaire with Automatic Profile Dimming, with Motion Response Override. The GL18-APD-MRO combines the benefits of both automatic profile dimming and motion response. The luminaire will dim to 50% power, 50% light output, per the dimming profile shown for the GL18-APD. If motion is detected during the time that the luminaire is operating at 50%, the luminaire returns to 100% power and light output. The luminaire remains on high until no motion is detected for the duration period, after which the luminaire returns to low. Duration period is factory set at 15 minutes, and is field adjustable from 5 minutes up to 15 minutes.

This configuration is not available for use with wall mounted luminaires.

GL18-APD-MRO is available in 120V through 277V input only to luminaire. The motion sensor requires either 120V or 277V input to the motion sensor.

The GL18-APD-MRO has the same pole requirements and utilizes the same motion sensors as the GL18-MR-50. The motion sensor mounts and wires identically as well. The GL18-APD-MRO utilizes the identical dimming profile as shown for the GL18-APD.

By combining the benefits of automatic profile dimming and motion response, the GL18-APD-MRO assures maximum energy savings, and insures that adequate light is present if motion is detected.

Note: All motion sensors utilized consume 0.0 watts in the off state.

GL18-RK: Philips Gardco Gullwing LED Retrofit kit for existing Gullwing luminaires. The retrofit kit provides a simple way to convert existing sites that utilize Gullwing luminaires to LED. The retrofit kit includes all necessary components to complete the retrofit conversion. The existing optic, ballast tray and door assembly are removed and replaced by retrofit kit components. The retrofit kit includes the complete door frame and the LED driver assembly.

The GL18-RK is available only in a constant wattage, constant light output design, and is not available with any Options, except as specifically indicated on page 2.

Note: TGIC polyester powdercoat will fade somewhat in exterior environments over time. Once the retrofit kit is installed, there is a possibility that the upper housing may have faded to a point where there is a noticeable paint difference between the upper housing (existing) and the new retrofit kit door frame.

SPECIFICATIONS

GENERAL DESCRIPTION: The Philips Gardco Gullwing LED is defined by its high performance, sleek profile and rugged construction. The housing is one-piece, die cast aluminum and mounts directly to a pole or wall without the need of a separate support arm. Gullwing LED luminaires combine LED performance excellence and advanced Philips Gardco LED thermal management technology with the distinct Gullwing style to provide outdoor area lighting that is both energy efficient and aesthetically pleasing.

HOUSING: A one-piece die cast aluminum housing mounts directly to a pole or wall without the need for a support arm. The low profile rounded form reduces the effective projected area of the luminaire to only 1.2 ft² /.12 m².

IP RATING: Gullwing LED 18" luminaires have a rating of IP66.

LED RELIABILITY:

PREDICTED LUMEN DEPRECIATION DATA		
Ambient Temperature °C	Driver mA	L_{70} Hours[20]
25 °C	350 mA	130,000
	530 mA	100,000
	700 mA	70,000
40 °C	350 mA	100,000
	530 mA	70,000
	700 mA	50,000

20 Predicted performance derived from LED manufacturer's data and engineering design estimates, based on IESNA LM-80 methodology. Actual experience may vary due to field application conditions. L_{70} is the predicted time when LED performance depreciates to 70% of initial lumen output.

THERMAL MANAGEMENT: The Philips Gardco Gullwing LED provides die cast aluminum integral thermal radiation fins combined with lateral air ways, to provide the excellent thermal management so critical to long LED system life.

OPTICAL SYSTEMS: LED arrays are set to achieve IES Type II, Type III, Type IV,Type V , and Backlight Control (BLC) distributions. Individual LED arrays are replaceable. Luminaires feature high performance Class 1 LED systems.

ELECTRICAL: Luminaires are equipped with an LED driver that accepts 120V through 277V or 347V through 480V, 50hz to 60hz, input. Driver output is based on the LED wattage selected. Component-to-component wiring within the luminaire will carry no more than 80% of rated current and is listed by UL for use at 600 VAC at 302°F / 150°C or higher. Plug disconnects are listed by UL for use at 600 VAC, 15A or higher. Power factor is not less than 90%. Luminaire consumes 0.0 watts in the off state. All motion sensors utilized consume 0.0 watts in the off state. Surge protector standard. IOKA per ANSI/ IEEE C62.41.2.

FINISH: Each standard color luminaire receives a fade and abrasion resistant, electrostatically applied, thermally cured, triglycidal isocyanurate (TGIC) textured polyester powdercoat finish. Standard colors include bronze (BRP), black (BLP), white (WP), and natural aluminum (NP). Consult factory for specs on optional or custom colors.

LABELS: All luminaires bear UL or CUL (where applicable) Wet Location labels.

WARRANTY: Philips Gardco luminaires feature a 5 year limited warranty. Philips Gardco LED luminaires with LED arrays feature a 5 year limited warranty covering the LED arrays and LED drivers. Motion sensors are covered by warranty for 5 years by the motion sensor manufacturer. See Warranty Information on philips.com/luminaires for complete details and exclusions.

FULL CUTOFF PERFORMANCE: Full cutoff performance means a luminaire distribution where zero candela intensity occurs at an angle at or above 90° above nadir. Additionally, the candela per 1000 lamp lumens does not numerically exceed 100 (10 percent) at a vertical angle of 80° above nadir. This applies to all lateral angles around the luminaire.

LUMINAIRE CONFIGURATION INFORMATION *(CONTINUED ON PAGE 5)*

GL18: Philips Gardco Gullwing LED standard luminaire providing constant wattage and constant light output when power to the luminaire is energized.

GL18-DCC: Philips Gardco Gullwing LED luminaire provided with dual circuiting, permitting separate switching of each led array. Available on luminaires with dual led arrays only.

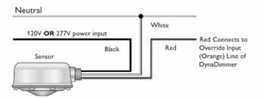
GL18-DIM: Philips Gardco Gullwing LED luminaire provided with 0 -10V dimming for connection to a control system provided by others.

GL18-MR-50: Philips Gardco Gullwing LED luminaire with motion response, providing a 50% power reduction on low and a commensurate reduction in light output. The power and light output reduction is accomplished utilizing the Philips DynaDimmer module, programmed for a constant 50% power. Power supplied by the motion sensor connected to the override line on the DynaDimmer takes the luminaire to high setting, 100% power and light output, when motion is detected. The luminaire remains on high until no motion is detected for the motion sensor duration period, after which the luminaire returns to low. Duration period is factory set at 15 minutes, and is field adjustable from 5 minutes up to 15 minutes.

This configuration is not available for use with wall mounted luminaires.

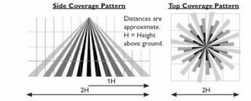
GL18-MR50 is available in 120V through 277V input only to the luminaire. Motion sensors require single voltage 120V or 277V input.

The Pedestrian PIR motion sensor is the WattStopper HB350W-L3. One motion sensor per pole is required and is ordered separately as the MS-P accessory, see page 2. The Pedestrian sensor accept 120V through 277V input.

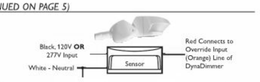


The pedestrian motion detector provides coverage equal to the sensor height above ground , in all directions from the sensor (360°.)

Pedestrian PIR Motion Sensor Coverage Pattern:

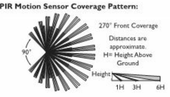


The Area PIR motion sensor is the WattStopper EW-200-120-W (120V Input - MS-GLA-120V) or the WattStopper EW-200-277-W (277V Input - MS-GLA-277V) One motion sensor per pole is required and is ordered separately. Area sensors require single voltage 120V or 277V input.



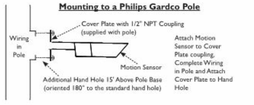
The area motion detector provides coverage equal to up to 6 times the sensor height above ground, 270° from the front-center of the sensor.

Area PIR Motion Sensor Coverage Pattern:



Motion response requires that the pole include an additional hand hole 15 feet above the pole base, normally oriented 180° to the standard hand hole. For Philips Gardco poles, order the pole with the Motion Sensor Mounting (MSM) option which includes the hand hole and a special hand hole cover plate for the sensor with a 1/2" NPT receptacle centered on the hand hole cover plate into which the motion sensor mounts. Once the motion sensor is connected to the hand hole cover plate, then wiring connections are completed in the pole. The plate (complete with motion sensor attached and wired) is then mounted to the hand hole. **If poles are supplied by others, the customer is responsible for providing suitable mounting accommodations for the motion sensor in the pole.**

Mounting to a Philips Gardco Pole



GL18-APD: Philips Gardco Gullwing LED luminaire with Automatic Profile Dimming. Luminaire is provided with the Philips DynaDimmer module included. The DynaDimmer module is programmed to go to 50% power, 50% light output two (2) hours prior to night time mid-point and remain at 50% for six (6) hours after night time mid-point. Mid-point is continuously recalculated by the DynaDimmer module based on the average mid-point of the last two full night cycles. Short duration cycles, and power interruptions are ignored and do not affect the determination of mid-point.

GL18-APD is available in 120V through 277V input only.

GL18-APD Dimming Profile:

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phone: (801) 532-4422

consultant:

project:
LAS COLONIAS AMPHITHEATER

Grand Junction, CO

project#: 14.0650
date: July 15, 2016

revisions :

title:
LIGHT FIXTURE CUTSHEETS

sheet:
EL801

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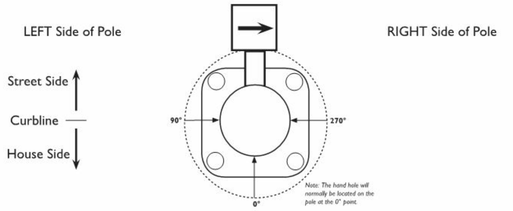
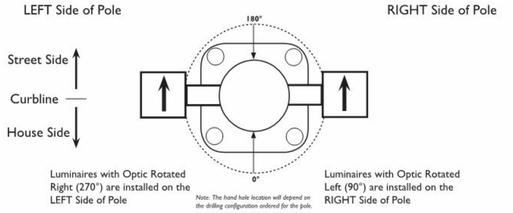
ASYMMETRIC OPTICAL ORIENTATION INFORMATION *(CONTINUED FROM PAGE 6)*

OPTIC ROTATED RIGHT (270°) OPTIC POSITION:
Luminaires ordered with asymmetric optical systems in the **OPTIC ROTATED RIGHT (270°)** optic position will have the optical system oriented as shown below:



TWIN LUMINAIRE ASSEMBLIES WITH ROTATED OPTICAL SYSTEMS:
Twin luminaire assemblies installed with rotated optical systems are an excellent way to direct light toward the interior of the site (Street Side) without additional equipment. It is important, however, that care be exercised to insure that luminaires are installed in the proper location.



G200-016 08/14 page 7 of 7 www.philips.com/luminaires

Philips Lighting
North America Corporation
200 Franklin Square Drive
Somerset, NJ 08873
Tel. 855-486-2216

Imported by: Philips Lighting,
A division of Philips Electronics Ltd.
281 Hillmount Rd.
Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

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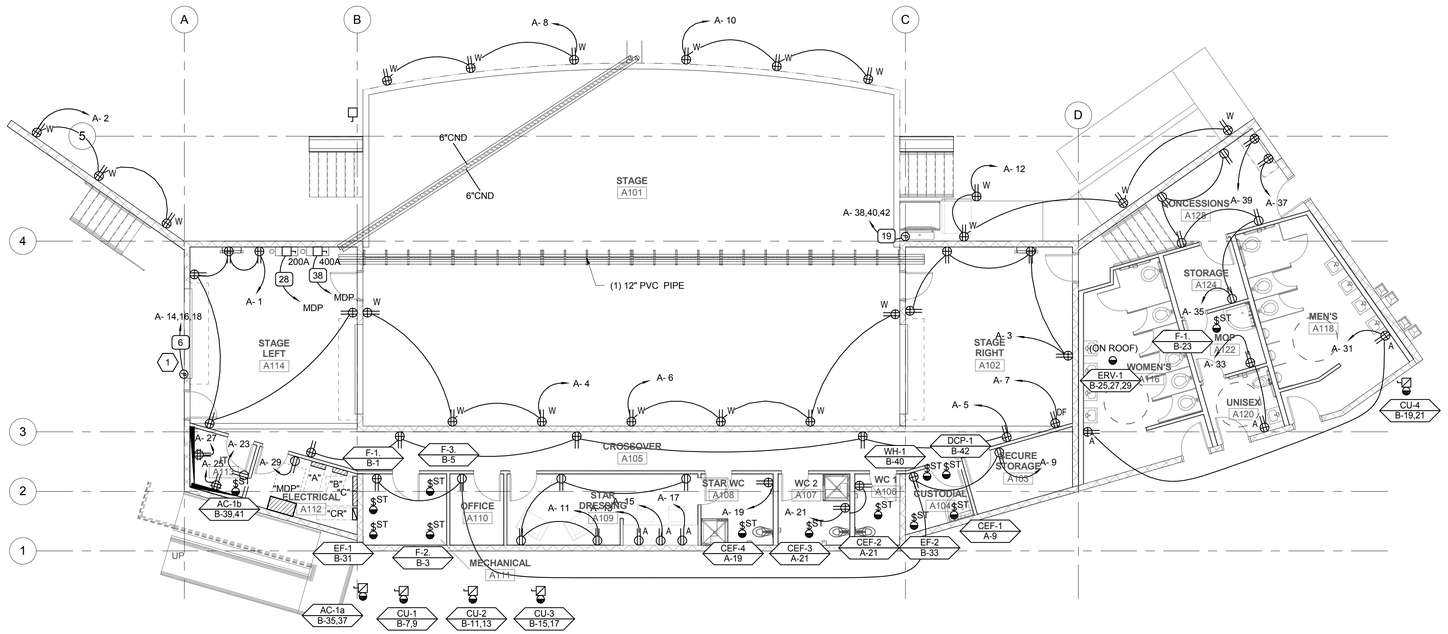

1 STAGE LEVEL POWER PLAN

SCALE: 1/8" = 1'-0"

GENERAL SHEET NOTES

SHEET KEYNOTES

1 PROVIDE ELECTRICAL CONNECTIONS TO OVERHEAD DOOR. PROVIDE CONTROL SWITCH MOUNTED IN LOCATION APPROVED BY ARCHITECT AND OWNER. COORDINATE EXACT LOCATION WITH DOOR INSTALLER PRIOR TO ROUGH-IN.

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7/15/2016

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STAGE LEVEL POWER PLAN

sheet:

EP101

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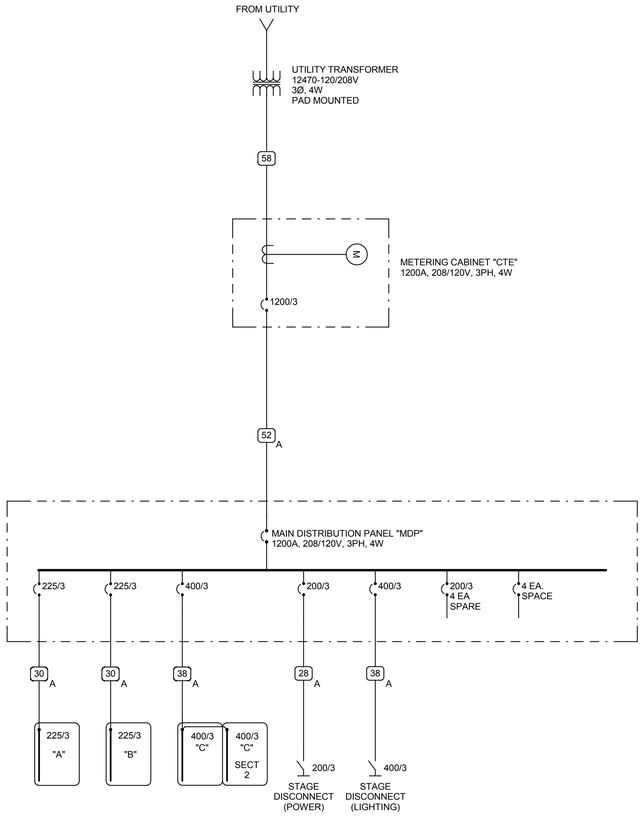

A1 ONE-LINE DIAGRAM

SCALE: NTS

ALUMINUM CONDUCTOR AND CONDUIT SCHEDULE

SCHEDULE NUMBER
SUBSCRIPT (NOTE 5)
(E.G.) 5 IG

SYM	AMP	CONDUIT SIZE	CONDUCTOR (NOTE 1) QTY	SIZE	G	IG	SE	NOTES
1A								
2A								
3A								
4A								
5A								
6A								
7A								
8A								
9A								
10A								
11A								
12A								
13A								
14A								
15A								
16A								
17A								
18A								
19A								
20A								
21A	130	2	3	2/0	4	1/0	4	2,7
22A	130	2	4	2/0	4	1/0	4	2,7
23A	150	2	3	3/0	4	1/0	4	2,7
24A	150	2	4	3/0	4	1/0	4	2,7
25A	175	2	3	4/0	4	1/0	2	2,7
26A	175	2.50	4	4/0	4	1/0	2	2,7
27A	200	2.50	3	250	4	1/0	2	2,7
28A	200	3	4	250	4	1/0	2	2,7
29A	230	2.50	3	300	2	1/0	1/0	2,7
30A	230	3	4	300	2	1/0	1/0	2,7
31A	250	3	3	350	2	2/0	1/0	2,7
32A	250	3	4	350	2	2/0	1/0	2,7
33A	310	3	3	500	1	3/0	1/0	2,7
34A	310	4	4	500	1	3/0	1/0	2,7
35A	380	2 EA 2.50	3	250	1	4/0	3/0	2,7
36A	380	2 EA 3	4	250	1	4/0	3/0	2,7
37A	400	2 EA 2.50	3	250	1/0	4/0	3/0	2,7
38A	400	2 EA 2.50	4	250	1/0	4/0	3/0	2,7
39A	500	2 EA 3	3	350	1/0	300	3/0	2,4,7
40A	500	2 EA 3	4	350	1/0	300	3/0	2,4,7
41A	620	2 EA 3	3	500	3/0	300	3/0	2,4,7
42A	620	2 EA 4	4	500	3/0	300	3/0	2,4,7
43A	750	3 EA 3	3	350	3/0	300	4/0	2,4,7
44A	750	3 EA 4	4	350	3/0	300	4/0	2,4,7
45A	810	3 EA 3	4	400	4/0	300	250	2,4,7
46A	810	3 EA 4	4	400	4/0	300	250	2,4,7
47A	1000	4 EA 3	3	350	4/0	300	250	4,7
48A	1000	4 EA 3	4	350	4/0	300	250	4,7
49A	1140	4 EA 4	3	500	250	300	250	4,7
50A	1140	4 EA 4	4	500	250	300	250	4,7
51A	1240	4 EA 4	3	500	350	300	250	4,7
52A	1240	4 EA 4	4	500	350	300	250	4,7
53A	1620	6 EA 4	4	400	400	350	250	4,7
54A	2170	7 EA 4	4	500	400	500	250	4,7
55A	2695	7 EA 4	4	750	600	750	750	4,7
56A	3080	8 EA 4	4	750	600	750	750	4,7
57A	4235	11 EA 4	4	750	800	750	750	4,7
58A	-	5 EA 4	-	-	-	-	-	6
59A	-	5	-	-	-	-	-	6
60A	-	10 EA 4	-	-	-	-	-	6

1. CONDUCTORS SHOWN ARE SHOWN FOR EACH CONDUIT WITH MODIFICATIONS AS NOTED IN NOTE 5. ALL CONDUCTORS SHOWN ARE THWN UNLESS OTHERWISE NOTED.
2. PROVIDE EQUIPMENT GROUND CONDUCTORS PER TABLE 250-122 WHEN CIRCUIT BREAKERS ARE SIZED GREATER THAN AMPERE RATING SHOWN IN TABLE.
3. PROVIDE #10 NEUTRALS FOR MULTIWIRE BRANCH CIRCUITS SERVING COMPUTERS.
4. GROUND (G) CONDUCTOR MAY BE DELETED ON SERVICE ENTRANCE CONDUCTORS.
5. SYMBOL SUBSCRIPTS:
   - "2N": INCLUDE TWO NEUTRAL CONDUCTORS, SIZED AS SCHEDULED FOR PHASED AND NEUTRAL CONDUCTORS.
   - "FG": FULL SIZE GROUND, SIZE EQUIPMENT GROUNDING CONDUCTOR TO BE SAME SIZE AS THE PHASE CONDUCTORS.
   - "HH": NEUTRAL CURRENTS EXIST DUE TO HIGH HARMONIC "NONLINEAR" LOADS. CURRENT CARRYING CONDUCTORS DERATED ACCORDINGLY.
   - "IG": INCLUDE IG (INSULATED/ISOLATED GROUND CONDUCTOR) SCHEDULED ALONG WITH THE GROUND OF EQUIPMENT GROUND CONDUCTOR.
   - "SE": SUBSTITUTE "SE" CONDUCTOR FOR "G" CONDUCTOR SHOWN, WHICH IS SIZED FOR THE GROUNDING OF THE SECONDARY OF THE SEPARATELY DERIVED SYSTEM.
6. RACEWAY ONLY. CONDUCTORS PROVIDED BY UTILITY.
7. ALUMINUM CONDUCTORS NOT TO BE USED FOR CONNECTION TO MOTORS OR MOTOR DRIVEN EQUIPMENT.

FAULT CURRENT TABLE

BUS	FAULT CURRENT
1DPHA	
1DPLA	
A	
B	

PROVIDE FULLY RATED CIRCUIT BREAKERS IN PANELBOARDS FOR THE FAULT CURRENT SHOWN. SERIES RATINGS WITH NEXT LEVEL UPSTREAM OVERCURRENT PROTECTIVE DEVICES ARE PERMITTED SUBJECT TO FACTORY UL DOCUMENTATION OF SERIES RATING SUBMITTED TO ENGINEER. IF DEVICE OR EQUIPMENT FAULT CURRENT RATING IS NOT SHOWN, ASSUME 100,000 AIC.NSFORMER

GENERAL SHEET NOTES

1. PROVIDE NEMA 3R ENCLOSURES FOR EQUIPMENT LOCATED OUTDOORS. REFER TO PLANS FOR EQUIPMENT LOCATIONS.
2. REFER TO PLANS FOR CONSTRAINTS ON PHYSICAL DIMENSIONS AND CLEARANCE REQUIREMENTS OF EQUIPMENT. PROVIDE EQUIPMENT DIMENSIONS THAT FALL WITHIN THE CONSTRAINTS OF EACH SPECIFIC LOCATION.
3. ALL EQUIPMENT SHALL BE CONSTRUCTED AND BRACED FOR THE SEISMIC CONDITIONS OF THE PROJECT. REFER TO ELECTRICAL SPECIFICATIONS FOR REQUIREMENTS.
4. PROVIDE PERFORMANCE TESTING FOR GROUND-FAULT PROTECTION SYSTEMS ON SITE WITH A WRITTEN RECORD OF THIS TEST SUBMITTED TO THE AUTHORITY HAVING JURISDICTION PER 2011 NEC 230.95(C).

COPPER CONDUCTOR AND CONDUIT SCHEDULE

SCHEDULE NUMBER
SUBSCRIPT (NOTE 5)
(E.G.) 5 IG

SYM	AMP	HH AMPS	CONDUIT SIZE	CONDUCTOR (NOTE 1) QTY	SIZE	G	IG/HH	SE	NOTES
1	20	-	.75	2	12	12	12	8	2
2	20	-	.75	3	12	12	12	8	2,3
3	20	24	.75	4	12	12	12	8	2,3
4	30	-	.75	2	10	10	10	8	2
5	30	-	.75	3	10	10	10	8	2
6	30	32	.75	4	10	10	10	8	2
7	40	-	1	2	8	10	8	6	2
8	40	-	1	3	8	10	8	6	2
9	40	44	1	4	8	10	8	6	2
10	55	-	1	2	6	10	8	4	2
11	55	-	1	3	6	10	8	4	2
12	55	60	1.25	4	6	10	8	4	2
13	70	-	1	2	4	8	4	2	2
14	70	-	1.25	3	4	8	4	2	2
15	70	76	1.25	4	4	8	4	2	2
16	85	-	1.25	2	3	8	3	2	2
17	85	-	1.25	3	3	8	3	2	2
18	85	92	1.25	4	3	8	3	2	2
19	95	-	1.25	3	2	8	2	2	2
20	95	104	1.50	4	2	8	2	2	2
21	130	-	1.50	3	1	6	2	2	2
22	130	116	1.50	4	1	6	2	2	2
23	150	-	2	3	1/0	6	2	1/0	2
24	150	136	2	4	1/0	6	2	1/0	2
25	175	-	2	3	2/0	6	2	2/0	2
26	175	156	2	4	2/0	6	2	2/0	2
27	200	-	2	3	3/0	6	2	2/0	2
28	200	180	2.50	4	3/0	6	2	2/0	2
29	230	-	2.50	3	4/0	4	2	2/0	2
30	230	208	2.50	4	4/0	4	2	2/0	2
31	255	-	2.50	3	250	4	1	2/0	2
32	255	232	2.50	4	250	4	1	2/0	2
33	310	-	3	3	350	3	1/0	3/0	2
34	310	280	3	4	350	3	1/0	3/0	2
35	380	-	3.50	3	500	3	3/0	3/0	2
36	380	344	4	4	500	3	3/0	3/0	2
37	400	-	2 EA 2	3	3/0	3	3/0	3/0	2
38	400	360	2 EA 2.50	4	3/0	3	3/0	3/0	2
39	510	-	2 EA 2.50	3	250	1	4/0	3/0	2
40	510	464	2 EA 3	4	250	1	4/0	3/0	2
41	620	-	2 EA 3	3	350	1/0	4/0	3/0	2,4
42	620	560	2 EA 3	4	350	1/0	4/0	3/0	2,4
43	760	-	2 EA 3.50	3	500	1/0	4/0	3/0	2,4
44	760	688	2 EA 4	4	500	1/0	4/0	3/0	2,4
45	855	-	3 EA 3	3	300	2/0	4/0	3/0	2,4
46	855	768	3 EA 3	4	300	2/0	4/0	3/0	2,4
47	1000	-	3 EA 3.50	3	400	2/0	4/0	3/0	4
48	1000	912	3 EA 3.50	4	400	2/0	4/0	3/0	4
49	1140	-	3 EA 4	3	500	3/0	4/0	3/0	4
50	1140	1032	3 EA 4	4	500	3/0	4/0	3/0	4
51	1240	-	4 EA 3	3	350	3/0	4/0	3/0	4
52	1240	1120	4 EA 3	4	350	3/0	4/0	3/0	4
53	1675	1520	5 EA 4	4	400	4/0	4/0	4/0	4
54	2010	1824	6 EA 4	4	400	250	250	250	4
55	2660	2408	7 EA 4	4	500	350	350	350	4
56	3040	2752	8 EA 4	4	500	500	500	500	4
57	4180	3784	11 EA 4	4	500	500	500	500	4
58	-	-	5 EA 4	-	-	-	-	-	6
59	-	-	5	-	-	-	-	-	6
60	-	-	10 EA 4	-	-	-	-	-	6

CONDUIT AND CONDUCTOR SCHEDULE NOTES

1. CONDUCTORS SHOWN ARE SHOWN FOR EACH CONDUIT WITH MODIFICATIONS AS NOTED IN NOTE 5. ALL CONDUCTORS SHOWN ARE THWN UNLESS OTHERWISE NOTED.
2. PROVIDE EQUIPMENT GROUND CONDUCTORS PER TABLE 250-122 WHEN CIRCUIT BREAKERS ARE SIZED GREATER THAN AMPERE RATING SHOWN IN TABLE.
3. PROVIDE #10 NEUTRALS FOR MULTIWIRE BRANCH CIRCUITS SERVING COMPUTERS.
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5. SYMBOL SUBSCRIPTS:
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   - "FG" FULL SIZE GROUND, SIZE EQUIPMENT GROUNDING CONDUCTOR TO BE SAME SIZE AS THE PHASE CONDUCTORS.
   - "HH": NEUTRAL CURRENTS EXIST DUE TO HIGH HARMONIC "NONLINEAR" LOADS. CURRENT CARRYING CONDUCTORS DERATED ACCORDINGLY. PROVIDE THE IG/HH SIZE FOR THE EQUIPMENT GROUNDING CONDUCTOR.
   - "IG": INCLUDE IG (INSULATED/ISOLATED GROUND CONDUCTOR) SCHEDULED ALONG WITH THE GROUND OF EQUIPMENT GROUND CONDUCTOR.
   - "SE": SUBSTITUTE "SE" CONDUCTOR FOR "G" CONDUCTOR SHOWN, WHICH IS SIZED FOR THE GROUNDING OF THE SECONDARY OF THE SEPARATELY DERIVED SYSTEM.
6. RACEWAY ONLY. CONDUCTORS PROVIDED BY UTILITY.

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date: July 15, 2016

revisions :

title:
ONE-LINE DIAGRAM

sheet:
EP601

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EQUIPMENT SCHEDULE

xxxxxxxx

EQUIPMENT SCHEDULE KEY
E - DIVISION 26
Q - FURNISHED WITH EQUIPMENT
* - COORDINATE WITH THE DIVISION 23 TEMPERATURE CONTROL INSTALLER
** - AUTOMATIC CONTROL WIRING BY DIVISION 23

			LOAD DATA								OVERCURRENT PROTECTION			DISCONNECT			STARTER										
MARK	QTY	ITEM DESCRIPTION	HP	kW	MCA	FLA	VOLT	PH	Hz	WIRE AND CONDUIT SIZE	FURN BY	DEVICE	LOCATION	FURN BY	DEVICE	LOCATION	FURN BY	DEVICE	SIZES	SELECTOR SWITCH	PILOT LAMP	NORMALLY OPEN CONTACT	NORMALLY CLOSED CONTACT	PHASE FAILURE RELAY	NOTES	MARK
AC-1a	1	AIR CONDITIONER (OUTDOOR UNIT)	-	-	-	15	208	1	60	2 #8, #10 GR 1" CND	E	30/2 CB	B	E	30A/2P FRS-20	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		AC-1a
AC-1b	1	AIR CONDITIONER (INDOOR UNIT)	-	-	-	3.2	208	1	60	2 #12, 12 GR 0.75" CND	E	20/2 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		AC-1b
CEF-1	1	CEILING EXHAUST FAN	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	A	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CEF-1
CEF-2	1	CEILING EXHAUST FAN	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	A	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CEF-2
CEF-3	1	CEILING EXHAUST FAN	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	A	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CEF-3
CEF-4	1	CEILING EXHAUST FAN	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	A	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CEF-4
CU-1	1	CONDENSING UNIT	-	-	17.5	17.5	208	1	60	2 #6, #10 GR 1" CND	E	50/2 CB	B	E	60A/2P FRS-25	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CU-1
CU-2	1	CONDENSING UNIT	-	-	21.9	21.9	208	1	60	2 #6, #10 GR 1" CND	E	50/2 CB	B	E	60A/2P FRS-35	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CU-2
CU-3	1	CONDENSING UNIT	-	-	17.5	17.5	208	1	60	2 #6, #10 GR 1" CND	E	50/2 CB	B	E	60A/2P FRS-25	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CU-3
CU-4	1	CONDENSING UNIT	-	-	21.9	21.9	208	1	60	2 #6, #10 GR 1" CND	E	50/2 CB	B	E	60A/2P FRS-35	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		CU-4
DCP-1	1	DOMESTIC WATER CIRCULATING PUMP	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		DCP-1
EF-1	1	INLINE EXHAUST FAN	1/4	-	-	5.8	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		EF-1
EF-2	1	INLINE EXHAUST FAN	1/4	-	-	5.8	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		EF-2
ERV-1	1	ENERGY RECOVERY VENTILATOR	-	-	-	5	208	3	60	3 #12, #12GR 0.75" CND	E	20/3 CB	B	Q		ADJ TO EQUIP	Q	-	-	-	-	-	-	-		ERV-1
F-1.	2	GAS FIRED FURNACE	1/3	-	-	7.2	120	1	60	2 #12, 12 GR 0.75" CND	E	20/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		F-1.
F-2.	1	GAS FIRED FURNACE	1/3	-	-	7.2	120	1	60	2 #12, 12 GR 0.75" CND	E	20/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		F-2.
F-3.	1	GAS FIRED FURNACE	1/3	-	-	7.2	120	1	60	2 #12, 12 GR 0.75" CND	E	20/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		F-3.
WH-1	1	WATER HEATER	1/6	-	-	4.4	120	1	60	2 #12, 12 GR 0.75" CND	E	15/1 CB	B	E	TOGGLE SWITCH	ADJ TO EQUIP	Q	-	-	-	-	-	-	-		WH-1

COLORADO REGISTERED
DAVID E. WEBER
PROFESSIONAL ENGINEER
7/15/2016

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project:

LAS COLONIAS AMPHITHEATER

Grand Junction, CO

project#: 14.0650
date: July 15, 2016

revisions :

title:

EQUIPMENT SCHEDULE

sheet:

EP602

100% CONSTRUCTION DOCUMENTS

PANEL: "C"

VOLTS/PHASE/WIRE:	PANEL SIZE & TYPE:	MAIN SIZE AND TYPE:	LOCATION:	CABINET:	NOTES:
120/208V, 3 PH 4 WIRE	22" W x 6" D, BOLT-ON	225 AMPERE	ELECTRICAL A112	SURFACE	

ACCESSORIES: PANEL DIRECTORY, IDENTIFICATION, GROUNDING BAR — **AIC RATING:**

CKT	OCP		LOAD (kVA)				PHASE LOAD							LOAD (kVA)			OCP		CKT
NO	AMP	POLE	LTG	PWR	CO	DESCRIPTION	A		B		C		DESCRIPTION	CO	PWR	LTG	POLE	AMP	NO
1	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.4					CR1	0.0	0.0	0.8	2	20	2
3	--	--	--	--	--	--			0.1	0.4			--	--	--	--	--	--	4
5	--	--	--	--	--	--					0.1	0.4	CR2	0.0	0.0	0.8	2	20	6
7	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.4					--	--	--	--	--	--	8
9	--	--	--	--	--	--			0.1	0.2			CR3	0.0	0.0	0.4	2	20	10
11	--	--	--	--	--	--					0.1	0.2	--	--	--	--	--	--	12
13	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.6					CR4	0.0	0.0	1.2	2	20	14
15	--	--	--	--	--	--			0.1	0.6			--	--	--	--	--	--	16
17	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	18
19	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	20
21	--	--	--	--	--	--			0.1	0.3			CR6	0.0	0.0	0.6	2	20	22
23	--	--	--	--	--	--					0.1	0.3	--	--	--	--	--	--	24
25	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.5					CR7	0.0	0.0	1.0	2	20	26
27	--	--	--	--	--	--			0.1	0.5			--	--	--	--	--	--	28
29	--	--	--	--	--	--					0.1	0.9	CR8	0.0	0.0	1.8	2	20	30
31	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.9					--	--	--	--	--	--	32
33	--	--	--	--	--	--			0.1	0.9			CR9	0.0	0.0	1.8	2	20	34
35	--	--	--	--	--	--					0.1	0.9	--	--	--	--	--	--	36
37	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	1.2					CR10	0.0	0.0	2.4	2	20	38
39	--	--	--	--	--	--			0.1	1.2			--	--	--	--	--	--	40
41	--	--	--	--	--	--					0.1	1.2	CR11	0.0	0.0	2.4	2	20	42
43	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	1.2					--	--	--	--	--	--	44
45	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	46
47	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	48
49	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	50
51	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	52
53	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	54
55	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	56
57	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	58
59	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	60
61	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	62
63	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	64
65	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	66
67	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	68
69	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	70
71	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	72
73	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.0					SPARE	--	--	--	1	20	74
75	--	--	--	--	--	--			0.1	0.0			SPARE	--	--	--	1	20	76
77	--	--	--	--	--	--					0.1	0.0	SPARE	--	--	--	1	20	78
79	40	3	0.0	0.2	0.0	PWR: OUTDOOR...	0.1	0.1					PWR: OUTDOOR...	0.0	0.2	0.0	3	40	80
81	--	--	--	--	--	--			0.1	0.1			--	--	--	--	--	--	82
83	--	--	--	--	--	--					0.1	0.1	--	--	--	--	--	--	84
TOTALS:						CONNECTED kVA PER PHASE	**6**		**5**		**5**		CONNECTED TOTAL kVA =	**16**					
						CONNECTED AMPS PER PHASE	**51**		**42**		**40**		AVERAGE CONNECTED AMPS PER PHASE =	**44**					

NEC DIVERSIFIED LOAD CALCULATIONS

LIGHTING & CONTINUOUS LOADS: **13.2 kVA @ 125% = 16.5 kVA** - 100% CONNECTED LOAD PLUS 25% — DIVERSIFIED TOTAL kVA = **19**

RECEPTACLES: - FIRST 10kVA @ 100%, REMAINDER @ 50% — AVERAGE AMPS PER PHASE = **53**

ALL OTHER LOADS @ 100% : **2.7 kVA** - MOTOR TOTALS INCLUDED IN ALL OTHER LOADS WITH LARGEST MOTOR CALCULATED @ 125% PER NEC

PANEL: "A"

VOLTS/PHASE/WIRE:	PANEL SIZE & TYPE:	MAIN SIZE AND TYPE:	LOCATION:	CABINET:	NOTES:
120/208V, 3 PH 4 WIRE	22" W x 6" D, BOLT-ON	225 AMPERE	ELECTRICAL A112	SURFACE	

ACCESSORIES: PANEL DIRECTORY, IDENTIFICATION, GROUNDING BAR — **AIC RATING:**

CKT	OCP		LOAD (kVA)				PHASE LOAD							LOAD (kVA)			OCP		CKT
NO	AMP	POLE	LTG	PWR	CO	DESCRIPTION	A		B		C		DESCRIPTION	CO	PWR	LTG	POLE	AMP	NO
1	20	1	0.0	0.0	0.9	CO STAGE LEFT A114	0.9	0.5					CO: OUTSIDE STAGE LEFT	0.5	0.0	0.0	1	20	2
3	20	1	0.0	0.0	0.7	CO STAGE RIGHT A102			0.7	0.5			CO STAGE A101	0.5	0.0	0.0	1	20	4
5	20	1	0.0	0.0	0.9	CO Room A102, A105, A114					0.9	0.7	CO STAGE A101	0.7	0.0	0.0	1	20	6
7	20	1	0.0	0.0	0.7	CO STAGE RIGHT A102	0.7	0.5					CO: OUTSIDE STAGE FRONT LEFT	0.5	0.0	0.0	1	20	8
9	20	1	0.0	0.3	0.7	CO Room A104, A103, A110, A111			1.0	0.5			CO: OUTSIDE STAGE FRONT RIGHT	0.5	0.0	0.0	1	20	10
11	20	1	0.0	0.0	0.7	CO STAR DRESSING A109					0.7	0.7	CO: OUTSIDE STAGE RIGHT	0.7	0.0	0.0	1	20	12
13	20	1	0.0	0.0	0.2	CO STAR DRESSING A109	0.2	0.3					PWR: OH DOOR	0.0	1.0	0.0	3	20	14
15	20	1	0.0	0.0	0.2	CO STAR DRESSING A109			0.2	0.3			--	--	--	--	--	--	16
17	20	1	0.0	0.0	0.2	CO STAR DRESSING A109					0.2	0.3	--	--	--	--	--	--	18
19	20	1	0.0	0.3	0.2	CO STAR WC A108	0.5	0.0					SPARE	--	--	--	1	20	20
21	20	1	0.0	0.6	0.4	CO Room A106, A107			0.9	0.0			SPARE	--	--	--	1	20	22
23	20	1	0.0	0.0	0.2	CO: IT A113					0.2	0.0	SPARE	--	--	--	1	20	24
25	20	1	0.0	0.0	0.4	CO IT A113	0.4	0.0					SPARE	--	--	--	1	20	26
27	20	1	0.0	0.0	0.4	CO IT A113			0.4	0.0			SPARE	--	--	--	1	20	28
29	20	1	0.0	0.0	0.2	CO ELECTRICAL A112					0.2	0.0	SPARE	--	--	--	1	20	30
31	20	1	0.0	0.0	0.4	CO Room A118	0.4	0.0					SPARE	--	--	--	1	20	32
33	20	1	0.0	0.0	0.4	CO ROOM A120, A122			0.4	0.0			SPARE	--	--	--	1	20	34
35	20	1	0.0	0.0	0.9	PWR: STRG/CONCESSIONS A128					0.9	0.0	SPARE	--	--	--	1	20	36
37	20	1	0.0	0.0	0.2	PWR: CONCESSIONS A128	0.2	6.7					PWR: ADA LIFT	0.0	20.0	0.0	3	100	38
39	20	1	0.0	0.0	0.2	PWR: CONCESSIONS A128			0.2	6.7			--	--	--	--	--	--	40
41	20	1	--	--	--	SPARE					0.0	6.7	--	--	--	--	--	--	42
TOTALS:						CONNECTED kVA PER PHASE	**11**		**12**		**12**		CONNECTED TOTAL kVA =	**35**					
						CONNECTED AMPS PER PHASE	**94**		**99**		**96**		AVERAGE CONNECTED AMPS PER PHASE =	**96**					

NEC DIVERSIFIED LOAD CALCULATIONS

LIGHTING & CONTINUOUS LOADS: - 100% CONNECTED LOAD PLUS 25% — DIVERSIFIED TOTAL kVA = **33**

RECEPTACLES: **12.4 kVA @ 90% = 11.2 kVA** - FIRST 10kVA @ 100%, REMAINDER @ 50% — AVERAGE AMPS PER PHASE = **93**

ALL OTHER LOADS @ 100% : **22.2 kVA** - MOTOR TOTALS INCLUDED IN ALL OTHER LOADS WITH LARGEST MOTOR CALCULATED @ 125% PER NEC

PANEL: "B"

VOLTS/PHASE/WIRE:	PANEL SIZE & TYPE:	MAIN SIZE AND TYPE:	LOCATION:	CABINET:	NOTES:
120/208V, 3 PH 4 WIRE	22" W x 6" D, BOLT-ON	225 AMPERE	ELECTRICAL A112	SURFACE	

ACCESSORIES: PANEL DIRECTORY, IDENTIFICATION, GROUNDING BAR — **AIC RATING:**

CKT	OCP		LOAD (kVA)				PHASE LOAD							LOAD (kVA)			OCP		CKT
NO	AMP	POLE	LTG	PWR	CO	DESCRIPTION	A		B		C		DESCRIPTION	CO	PWR	LTG	POLE	AMP	NO
1	20	1	0.0	0.5	0.0	PWR: F-1	0.5	1.0					LTG: CORRIDOR	0.0	0.0	1.0	1	20	2
3	20	1	0.0	0.5	0.0	PWR: F-2			0.5	1.3			LTG: ELEC/MECH	0.0	0.0	1.3	1	20	4
5	20	1	0.0	0.5	0.0	PWR: F-3					0.5	0.1	LTG: STEP LIGHTS	0.0	0.0	0.1	1	20	6
7	50	2	0.0	3.6	0.0	PWR: CU-1	1.8	0.9					LTG: RESTROOMS	0.0	0.0	0.9	1	20	8
9	--	--	--	--	--	--			1.8	0.3			LTG: EXTERIOR	0.0	0.0	0.3	1	20	10
11	50	2	0.0	4.6	0.0	PWR: CU-2					2.3	0.0	SPARE	--	--	--	1	20	12
13	--	--	--	--	--	--	2.3	0.0					SPARE	--	--	--	1	20	14
15	50	2	0.0	3.6	0.0	PWR: CU-3			1.8	0.0			SPARE	--	--	--	1	20	16
17	--	--	--	--	--	--					1.8	0.0	SPARE	--	--	--	1	20	18
19	50	2	0.0	4.6	0.0	PWR: CU-4	2.3	0.0					SPARE	--	--	--	1	20	20
21	--	--	--	--	--	--			2.3	0.0			SPARE	--	--	--	1	20	22
23	20	1	0.0	0.5	0.0	PWR: F-4					0.5	0.0	SPARE	--	--	--	1	20	24
25	20	3	0.0	1.8	0.0	PWR: ERV-1	0.6	0.0					SPARE	--	--	--	1	20	26
27	--	--	--	--	--	--			0.6	0.0			SPARE	--	--	--	1	20	28
29	--	--	--	--	--	--					0.6	0.0	SPARE	--	--	--	1	20	30
31	20	1	0.0	0.4	0.0	PWR: EF-1	0.4	0.0					SPARE	--	--	--	1	20	32
33	20	1	0.0	0.4	0.0	PWR: EF-2			0.4	0.0			SPARE	--	--	--	1	20	34
35	30	2	0.0	3.1	0.0	PWR: AC-1a					1.6	0.0	SPARE	--	--	--	1	20	36
37	--	--	--	--	--	--	1.6	0.0					SPARE	--	--	--	1	20	38
39	20	2	0.0	0.7	0.0	PWR: AC-1b			0.3	0.3			PWR: WH-1	0.0	0.3	0.0	1	20	40
41	--	--	--	--	--	--					0.3	0.3	PWR: DCP-1	0.0	0.3	0.0	1	20	42
TOTALS:						CONNECTED kVA PER PHASE	**11**		**10**		**8**		CONNECTED TOTAL kVA =	**29**					
						CONNECTED AMPS PER PHASE	**96**		**82**		**66**		AVERAGE CONNECTED AMPS PER PHASE =	**80**					

NEC DIVERSIFIED LOAD CALCULATIONS

LIGHTING & CONTINUOUS LOADS: **3.7 kVA @ 125% = 4.6 kVA** - 100% CONNECTED LOAD PLUS 25% — DIVERSIFIED TOTAL kVA = **31**

RECEPTACLES: - FIRST 10kVA @ 100%, REMAINDER @ 50% — AVERAGE AMPS PER PHASE = **86**

ALL OTHER LOADS @ 100% : **26.3 kVA** - MOTOR TOTALS INCLUDED IN ALL OTHER LOADS WITH LARGEST MOTOR CALCULATED @ 125% PER NEC

COLORADO REGISTERED DAVID E. WEBER 38706 PROFESSIONAL ENGINEER 7/15/2016

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consultant:

project:

LAS COLONIAS AMPHITHEATER

Grand Junction, CO

project#: 14.0650
date: July 15, 2016

revisions :

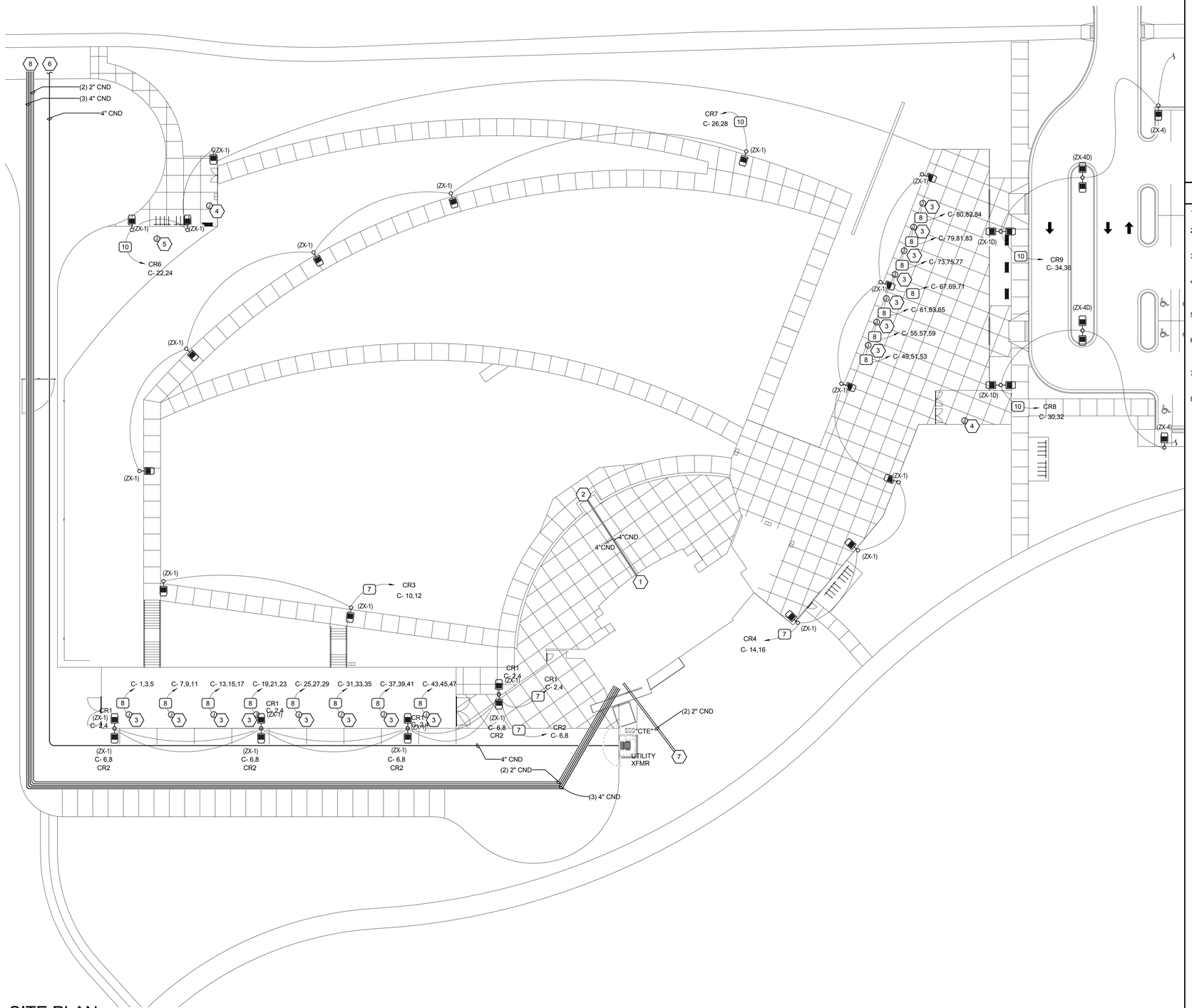
title:

PANEL SCHEDULES

sheet:

EP603

100% CONSTRUCTION DOCUMENTS



1 SITE PLAN
SCALE: 1" = 30'-0"

GENERAL SHEET NOTES

1 PROVIDE MINIMUM 1.25" CONDUIT FOR ALL SITE ELECTRICAL UNLESS OTHERWISE NOTED.

2 REFER TO CIVIL DRAWINGS FOR COORDINATED LOCATIONS OF UNDERGROUND UTILITIES. LOCATIONS SHOWN ON ELECTRICAL SHEETS ARE FOR REFERENCE ONLY.

SHEET KEYNOTES

1 EXTEND CONDUITS UNDER STAGE AS INDICATED ON POWER PLANS.

2 EXTEND CONDUIT TO SOUNDBOARD. TERMINATE IN IN-GRADE JUNCTION BOX. COORDINATE WITH LANDSCAPE ARCHITECT.

3 PROVIDE 3#8, #10G IN 1" CONDUIT BACK TO THE ELECTRICAL ROOM FOR VENDOR AND/OR CONCESSION USE. TERMINATE CONDUITS IN AN IN-GRADE JUNCTION BOX.

4 PROVIDE 1" CONDUIT FOR POWER FROM THE ELECTRICAL ROOM TO THIS LOCATION FOR TICKETING. TERMINATE CONDUITS IN AN IN-GRADE JUNCTION BOX FOR FUTURE USE.

5 PROVIDE TWO 1.5" CONDUITS BACK TO THE ELECTRICAL ROOM FOR FUTURE RESTROOM. TERMINATE CONDUITS IN AN IN-GRADE JUNCTION BOX FOR FUTURE USE.

6 EXTEND UTILITY CONDUITS TO EXISTING UTILITY SWITCHGEAR OR GROUND SLEEVE. COORDINATE EXACT LOCATION WITH UTILITY PRIOR TO ROUGH-IN. INCLUDE IN BID AN ADDITIONAL 300' OF 6" CONDUIT.

7 PROVIDE A PULL BOX THAT ALLOWS GOING EAST & WEST IN THE FUTURE. COORDINATE EXACT LOCATION WITH ARCHITECT AND OWNER.

8 PROVIDE (2) 2" CND FOR IT. PROVIDE (3) 4" CND FOR OTHER INTERNET PROVIDERS. ONE FOR EACH DIFFERNET PROVIDER (CENTURY LINK, CHARTER, OTHER). CND WILL GO TO EXISTING PULL BOXS WITH ACTIVE LINES NEAR THIS LOCATION.

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PROFESSIONAL ENGINEER
38706
7/15/2016

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1	Revision 1	06/08/2016

title:

ELECTRICAL SITE PLAN

sheet:

ES101

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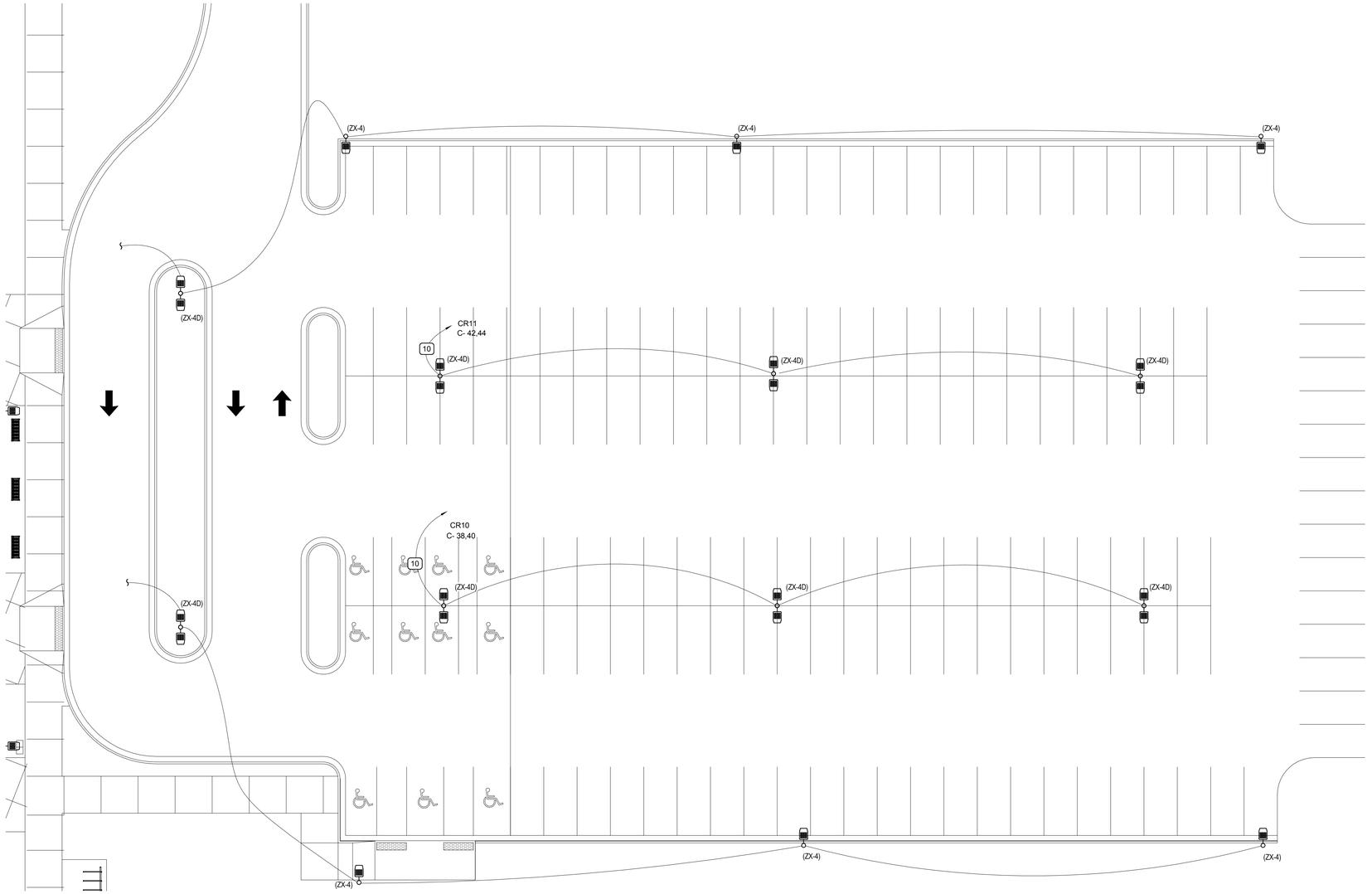

1 SITE PARKING LOT PLAN
SCALE: 1/16" = 1'-0"

GENERAL SHEET NOTES

1 PROVIDE MINIMUM 1.25" CONDUIT FOR ALL SITE ELECTRICAL UNLESS OTHERWISE NOTED.

2 REFER TO CIVIL DRAWINGS FOR COORDINATED LOCATIONS OF UNDERGROUND UTILITIES. LOCATIONS SHOWN ON ELECTRICAL SHEETS ARE FOR REFERENCE ONLY.

SHEET KEYNOTES

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ELECTRICAL SITE PARKING LOT PLAN

sheet:
ES102

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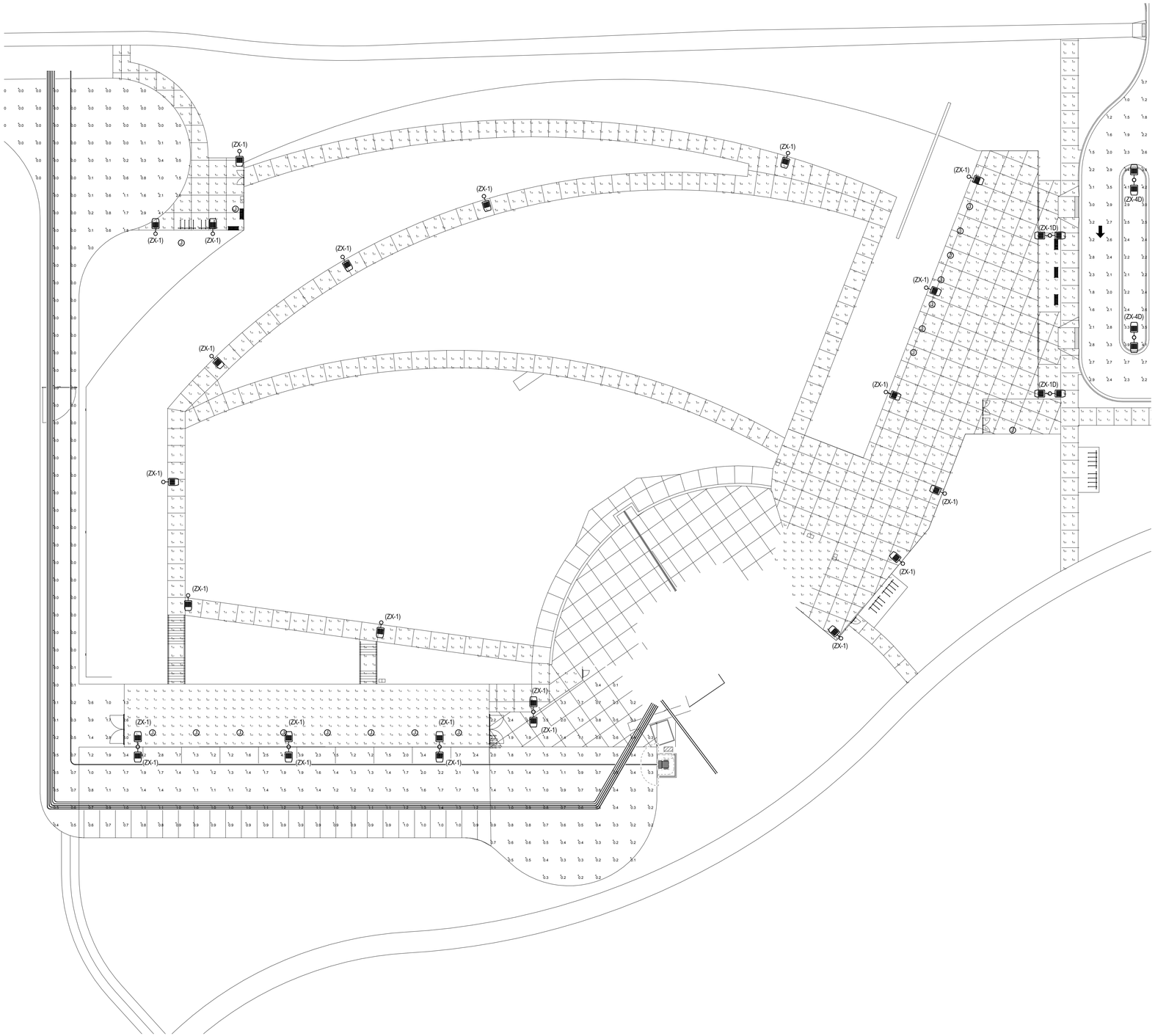

1 SITE PHOTOMETRIC PLAN
SCALE: 1" = 30'-0"

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SITE PHOTOMETRICS PLAN

sheet:

ES201

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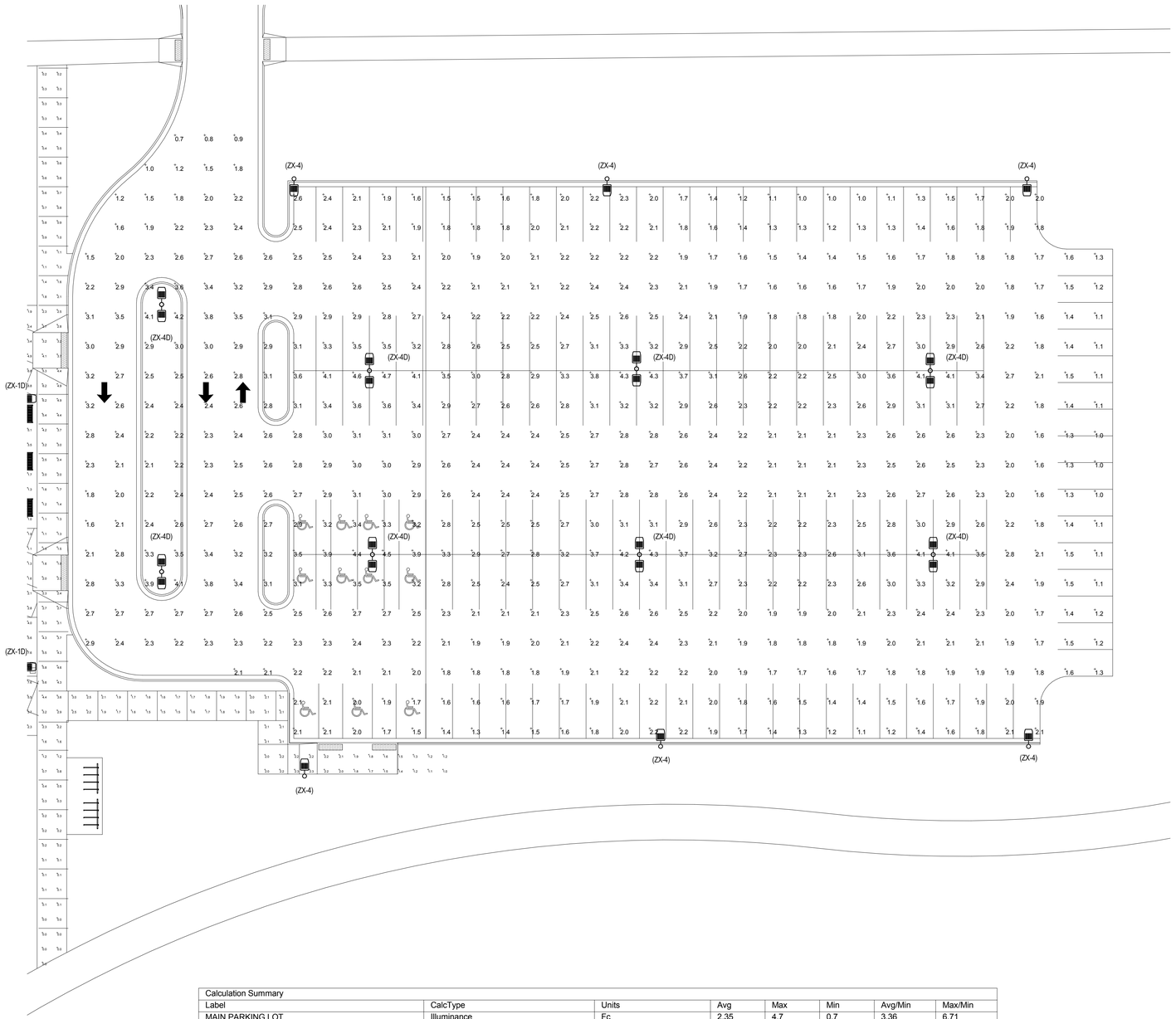

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
MAIN PARKING LOT	Illuminance	Fc	2.35	4.7	0.7	3.36	6.71
WALKWAYS	Illuminance	Fc	1.55	10.0	0.0	N.A.	N.A.
West Parking & Drive	Illuminance	Fc	0.81	5.0	0.0	N.A.	N.A.
West Parking	Illuminance	Fc	1.45	4.6	0.6	2.42	7.67

Luminaire Schedule						
Symbol	Qty	Label	Arrangement	Total Lamp Lumens	LLF	Description
	26	ZX-4	SINGLE	N.A.	0.808	GL18-4-105LA-4870-NW
	24	ZX-1	SINGLE	N.A.	0.808	GL18-4-50LA-4835-NW

1 SITE PARKING LOT PHOTOMETRIC PLAN

SCALE: 1" = 20'-0"

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Grand Junction, CO

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date: July 15, 2016

revisions :

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title:

SITE PHOTOMETRICS PARKING LOT PLAN

sheet:

ES202

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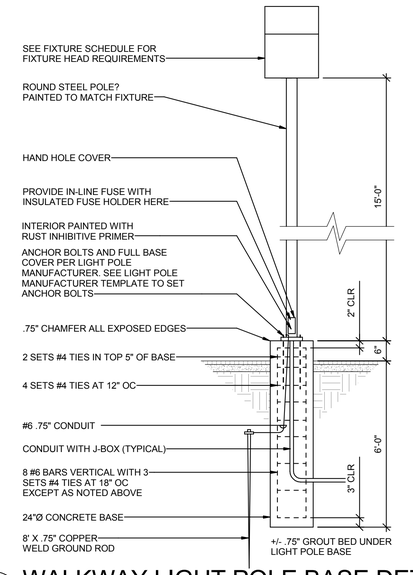
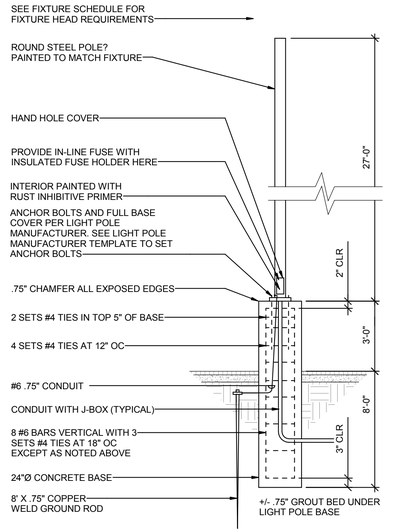


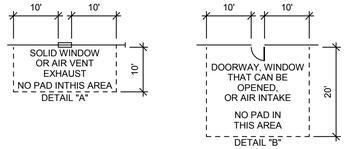
1 WALKWAY LIGHT POLE BASE DETAIL

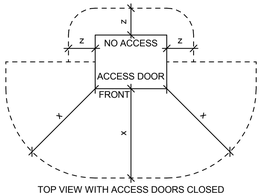
SCALE: 1/8" = 1'-0"



B1 PARKING LOT LIGHT POLE BASE DETAIL

SCALE: 1/8" = 1'-0"





TOP VIEW WITH ACCESS DOORS CLOSED
DETAIL "C"

CLEARANCE GENERAL NOTES:

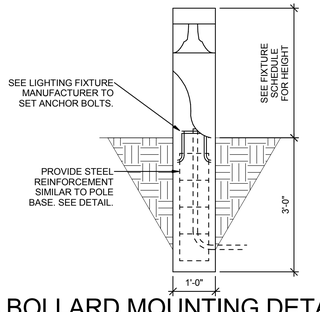
1. CLEARANCES: THE FRONT OF THE PAD SHOULD ALWAYS FACE AWAY FROM ADJACENT STRUCTURES AND BE FREE OF OBSTRUCTIONS. AT LEAST 3 FEET MUST SEPARATE THE EDGES OF THE PAD FROM ANY ADJACENT STRUCTURE. THE EDGES OF THE PAD MUST BE AT LEAST 10 FEET FROM ANY COMBUSTIBLE STRUCTURE. IF AN ADJACENT STRUCTURE HAS ANY OVERHANG OR EAVE WITHIN 27 VERTICAL FEET OF THE TOP OF THE PAD, CLEARANCES MUST BE MEASURED FROM THE OUTSIDE OF THE OVERHANG. THE PAD MUST NOT BE PLACED IN AN AREA 10 FEET IN LINE WITH OR 10 FEET TO EITHER SIDE OF ANY WINDOW IN AN ADJACENT STRUCTURE (SEE DETAIL "A"). CLEARANCE FOR A DOOR MUST BE 20 FEET IN LINE WITH IT AND 10 FEET ON THE SIDES (SEE DETAIL "B"). PADS MUST NOT BE PLACED WITHIN 15 FEET OF ANY VALVE OR WITHIN 25 FEET OF ANY PLUMBING OR STORAGE FACILITY CONTAINING FLAMMABLE MATERIAL. NO WALLS, FENCES, OR ANY OTHER OBSTRUCTIONS WILL BE PLACED WITHIN 3 FEET OF THE SIDES OR BACK OF THE PAD, OR WITHIN 10 FEET OF THE FRONT OF THE PAD (SEE DETAIL "C"). THE AREA IN FRONT OF THE PAD MUST HAVE 10 FEET OF CLEAR, LEVEL WORKING AREA FOR MAINTENANCE OF THE TRANSFORMER. THE PAD MAY NOT BE PLACED IN LINE WITH AN AIR INTAKE WITHIN 32 VERTICAL FEET OF THE SURFACE PAD. ALSO VERTICALLY, IT MUST NOT BE PLACED WITHIN 12 FEET OF A DOOR OR WINDOW. VAULTS SHALL BE LOCATED WITHIN 15 FEET OF A GRAVELED OR PAVED SURFACE SUITABLE FOR INCIDENTAL HEAVY TRUCK ACCESS.
2. BARRIERS: IF THE TRANSFORMER PAD IS TO BE LOCATED IN AREAS SUBJECT TO VEHICULAR TRAFFIC, (PARKING LOTS, DRIVEWAYS, ETC) CONTACT ROCKY MOUNTAIN POWER FOR PROTECTIVE BARRIER REQUIREMENTS.
3. IF THE TRANSFORMER WILL NOT COVER THE CABLE OPENINGS ON THESE STANDARD PADS, SEAL THE SIDES OF THE CABLE OPENING TO FIT THE TRANSFORMER USING SACKRETE OR COMPARABLE.

MINIMUM DISTANCE REQUIRED FROM PAD:

x = 10 FT. CLEAR AREA IN FRONT OF, ANY EQUIPMENT ACCESS DOOR OR OPENING TO ALLOW THE USE OF HOT STICKS. (SEE DIMENSIONS IN DETAIL "C". LOCATE PADMOUNTED EQUIPMENT WITH ACCESS DOORS AWAY FROM BUILDING WALLS OR OTHER BARRIERS TO ALLOW SAFE WORKING PRACTICES. IF THE EQUIPMENT ACCESS SIDE MUST FACE A WALL, ALLOW 10 FEET FOR WORKING CLEARANCE. NO VEGETATION OR TRIP HAZARDS IN THIS WORK SPACE ARE PERMITTED.)

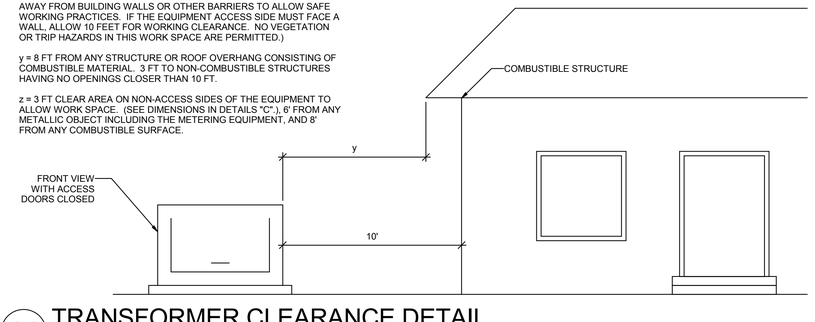
y = 8 FT FROM ANY STRUCTURE OR ROOF OVERHANG CONSISTING OF COMBUSTIBLE MATERIAL. 3 FT TO NON-COMBUSTIBLE STRUCTURES HAVING NO OPENINGS CLOSER THAN 10 FT.

z = 3 FT CLEAR AREA ON NON-ACCESS SIDES OF THE EQUIPMENT TO ALLOW WORK SPACE. (SEE DIMENSIONS IN DETAILS "C".), 6' FROM ANY METALLIC OBJECT INCLUDING THE METERING EQUIPMENT, AND 8' FROM ANY COMBUSTIBLE SURFACE.



A2 BOLLARD MOUNTING DETAIL

SCALE: 1/8" = 1'-0"



A1 TRANSFORMER CLEARANCE DETAIL

SCALE: NTS

GENERAL SHEET NOTES

1. SCOPE

THIS MATERIAL SPECIFICATION OUTLINES THE MINIMUM REQUIREMENTS FOR PADVAULTS TO BE USED IN CONJUNCTION WITH XCEL- OWNED THREE-PHASE TRANSFORMERS (SEE FIGURE 1). THE MATERIAL SPECIFICATION APPLIES WHETHER THE PADVAULT IS TO BE INSTALLED BY COMPANY PERSONNEL, CONTRACTOR, CUSTOMER, OR THE SUPPLIER.

2. APPLICABLE DOCUMENTS

THE LATEST REVISIONS OF THE DOCUMENTS, STANDARDS, CODES, AND REQUIREMENTS LISTED IN 2.1, XCEL, AND 2.2, CODES AND STANDARDS, IN EFFECT ON THE DATE OF INVITATION TO BID APPLY TO THE EXTENT SPECIFIED HEREIN.

2.1 XCEL

ZG 301 GENERAL EQUIPMENT BASE AND ENCLOSURE REQUIREMENTS

ZG 311 CONCRETE REQUIREMENTS

2.2 CODES AND STANDARDS

WESTERN UNDERGROUND COMMITTEE GUIDE 2.13, SECURITY FOR PADMOUNTED EQUIPMENT ENCLOSURES

APPLICABLE CODES, ANSI STANDARDS, IEEE STANDARDS, NEMA STANDARDS

3. GENERAL

3.1 APPLICATION INFORMATION

THIS MATERIAL SPECIFICATION STATES MATERIAL AND CONSTRUCTION REQUIREMENTS THAT ARE APPLICABLE TO ALL THREE-PHASE TRANSFORMER PADVAULTS.

3.2 AUTHORIZED MATERIAL SPECIFICATION

THIS MATERIAL SPECIFICATION IS NOT CONSIDERED VALID UNTIL EACH PAGE CONTAINS THE APPROVAL SIGNATURE OR INITIALS OF THE PERSONS NAMED IN THE TITLE BLOCKS.

4. APPLICABLE STOCK ITEM NUMBERS

MATERIALS BEING SUBMITTED FOR THE FOLLOWING XCEL STOCK ITEM NUMBERS ARE SUBJECT TO EVALUATION IN ACCORDANCE WITH REQUIREMENTS IN THIS MATERIAL SPECIFICATION.

1790023, PADVAULT, TRANSFORMER, 3-PHASE, 75-500 KVA

1790024, PADVAULT, TRANSFORMER, 3-PHASE, 500-2500 KVA

5. PRODUCT AND INSTALLATION REQUIREMENTS

THE PURPOSE OF A THREE-PHASE TRANSFORMER PADVAULT IS TO SUPPORT A THREE-PHASE TRANSFORMER.

5.1 PADVAULT LAYOUT

THE THREE-PHASE TRANSFORMER PADVAULT IS COMPOSED OF TWO PIECES: (1) THE PAD, AND (2) THE ENCLOSURE. UNLESS OTHERWISE APPROVED BY XCEL ENGINEERING, ALL DIMENSIONS AND PLACEMENT OF HARDWARE SHALL CONFORM TO THOSE SHOWN ON THIS SHEET. THE ENCLOSURE IS COMMON TO ALL PADVAULTS COVERED BY THIS MATERIAL SPECIFICATION, ZG 531, PADVAULT-THREE-PHASE SECTIONALIZING CABINET, AND ZG 551, PADVAULT-THREE-PHASE FUSING CABINET.

5.2 INSERTS

TWO .375" 16UNC STAINLESS STEEL OR NYLON THREADED INSERTS AND STAINLESS STEEL BOLTS WITH CLEATS FOR MOUNTING THE TRANSFORMER SHALL BE PLACED IN THE PAD AS SHOWN IN FIGURE 2.

5.3 PULLING ATTACHMENTS

CABLE PULLING ATTACHMENTS SHALL BE INSTALLED OPPOSITE OF EACH SET OF CONDUIT BREAKOUTS SUCH THAT BLOCKS MAY BE ATTACHED FOR A STRAIGHT CABLE PULL. PULLING ATTACHMENTS SHALL HAVE A MINIMUM PULLOUT STRENGTH OF 6000 POUNDS. ATTACHMENTS SHALL ALLOW THE ATTACHMENT OF A CLEVIS WITH A ONE-INCH DIAMETER THROUGH BOLT. PULLING ATTACHMENTS MAY BE DESIGNED BY THE MANUFACTURER TO MEET THESE REQUIREMENTS.

5.4 CONDUIT ENTRANCES

BANKS OF NINE (9) SIX-INCH SQUARE BREAKOUTS SHALL BE USED FOR CONDUIT ENTRANCES. TWO BANKS OF KNOCKOUTS SHALL BE PLACED IN EACH SIDE AND IN EACH END OF THE ENCLOSURE.

5.5 LIFTING ATTACHMENTS

ENOUGH LIFTING ATTACHMENTS SHALL BE PROVIDED TO ENSURE SAFE INSTALLATION OF ALL PIECES AT THE SITE.
ENOUGH LIFTING ATTACHMENTS SHALL BE PROVIDED TO ENSURE SAFE INSTALLATION OF ALL PIECES AT THE SITE.

5.6 INSTALLATION

THIS UNIT SHALL BE INSTALLED AT THE SITE BY THE SUPPLIER OR CONTRACTOR. ALL EARTH UNDER THE PADVAULT SHALL BE COMPACTED AND LEVEL PRIOR TO SETTING THE PADVAULT. PROVIDE 6" OF 3/4-INCH-MINUS GRAVEL BACKFILL BASE. THE JOINT BETWEEN THE PAD AND ENCLOSURE SHALL BE SEALED USING TAR OR MASTIC. THE TOP OF THE PAD SHOULD BE TWO TO FOUR INCHES ABOVE FINAL GRADE, WHEN INSTALLED.

6. TESTING

6.1 TEST COMPLIANCE

PADVAULTS SUBMITTED UNDER THIS MATERIAL SPECIFICATION SHALL MEET ALL TESTS AND REQUIREMENTS CONTAINED IN ZG 301, GENERAL EQUIPMENT BASE AND ENCLOSURE REQUIREMENTS, ZG 311, CONCRETE REQUIREMENTS, AND THIS MATERIAL SPECIFICATION. PADVAULTS WILL ALSO COMPLY WITH REQUIREMENTS IN APPLICABLE NATIONAL STANDARDS.

6.2 SECURITY TEST

TRANSFORMER PADVAULTS MUST BE ABLE TO PASS THE FOLLOWING SECURITY TEST. THE SECURITY TEST IS DESIGNED TO ENSURE THAT PADMOUNT EQUIPMENT, WHICH COMPLIES WITH WESTERN UNDERGROUND COMMITTEE GUIDE 2.13, SECURITY FOR PADMOUNTED EQUIPMENT ENCLOSURES, IS NOT COMPROMISED BY UNEVEN PAD SETTING.

WITH THE APPROPRIATE TRANSFORMER MOUNTED, ATTEMPT TO PASS A #14 AWG SOFT-DRAWN COPPER WIRE THROUGH THE INTERFACE BETWEEN THE CABINET AND PAD. IF THE WIRE CAN BE PASSED THROUGH, THE PADVAULT HAS FAILED THE TEST AND IS NOT ACCEPTABLE.

7. PROVIDE AMCOR TYPE GV151 PADVAULT OR AS APPROVED OR DIRECTED BY ROCKY MOUNTAIN POWER.

8. REQUIREMENTS ARE SUBJECT TO CHANGE. SUBMIT PADVAULT TO ROCKY MOUNTAIN POWER FOR APPROVAL PRIOR TO THE PURCHASE AND INSTALLATION OF THE PADVAULT, AND INCLUDE ALL COSTS IN BID.

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LAS COLONIAS AMPHITHEATER

Grand Junction, CO

project#: 14.0650
date: July 15, 2016

revisions :

title:

SITE ELECTRICAL DETAILS

sheet:

ES501

100% CONSTRUCTION DOCUMENTS

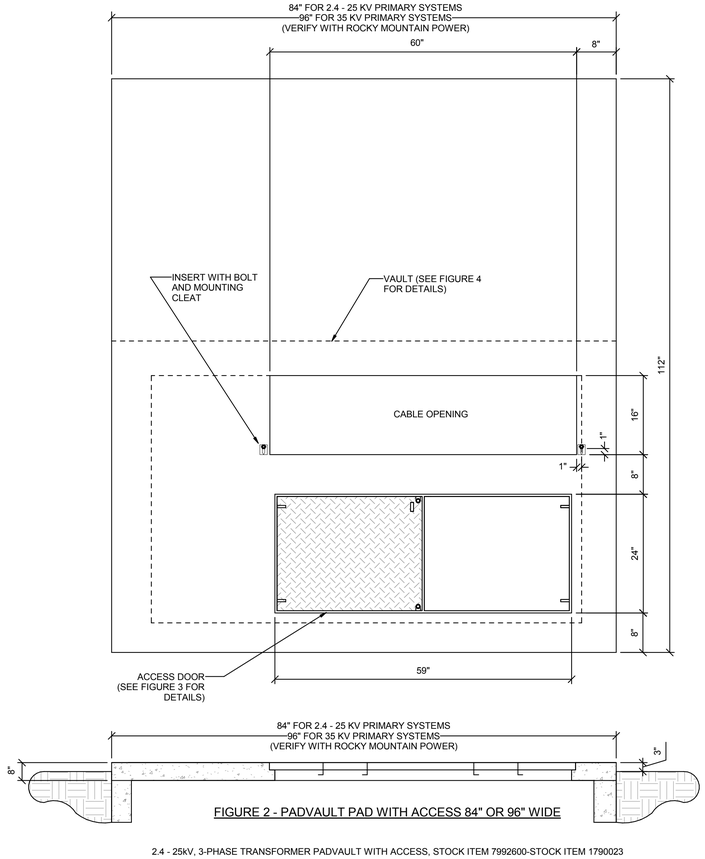


FIGURE 2 - PADVAULT PAD WITH ACCESS 84" OR 96" WIDE

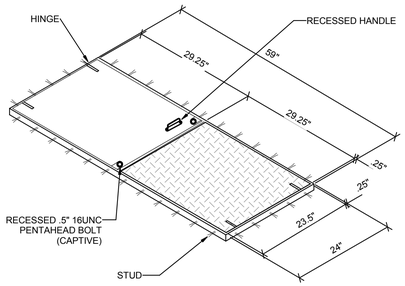
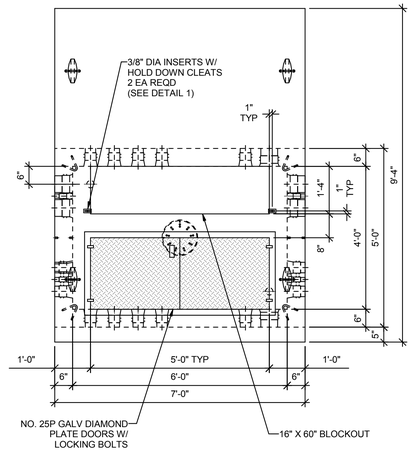
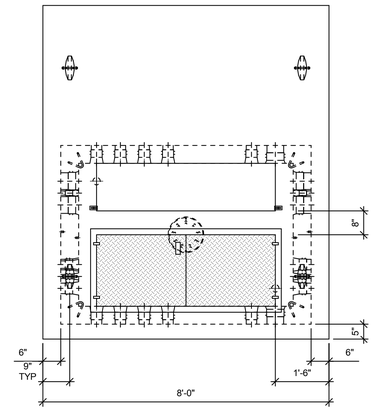


FIGURE 3 - ACCESS DOOR DETAIL



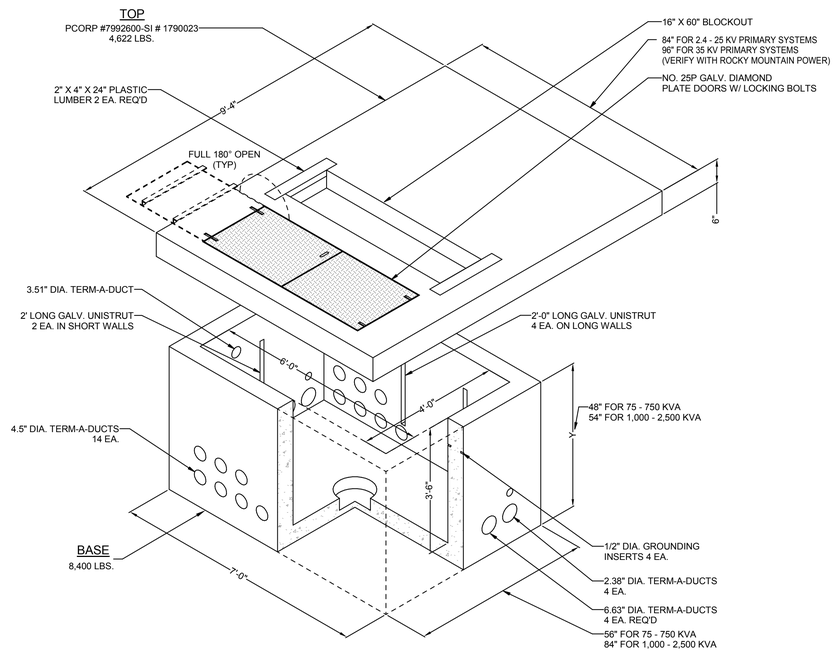
PLAN VIEW

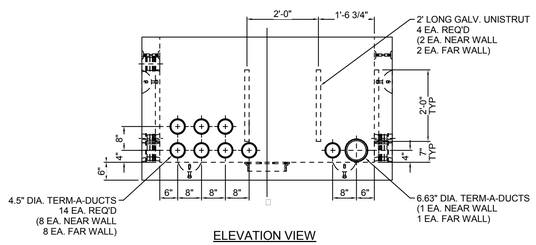
2.4-25 kV, 3-PHASE TRANSFORMER PADVAULT WITH ACCESS
PCORP #7992600 - SI #1790023



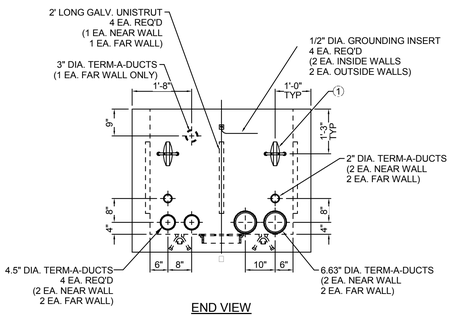
PLAN VIEW

35 kV, 3-PHASE TRANSFORMER PADVAULT WITH ACCESS
PCORP #7992602 - SI #1008977





ELEVATION VIEW



END VIEW

*LIFTING DEVICE TYPE & LOCATION MAY CHANGE WITHOUT NOTICE.

2.4 - 25kV, 3-PHASE TRANSFORMER PADVAULT WITH ACCESS, STOCK ITEM 7992600-STOCK ITEM 1790023

A1 THREE-PHASE TRANSFORMER PADVAULT

SCALE: NTS

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