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Y18-773-TA

INVITATION FOR BIDS

FOR

SOUTH WATER RECLAMATION FACILITY BUILDING IMPROVEMENTS

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PART H
TECHNICAL SPECIFICATIONS

Bid Submittal

June 2018

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PART H

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INDEX TO PROJECT MANUAL
ORANGE COUNTY

SOUTH WATER RECLAMATION FACILITY BUILDING IMPROVEMENTS
BID SUBMITTAL

OCU Sequence No. 74866
CPH Project No. O28427
June 2018

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DIVISION 1 - GENERAL REQUIREMENTS

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SECTION 01001

GENERAL WORK REQUIREMENTS

SECTION 01001

GENERAL WORK REQUIREMENTS

PART 1 - GENERAL

1.01 NOTICES

A. All notices or other papers required to be delivered by the Contractor to the County shall be delivered to the office of the Engineering Division, Orange County Utilities Department, 9150 Curry Ford Road, Orlando, FL 32825.

1.02 WORK TO BE DONE

A. The Contractor shall furnish all labor, materials, equipment, tools, services, and incidentals to complete all work required by these specifications and as shown on the Drawings, at a rate of progress which will ensure completion of the Work within the Contract Time stipulated.

B. The Contractor shall perform the Work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, clean up, replacements, and restoration required as a result of damages caused during this construction.

C. The Contractor shall comply with all City, County, State, Federal, and other codes, which are applicable to the proposed Work.

D. All newly constructed Work shall be carefully protected from injury in any way. No wheeling, walking, or placing of heavy loads on it shall be allowed and all portions damaged shall be reconstructed by the Contractor at his own expense.

E. Scope of Work: See Section 01010 "Summary of Work" and the Bid Schedule for details.

1.03 DRAWINGS AND PROJECT MANUAL

A. The Work shall be performed in accordance with the Drawings and Specifications prepared by the County/Professional. All work and materials shall conform to the Orange County Utilities Standards and Construction Specifications Manual, latest edition or as indicated in these Specifications or Drawings.

B. The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the County/Professional, and shall notify same, in writing, of all errors, omissions, conflicts and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory Work, faulty construction or improper operation resulting there from, nor from rectifying such conditions at his own expense.

C. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under this Contract.

D. Intent:
   1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified either in the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
   2. Items of material, equipment, machinery, and the like may be specified on the Drawings and not in the Specifications. Such items shall be provided by the Contractor in accordance with the specification on the Drawings.
   3. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any Work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

   4. Refer to the Contract for the order of precedence of items and documents.

1.04 PROTECTION AND RESTORATION

A. The Contractor shall be responsible for the preservation of all public and private property, and shall use every means of protection necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition similar or equal to that existing before the damage was done, or the Contractor shall make good the damage in other manner acceptable to the County/Professional.

B. Protection of Trees and Shrubs
   1. Protect with boxes or other barricades.
   2. Do not place excavated material so as to injure trees or shrubs.
   3. Install pipelines in short tunnels between and under root systems.
   4. Support trees to prevent root disturbance during nearby excavation.

C. Tree and Limb Removal
   1. Tree limbs, which interfere with equipment operation and are approved for pruning, shall be neatly trimmed and the tree cut coated with tree paint.
   2. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. The Contractor shall obtain any permits required for removal of trees. Ordered tree removal shall be paid for under the appropriate Contract Items.

D. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by the Contractor with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.

E. Lawn Areas: All lawn areas disturbed by construction shall be replaced with like kind to a condition similar or equal to that existing before construction. Where sod is to be removed, it shall be carefully removed, and the same re-sodded, or the area where sod has been removed shall be restored with new sod in the manner described in the applicable section.

F. Where fencing, walls, shrubbery, grass strips or area must be removed or damaged incident to the construction operation, the Contractor shall, after completion of the work, replace or restore to the original condition.

G. The cost of all labor, materials, equipment, and work for restoration shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

1.05 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including, but not limited to, encroachment on adjacent lands, flooding of adjacent lands, or excessive noise.

B. Sound levels measured by the County/Professional shall not exceed 45 dBA from 8 p.m. to 8 a.m. or 55 dBA 8 a.m. to 8 p.m. This sound level shall be measured at the exterior of the nearest exterior wall of the nearest residence. Levels at the equipment shall not exceed 85 dBA at any time. Sound levels in excess of these values are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the County/Professional for excessive noise shall not relieve the Contractor of the other portions of this specification including, but not limited to, completion dates and bid amounts.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.06 CONTRACTOR'S PAYMENTS TO COUNTY FOR OVERTIME WORK

A. County Inspector Work Hours: Normal work hours for the County's inspector(s) are defined as any 8-hour period between the hours of 7:00 a.m. and 7:00 p.m. on the weekdays of Monday through Friday. Any County Inspector(s) work beyond the aforementioned normal work hours shall be requested in writing 48-hours in advance. All overtime, any County holidays or weekend work compensation for the County's Inspector(s) to work beyond the normal working hours are considered overtime compensation and shall be paid for by the Contractor. The overtime pay rate will be <u>$51.00 per hour</u> or the most current rate as listed in the County Fee Directory prepared by the Office of Management and Budget, in section "Orange County Utilities Engineering & Construction", under the heading of "Inspection Fee other than Normal Working Hours". The Contractor agrees that the County shall deduct charges for work outside normal work hours and for overtime pay from payments due the Contractor.

1.07 MAINTENANCE OF SERVICE

A. Unless noted otherwise on the plans, the operation of the existing water, reclaimed water or wastewater facility on each of the respective locations shall remain in service until the transfer of service has been completed. The Contractor shall, prior to interrupting any utility service (water, sewer, etc.) for the purpose of making cut-ins to the existing lines or for any other purposes, contact the County and make arrangements for the interruption which will be satisfactory to the County.

B. Utility lines that are damaged during construction shall be repaired by the Contractor and service restored within 4-hours of the breakage. The County retains the option of repairing any damage to utility pipes in order to expedite service to the customers. The Contractor will remain responsible for all costs associated with the repair.

1.08 TRANSFER OF SERVICE

A. When the County has accepted a proposed facility and placed it into operation, the transfer of service is complete. The Contractor may begin the work of removing the existing or temporary facilities.

1.09 LABOR

A. Supervision: The Contractor shall supervise and direct the Work efficiently and with his best skills and attention. The Contractor shall have a competent, English speaking superintendent or representative, who shall be on the site of the Project at all working hours, and who shall have full authority by the Contractor to direct the performance of the Work and make arrangements for all necessary materials, equipment, and labor without delay.

B. Jurisdictional Disputes: It shall be the responsibility of the Contractor to pay all costs that may be required to perform any of the Work shown on the Drawings or specified herein to avoid any work stoppages due to jurisdictional disputes. The basis for subletting work in question, if any, shall conform to precedent agreements and decisions on record with the Building and Construction Trades Department, AFL-CIO, dated June, 1973, including any amendments thereto.

C. Apprenticeship: The Contractor shall comply with all of the requirements of Section 446, Florida Statutes, for all contracts in excess of $25,000 excluding roadway, highway or bridge contracts and the Contractor agrees to insert in any subcontract under this Contract the requirements of this Article.

1.10 MATERIALS AND EQUIPMENT

A. MANUFACTURER
   1. All transactions with the manufacturers or Subcontractors shall be through the Contractor, unless the Contractor and the County/Professional request that the manufacturer or Subcontractor communicate directly with the County/Professional. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
   2. All workmanship and materials shall be of the highest quality. The equipment shall be the product of manufacturers who are experienced and skilled in the field with an established record of research and development. No equipment will be considered unless the manufacturer has designed and manufactured equipment of comparable type and size and have demonstrated sufficient experience in such design and manufacture.
   3. No material shall be delivered to the Site without prior approval of the County/Professional.

4. All apparatus, mechanisms, equipment, machinery, and manufactured articles for incorporation into the Project shall be the new (most current production at time of bid) and unused standard products of recognized reputable manufacturers.
5. Manufactured and fabricated products:
    a. Design, fabricate and assemble in accord with the best engineering and shop practices.
    b. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
    c. Any two or more pieces of material or equipment of the same kind, type or classification, and being used for identical types of service, shall be made by the same manufacturer.
    d. Products shall be suitable for service conditions as specified and as stated by manufacturer.
    e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
    f. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.11 MANUFACTURER'S SERVICE

A. Where service by the manufacturer is specified to be furnished as part of the cost of the item of equipment, the Work shall be at the Contractor's expense.

B. The services provided shall be by a qualified manufacturer's service representative to check and verify the completed installation, place the equipment in operation, and instruct the County's operators in the operation and maintenance procedures. Such services are to be for period of time and for the number of trips specified. A working day is defined as a normal 8-hour working day on the job and does not include travel time.

C. The services shall further demonstrate to the County/Professional's complete satisfaction that the equipment will satisfactorily perform the functions for which it has been installed.

1.12 INSPECTION AND TESTING

A. General
1. All materials and equipment furnished by the Contractor shall be subject to the inspection, review and acceptance of the County and meet the requirements as outlined in the Orange County Utilities Standards and Construction Specifications Manual. If in the testing of any material or equipment it is ascertained by the County/Professional that the material or equipment does not comply with the Contract, the Contractor shall be notified thereof, and the Contractor will be directed to refrain from delivering said material or equipment, or to remove it promptly from the Site or from the Work and not accepted by the County shall be replaced with acceptable material, without cost to the County.
2. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEE, except as may otherwise be stated herein.

3. The Contractor shall give notice in writing to the County sufficiently in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture or preparation of materials. Upon receipt of such notice, the County shall arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials; or the County will notify the Contractor that the inspection will be made at a point other than the point of manufacture; or the County will notify the Contractor that inspection will be waived.
4. When inspection is waived or when the County/Professional so requires, the Contractor shall furnish to the County authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include five (5) copies of the results of physical tests and chemical analysis, where necessary, that have been made directly on the product or on similar products of the manufacturer.
5. The Contractor must comply with these provisions before shipping any material. Such inspections by the County shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

B. Cost
1. County shall employ and pay for the services of an independent testing laboratory to perform testing indicated on the Contract Documents, or at the County's discretion to ensure conformity with the Contract Documents.
2. The cost of field leakage and pressure tests and shop tests of materials and equipment specifically called for in the Contract Documents shall be borne by the Contractor. Such costs shall be deemed to be included in the Contract price.
3. The Contractor shall notify the County laboratory a minimum of 48-hours in advance of operations for scheduling of tests. When tests or inspections cannot be performed after such notice, the Contractor shall reimburse County for expenses incurred.
4. The Contractor shall pay for all work required to uncover, remove, replace, retest, etc., any work not tested due to the Contractor's failure to provide the 48-hours advance notice or due to failed tests. The Contractor shall also provide compensation for the County/Professional's personnel for required re-testing due to failed or rescheduled testing.

C. Shop Testing
1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the manufacturer in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the worksite until the County/Professional notifies the Contractor, in writing, that the results of such tests are acceptable.

2. The manufacturing company shall provide five (5) copies of the manufacturer's actual shop test data and interpreted results signed by a responsible official of the manufacturing company and notarized, showing conformity with the Contract Documents as a prerequisite for the acceptance of any equipment. The cost of shop tests (excluding cost of County's representative) and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor and shall be included in the Contract price.

D. Field Testing:
   1. The County shall employ and pay for services of an independent testing laboratory to perform testing specifically indicated in the Contract Documents. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the Work of the Contract. The Contractor shall provide compensation for retesting of all failed tests.
   2. The County may at any time during the progress of the Work, request additional testing beyond that which is specified in the Contract. This testing will be at the County's expense. Contractor shall:
      a. Cooperate with laboratory personnel, provide access to the Project.
      b. Secure and deliver to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
      c. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes, which require control by the testing laboratory.

E. Demonstration Tests: Upon completion of the Work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance or demonstration tests as specified or required to provide compliance with the Contract Documents. The Contractor shall furnish all labor, fuel, energy, water and all other equipment necessary for the demonstration tests at no additional cost to the County.

F. Final Inspection: Prior to preparation of the final payment application, a final inspection will be performed by the County to determine if the Work is properly and satisfactorily constructed in accordance with the requirements of the Contract Documents. See also Section 01700 "Project Closeout."

G. Inspection by existing utility owners: The Contractor shall pay for all inspections during the progress of the work required and provided by the owner of all existing public utilities paralleling or crossing the Work, as shown on the Drawings. All such inspection fees shall be deemed included in the appropriate Contract Item or items, or if no specific item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

H. Inspection by Other Agencies: The Florida Department of Transportation, the Florida Department of Environmental Protection, and other authorized governmental agencies shall have free access to the site for inspecting materials and work, and the Contractor shall afford them all necessary facilities and assistance for doing so. Any instructions to the Contractor resulting from these inspections shall be given through the County. These rights of inspections shall not be construed to create any contractual relationship between the Contractor and these agencies.

1.13 PROJECT SITE AND ACCESS

A. RIGHT-OF-WAY AND EASEMENTS

1. The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. Any earth or other excavated material shall be removed by the Contractor and the streets cleaned to the satisfaction of the County.
2. The Contractor shall not enter or occupy private land outside of easements, except by written permission of the property owner.
3. At the time of the Pre-Construction meetings, the Contractor shall become fully acquainted with the status of all easements. Should easements not be acquired by the County in specific areas of the Work, the Contractor shall sequence and schedule his work therein so as not to interfere with the progress of work in other areas of the Project. Any rescheduling of work due to easement acquisitions shall be performed by the Contractor at no additional cost to the County. The County agrees that it will make every effort to acquire all remaining easements with all speed and diligence possible so as to allow the completion of the Work within the Contract time.

B. ACCESS

1. Neither the material excavated nor the materials or equipment used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.
2. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business access with the business Owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored and all construction debris removed within 48-hours of backfilling trench.
3. Contractor agrees that representatives of the County and any governmental agents will have access to the Work wherever it is in preparation or progress and that the Contractor shall provide facilities for such access and inspection.

1.14 UTILITIES

A. UTILITY CONSTRUCTION

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto, whether owned or controlled by governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewerage, drainage or water. Other public or private property, which may be affected by the Work, shall be deemed included hereunder.
2. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required.
3. The length of open trench will be controlled by the particular surrounding conditions, but shall always be confined to the limits described by the County. If any excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures. As a minimum, the Contractor shall conform to the following restoration procedures:

a. Interim Restoration: All excavations shall be backfilled and compacted as specified by the end of each working day. For excavations within existing paved areas; limerock base or soil cement base (match existing) shall be spread and compacted to provide a relatively smooth surface free of loose aggregate material. At the end of each workweek, the S-I asphaltic surface course shall be completed and opened to traffic. Contractor shall coordinate his construction activity including density tests and inspections to allow sufficient time to achieve this requirement. All driveway cuts shall be backfilled, compacted, and limerock base spread and compacted immediately after installation. Contractor shall coordinate with the individual property owners prior to removing the driveway section. Any utility crossing an existing roadway, parking lot or other paved area shall be patched by the end of the working day.

b. All pipe and fittings shall be neatly stored in a location, which will cause the least disturbance to the public. All debris shall be removed and properly disposed of by the end of each working day.

c. Final Restoration Overlay: After completing all installations, and after testing of the pipe (but no sooner than 30-days after applying the S-I asphaltic surface), final restoration shall be performed. In no event shall final restoration begin after substantial completion. Final restoration shall provide an S-III asphaltic overlay as specified in an uninterrupted continuous operation until completion. Any additional restoration required after testing shall be repaired in a timely manner at no additional cost to the County.

d. Maintenance of all restored facilities shall be the Contractor's responsibility. This maintenance shall be performed on an on-going basis during the course of construction. The Contractor's Progress Schedule shall reflect the above restoration requirements.

e. Additional Restoration for Work in Business or Commercial Districts: The Contractor shall restore all private property, damaged by construction, to its original condition. Access to businesses located adjacent to the project site must be maintained at all times. Contractor may prearrange the closing of business accesses with the business owner. Such prearranged access closing shall not exceed two (2) hours. Property drainage and grading shall be restored within 24-hours of backfilling trench.

B. EXISTING UTILITIES

1. The locations of all existing underground piping, structures and other facilities are shown based on information received from the respective owner. The locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping, conduit and cables to be encountered. It is the Contractor's responsibility to verify all existing underground piping, structures and other facilities.
2. The Contractor shall, at all times, employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage or destruction of existing utility installations and structures; and shall, at all times in the performance of the Work, avoid unnecessary interference with, or interruption of, utility services; and shall cooperate fully with the owners thereof to that end.
3. When existing facilities are found to be in conflict with the Work, the County reserves the right to modify alignments to avoid interference with existing facilities.

4. All utilities, which do not interfere with the work, shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County. Any existing facilities, which require operation to facilitate repairs, shall be operated only by the owner of the respective utility.
5. It is the responsibility of the Contractor to ensure that all utility and/or poles, the stability of which may be endangered by the proximity of excavation, be temporarily stayed and/or shored in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation.

C. NOTICES
1. All governmental utility departments and other owners of public utilities, which may be affected by the Work, will be informed in writing by the Contractor two (2) weeks after the execution of the Contract or Contracts covering the Work. Such notice will be sent out in general, and directed to the attention of the governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the Work.
2. The Contractor shall comply with Florida Statute 553.851 regarding protection of underground gas pipelines. Evidence of notification to the gas pipeline owner shall be furnished to the County within two (2) weeks after the execution of the Contract.
3. It shall be the Contractor's responsibility to contact utility companies at least 72-hours in advance of breaking ground in any area or on any unit of the work so maintenance personnel can locate and protect facilities, if required by the utility company.
4. The Contractor shall give a minimum five (5) working day notice to utility personnel prior to interrupting a utility service (water, sewer, etc.).

D. EXPLORATORY EXCAVATIONS
1. Exploratory excavations shall be conducted by the Contractor for the purpose of locating underground pipelines or structures in advance of the construction. Test pits shall be excavated in areas of potential conflicts between existing and proposed facilities and at piping connections to existing facilities a minimum of 48-hours or 1,000-feet in advance of work. If there is a potential conflict, the Contractor shall notify the County/Professional immediately. Information on the obstruction to be furnished by the Contractor shall include: Location, Elevation, Utility Type, Material and Size. Test pits shall be backfilled immediately after their purpose has been satisfied and the surface restored and maintained in a manner satisfactory to the County.

E. UTILITY CROSSINGS
1. It is intended that wherever existing utilities must be crossed, deflection of the pipe within specified limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the County this procedure is not feasible, the County may direct the use of fittings for a utility crossing or conflict transition as detailed on the Drawings.

F. RELOCATIONS
1. Relocations shown on the Drawings: Public utility installations or structures, including but not limited to poles, signs, fences, piping, conduits and drains that interfere with the positioning of the work which are shown on the Drawings to be removed, relocated, replaced or rebuilt by the Contractor shall be considered as part

of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

2. Relocations not shown on the Drawings
   a. Where public utility installations or structures are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the Work, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the County, for the Contractor to accomplish.
   b. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required.
   c. If such work is accomplished by the Contractor, it will be paid for as a Change Order.
3. All existing castings, including valve boxes, junction boxes, manholes, hand holes, pull boxes, inlets and similar structures in the areas of construction that are to remain in service and in areas of trench restoration and pavement replacement, shall be adjusted by the Contractor to bring them flush with the surface of the finished work.
4. All existing utility systems which conflict with the construction of the work herein, which can be temporarily removed and replaced, shall be accomplished at the expense of the Contractor. Work shall be done by the utility unless the utility approves in writing that the Work may be done by the Contractor.

1.15 RELATED CONSTRUCTION REQUIREMENTS

A. PUBLIC INFORMATION OFFICER

1. The Contractor shall provide community interaction and coordination through a designated Public Information Officer (PIO). The PIO will provide resolution to complaints and problems from community members affected by the construction for the entire project duration. The PIO will manage a 24-hour hotline phone number for citizens to call. The PIO will field these calls, provide answers to questions, research issues with the project team or appropriate agencies and follow up each complaint in a timely manner. The PIO will maintain a daily diary of call and/or interactions with the community, as well as a complaint log chronicling all issues and proposed resolutions.
2. The PIO shall attend the project progress meetings and provide the project team with a report of public issues since the last progress meeting. The PIO will also disseminate roadway closures, sewer hookups, temporary and permanent restoration and other relevant construction information to the community, as well as, when appropriate, to the media, emergency services personnel and other interested agencies.
3. The designated PIO shall have previous experience in providing similar services on Orange County Utilities, Orange County Public Works or FDOT construction projects. The PIO shall be fluent in English and Spanish and shall visit the construction site, meeting locations and affected resident's homes as required.

B. TRAFFIC MAINTENANCE

Refer to Section 01570 – Maintenance of Traffic

C. BARRIER AND LIGHTS

1. The Contractor shall exercise extreme care in the conduct of the Work to protect health and safety of the workmen and the public. The Contractor shall provide all

protective measures and devices necessary, in conformance with applicable local, state and federal regulations. Protective measures shall include but are not limited to barricades, warning lights/flashers and safety ropes.

2. All equipment and vehicles operating within 10-feet of the roadway shall have flashing strobe lights attached.

D. DEWATERING AND FLOTATION

1. The Contractor, with his own equipment, shall do all pumping necessary to dewater any part of the work area during construction operations to insure dry working conditions. The Contractor shall take the necessary steps to protect on-site and off-site structures. Damage to any structures due to dewatering shall be repaired or the structures replaced at the Contractor's expense.
2. The Contractor shall be completely responsible for any tanks, wetwells or similar structures that may become buoyant during the construction and modification operations due to the ground water or floods and before the structure is put into operation. The proposed final structures have been designed to account for buoyancy; however the Contractor may employ methods, means and techniques during construction which may affect the buoyancy of structures. The Contractor shall take the necessary steps to protect structures. Damage to any structures due to floating or flooding shall be repaired or the structures replaced at the Contractor's expense.
3. Contractor shall be responsible for any required permits for the discharge of ground water.

E. DUST AND EROSION CONTROL

1. The Contractor shall prevent dust nuisance from his operations or from traffic.
2. Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.
3. Temporary erosion controls include, but are not limited to, grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
4. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the County, FDEP and any other agency having jurisdiction.
5. The construction of temporary erosion and sedimentation control facilities shall be in accordance with the technical provision of section 104 “Prevention, Control, and Abatement of Erosion and Water Pollution” of the FDOT Standard Specifications for Road and Bridge Construction, latest edition.

F. LINES AND GRADES

1. All Work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the County/Professional.
2. When the location of the Work is dimensioned on the Drawings, it shall be installed in that location; when the location of the Work is shown on a scaled drawing, without dimensions, the Work shall be installed in the scaled location unless the County approves an alternate location for the piping. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve the Contractor from

laying and jointing different or additional items where required. The County/Professional may require detailed pipe laying drawings and schedules for project control.

3. The Contractor shall, at his own expense, establish all working or construction lines and grades as required from the project control points set by the County, and shall be solely responsible for the accuracy thereof.
4. Water main and forcemain shall be installed to provide long uniform gradient or slope to pipe to minimize air pockets and air release valves. The stationing shown on the Drawings for air and vacuum release valve assemblies are approximate and the Contractor shall field adjust these locations to locate these valves at the highest point in the pipeline installed. All locations must be accepted by the County.
5. To insure a uniform gradient for gravity pipe and pressure pipe, all lines shall be installed using the following control techniques as a minimum:
   a. Gravity lines; continuous control, using laser beam technology.
   b. Pressure lines; control stakes set at 50-foot intervals using surveyors' level instrument.

G. TEMPORARY CONSTRUCTION

1. Temporary fences: If, during the course of the Work, it is necessary to remove or disturb any fencing, the Contractor shall at his own expense, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced.
2. Responsibility for Temporary Structures: In accepting the Contract, the Contractor assumes full responsibility for the sufficiency and safety of all temporary structures or work and for any damage which may result from their failure or their improper construction, maintenance or operation.

H. DAILY REPORTS

1. The Contractor shall submit to the County's Representative daily reports of construction activities including non-work days. The reports shall be complete in detail and shall include the following information:
   a. Days from Notice to Proceed; Days remaining to substantial and final completion.
   b. Weather information
   c. Work activities with reference to the Critical Path Method (CPM) schedule activity numbers (including manpower, equipment and daily production quantities for each individual activity).
   d. Major deliveries
   f. Visitors to site
   g. Test records
   h. New problems, and
   i. Other pertinent information
2. A similar report shall be submitted for/by each Subcontractor.
3. The report(s) shall be submitted to the County Representative within 2 days of the respective report date. Each report shall be signed by the Contractor's Superintendent or Project Manager. Pay request will not be processed unless daily reports are current.
4. If a report is incomplete, in error, or contains misinformation, a copy of the report shall be returned by the County Representative to the Contractor's Superintendent or Project Manager with corrections noted. When chronic errors or omissions occur, the Contractor shall correct the procedures by which the reports are produced.

I. CLEANING

1. During Construction
    a. During construction of the Work, the Contractor shall, at all times, keep the Site free from material, debris and rubbish as practicable and shall remove the same from any portion of the Site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable.
    b. Provide on-site containers for the collection of waste materials, debris and rubbish and remove such from the Site periodically by disposal at a legal disposal area away from the Site.
    c. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished. Use cleaning materials which will not create hazards to health or property and which will not damage surfaces. Use only those cleaning materials and methods recommended by the manufacturer of the surface material. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
    d. The Contractor shall remove from the site all surplus materials and temporary structures when no longer necessary to the Work at the direction of the County.
2. Final Cleaning
    a. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and the Contractor shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances. Employ skilled workmen for final cleaning. Thoroughly clean all installed equipment and materials to a bright, clean, polished and new appearing condition. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
    b. The Work shall be left in a condition as shown on the Drawings and the remainder of the site shall be restored to a condition equal or better than what existed before the Work.
    c. Prior to final completion, or County occupancy, Contractor shall conduct an inspection of interior and exterior surfaces, and all work areas to verify that the entire Work is clean. The County will determine if the final cleaning is acceptable.

1.16 CONSTRUCTION NOT PERMITTED

A. USE OF EXPLOSIVES

1. No blasting shall be done except as approved by the County and the governmental agency or political subdivision having jurisdiction.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01010
SUMMARY OF WORK

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. This Project involves work in three separate utility / office building facilities located on the South Water Reclamation Facility (SWRF) campus. All work performed will be required to be done while the owner maintains functional operations in all locations. This Project generally includes, but is not limited to the following:

1. Administration Building
    - Remove and replace interior acoustical ceiling tile and grid system.
    - Repair and paint interior gypsum ceilings.
    - Existing roof hatch shall be repaired.
    - Existing roof curb shall be removed and replaced or adjust as necessary for a new Roof Top Unit.
    - Existing Air Handlers (4) and Condensers (4) to be removed and replaced. Remove and replace existing thermostats.
    - Existing VAVs to be removed and replaced. Remove and replace existing thermostats.
    - Existing interior and exterior ductwork shall be removed and replaced, existinggrilles shall be removed, cleaned and reinstalled as indicated.
    - Roof mounted split and ground mounted condenser to be removed and replaced.
    - Install variable refrigerant flow system in server and UPS room. Remove wall mounted A/C from UPS room and seal wall to match existing.
    - Roof Replacement -
        - Remove existing lightning protection system, properly store and reinstall at the completion of the roofing system.
        - Remove existing copings, misc. penetrations and scuppers. Remove existing membrane down to existing light weight concrete deck (LWIC).
        - Existing roof access hatch, skylights, power vents to remain. Raise on existing curb as required. HVAC support stands to remain in place. Remove abandoned curbs and infill deck.
        - Replace existing roof drains. Add new 4'x4' sumps at ¾" per foot slope.
        - Locate new 4" dia. overflow drain per plans. Field verify route of drain leader piping below deck.
        - Raise vent stacks to a minimum of 8" above finished roof if necessary.
        - Apply counterflashing receiver at new HVAC curbs where indicated. Coordinate associated penetrations and install thru new weather-head curb.
        - Fasten a vented base sheet over the existing LWIC per manufactures recommendations to meet wind-up lift requirements.
        - Apply 2" thick non-tapered rigid insulation board and crickets, then a gypsum roof board over the vented base sheet; adhere the entire

system per the manufacturer approved adhesive patterns for the project design pressures.
    - Torch apply a 3-ply modified bitumen membrane roof system with 2-ply base flashing system per details
    - Install new coping fabrications along perimeter of parapet. Install counterflashings at mechanical unit as indicated.
- Electrical –
    - Disconnects, circuits, circuit breakers, conduit and wire shall be modified/replaced as indicated on the drawings for all new and replaced HVAC equipment and components.
    - Existing electrical panels shall be modified as indicated on the drawings.
    - Replace all existing lighting fixtures with new lighting fixtures as indicated on the drawings.

2. Maintenance Building
    - Remove and replace interior acoustical ceiling tile and grid system.
    - Repair and paint interior gypsum ceilings.
    - Existing interior ductwork shall be removed and replace per plan.
    - All grilles shall be new.
    - Existing Air Handlers (3) and condensers (3) to be removed and replaced.
    - Existing VAVs to be removed and replaced. Remove and replace existing thermostats.
    - Install dedicated split system to Server/UPS room.
    - Existing RTUs (2) serving maintenance service bay to be removed. Associated roof mounted ductwork to be removed. Openings in wall of maintenance service bay to be sealed to match existing.
    - Existing RTU (1) serving old auto repair bays to be removed and replaced including roof curb.
    - Exhaust fans serving old auto repair bays to be removed as indicated on the drawings. Patch and seal roof to match existing. Existing exhaust ductwork to be sealed just below ceiling.
    - Roof Replacement –
        - Remove existing lightning protection system, properly store and reinstall at the completion of the roofing system.
        - Remove existing edge metal, duct work, support stands, misc. penetrations and scuppers. Remove existing membrane down to existing light weight concrete deck (LWIC).
        - Existing roof access hatch, skylights, gravity vents and power vents to remain. Raise on existing curb as required. Remove abandoned curbs and infill deck.
        - Replace existing roof drains. Add new 4'x4' sumps at ¾" per foot slope.
        - Install new two-piece counterflashing receiver. Apply stucco to match existing finish over receiver per detail.
        - Raise vent stacks to a minimum of 8" above finished roof if necessary.
        - Apply counterflashing receiver at new HVAC curbs where indicated. Coordinate associated penetrations and install thru new weather-head curb.

- Fasten a vented base sheet over the existing LWIC per manufactures recommendations to meet wind-up lift requirements.
- Roof Areas 1/B & 2/B - Apply 2" thick non-tapered rigid insulation board and crickets, then a gypsum roof board over the vented base sheet; adhere the entire system per the manufacturer approved adhesive patterns for the project design pressures.
- Torch apply a 3-ply modified bitumen membrane roof system with 2-ply base flashing system per details
- Install new edge metal fabrications along perimeter. Install counterflashings at receivers along HVAC curb and base flashings.

- Electrical –
  - Disconnects, circuits, circuit breakers, conduit and wire shall be modified/replaced as indicated on the drawings for all new and replaced HVAC equipment and components.
  - Existing electrical panels shall be modified as indicated on the drawings.
  - New electrical panels shall be added as indicated on the drawings.
  - Replace all lighting fixtures with new lighting fixtures as indicated on the drawings.

3. <u>West Electrical Building</u>
   - Exterior walls shall be repaired and refinished. Existing cracks in masonry will need to be tuckpointed. All exterior louvers shall be remove and infilled with concrete masonry units. An "exterior insulation finish system" shall be applied on the entire building as indicated on the drawings.
   - A new door opening shall be installed on the east elevation.
   - Overhead door and track shall be removed and infilled on the south elevation.
   - Overhead door and track shall be removed and infilled on the north elevation reconfiguring the opening for a new double door.
   - Remove existing floor drains and repair floor flush with adjacent surfaces. Interior walls shall be painted.
   - Demo hose bibbs (3) on west side of building. Cut and cap lines on exterior of building.
   - Install new split HVAC systems (2) as indicated. Include duct smoke detectors. Condensate to drain to new drywell(s).
   - Demolish existing roof mounted exhaust fans and repair the interior and exterior openings as detailed within the drawings.
   - Roof Replacement –
     - Remove existing edge metal, gutters, downspouts and gravity vents. Remove existing membrane down to existing light weight concrete deck (LWIC).
     - Fasten a vented base sheet over the existing LWIC per manufactures recommendations to meet wind-up lift requirements.
     - Apply 3" thick non-tapered rigid insulation board, then a gypsum roof board over the vented base sheet; adhere the entire system per the manufacturer approved adhesive patterns for the project design pressures.
     - Torch apply a 3-ply modified bitumen membrane roof system.

- Install new edge metal with gutter fabrications along perimeter. Install new downspouts as indicated per plans.

- Electrical –
  - Provide new circuits to new HVAC System 1 and 2 to include circuit breakers, conduit and wire and disconnects as indicated on the drawings.
  - Provide new lighting as indicated on the drawings.

4. Fire Alarm Improvements.
   i. Provide new fire alarm systems and components as indicated on the drawings for the following facilities:
      1. Dewatering Building
      2. Digester Building
      3. Chlorine Storage Building
      4. Generator Building
      5. Administration Building
      6. Maintenance Building

The Contractor shall furnish all labor, equipment, tools, services and incidentals to complete all Work required by these Specifications and as shown on the Drawings. If conflicts arise between these specifications and the latest OCU Standards and Construction Specification Manual, then the OCU Standards shall govern.

A. Seventy-two hours in advance of breaking ground in any area or on any unit of the Work.

B. Some of the utility contacts are listed on the plans for the Contractor's convenience.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01015

PROJECT REQUIREMENTS

1. GENERAL DESCRIPTION OF WORK. The Work to be performed under these Contract Documents is generally described as follows:

   This Project involves HVAC and roof work in three separate utility / office building facilities located on the South Water Reclamation Facility (SWRF) campus. In addition, this project involves removing and replacing the fire alarm systems in six separate utility / office building facilities located on the South Water Reclamation Facility (SWRF) campus. All work performed will be required to be done while the owner maintains functional operations in all locations.

   The Contractor shall furnish all labor, equipment, tools, services and incidentals to complete all Work required by these Specifications.

2. UNITS OF MEASUREMENT. Both inch-pound (English) and SI (metric) units of measurement are specified herein; the values expressed in inch-pound units shall govern.

3. WORK BY PUBLIC UTILITIES. None.

4. WORK BY COUNTY None.

5. OFFSITE STORAGE. Offsite storage arrangements shall be approved by County for all materials and equipment not incorporated into the Work but included in Applications for Payment. Such offsite storage arrangements shall be presented in writing and shall afford adequate and satisfactory security and protection. Offsite storage facilities shall be accessible to County and Engineer.

6. SUBSTITUTES AND "OR-EQUAL" ITEMS. Consideration of Substitutions shall be in accordance with Division 0.

7. PREPARATION FOR SHIPMENT. All materials shall be suitably packaged to facilitate handling and protect against damage during transit and storage. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted to the satisfaction of Engineer. Each item, package, or bundle of material shall be tagged or marked as identified in the delivery schedule or on the Shop Drawings. Complete packing lists and bills of material shall be included with each shipment.

8. LAND FOR CONSTRUCTION PURPOSES. Contractor will be permitted to use available land belonging to County, on or near the Site, for construction purposes and for storage of materials and equipment.

Contractor shall immediately move stored materials or equipment if any occasion arises, as determined by County, requiring access to the storage area. Materials or equipment shall not be placed on the property of County until County has agreed to the location to be used for storage.

9. OPERATION OF EXISTING FACILITIES. The existing treatment plant must be kept in continuous operation throughout the construction period. The Contractor shall submit a Contractor's Assistance Request for Access to County Facilities at least 72 hours in advance for entering buildings or other restricted areas or equipment.

10. NOTICES TO COUNTIES AND AUTHORITIES. Contractor shall, as provided in the General Conditions, notify Counties of adjacent property and utilities when prosecution of the Work may affect them.

    When it is necessary to temporarily deny access to property, or when any utility service connection must be interrupted, Contractor shall give notices sufficiently in advance to enable the affected persons to provide for their needs. Notices shall conform to any applicable local ordinance and, whether delivered orally or in writing, shall include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby. Utilities and other concerned agencies shall be notified at least 24 hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

11. CONNECTIONS TO EXISTING FACILITIES. Unless otherwise specified or indicated, Contractor shall make all necessary connections to existing facilities, including structures, drain lines, and utilities such as water, sewer, gas, telephone, and electric. In each case, Contractor shall receive permission from County or the owning utility prior to undertaking connections. Contractor shall protect facilities against deleterious substances and damage. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials, and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the County or the owning Utility.

12. UNFAVORABLE CONSTRUCTION CONDITIONS. During unfavorable weather, wet ground, or other unsuitable construction conditions, Contractor shall confine its operations to work which will not be affected adversely by such conditions. No portion of the Work shall be constructed under conditions which would affect adversely the quality or efficiency thereof, unless special means or precautions are taken by Contractor to perform the Work in a proper and satisfactory manner.

13. CUTTING AND PATCHING. Contractor shall perform all cutting and patching required for the Work and as may be necessary in connection with uncovering Work for inspection or for the correction of defective Work.

Contractor shall provide all shoring, bracing, supports, and protective devices necessary to safeguard all Work and existing facilities during cutting and patching operations. Contractor shall not undertake any cutting or demolition which may affect the structural stability of the Work or existing facilities without Engineer's concurrence.
Materials shall be cut and removed to the extent indicated on the Drawings or as required to complete the Work. Materials shall be removed in a careful manner, with no damage to adjacent facilities or materials. Materials which are not salvable shall be removed from the site by Contractor.

All Work and existing facilities affected by cutting operations shall be restored with new materials, or with salvaged materials acceptable to Engineer, to obtain a finished installation with the strength, appearance, and functional capacity required. If necessary, entire surfaces shall be patched and refinished.

14. HAZARDOUS ENVIRONMENTAL CONDITIONS AT SITE. No Hazardous Environmental Conditions at the Site in areas that will be affected by the Work are known to the County.

15. CLEANING UP. Contractor shall keep the premises free at all times from accumulations of waste materials and rubbish. Contractor shall provide adequate trash receptacles about the Site and shall promptly empty the containers when filled.

Construction materials, such as concrete forms and scaffolding, shall be neatly stacked by Contractor when not in use. Contractor shall promptly remove splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from surfaces to prevent marring or other damage.

Volatile wastes shall be properly stored in covered metal containers and removed daily.

Wastes shall not be buried or burned on the Site or disposed of into storm drains, sanitary sewers, streams, or waterways. All wastes shall be removed from the Site and disposed of in a manner complying with local ordinances and antipollution laws.

Adequate cleanup will be a condition for recommendation of progress payment applications.

16. APPLICABLE CODES. References in the Contract Documents to local codes mean the following:

2017 Florida Building Code

Other standard codes which apply to the Work are designated in the Specifications.

17. REFERENCE STANDARDS. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code, or laws or regulations in effect at the time of opening of Bids (or on the effective date of the Contract or Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents. However, no provision of any referenced standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of County, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents, nor shall any such provision or instruction be effective to assign to County, Engineer, or any of Engineer's CONSULTANTS, agents, or employees, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

18. PRECONSTRUCTION CONFERENCE. Prior to the commencement of Work at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by:

Contractor and its superintendent.
Principal Subcontractors.
Representatives of principal Suppliers and manufacturers as appropriate.
Engineer.
Representatives of County. Government representatives as appropriate.
Others as requested by Contractor, County, or Engineer.

Unless previously submitted to Engineer, Contractor shall bring to the conference a preliminary schedule for each of the following:

Progress Schedule.
Procurement Schedule.
Schedule of Values for progress payment purposes.
Schedule of Shop Drawings and other submittals.

The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda will include:

Contractor's preliminary schedules.
Transmittal, review, and distribution of Contractor's submittals.
Processing Applications for Payment.
Maintaining record documents.

Critical Work sequencing.
Field decisions and Change Orders.
Use of premises, office and storage areas, security, housekeeping, and County's needs.
Major equipment deliveries and priorities.
Contractor's assignments for safety and first aid.

Engineer will preside at the conference and will arrange for keeping the minutes and distributing the minutes to all persons in attendance.

19. PROGRESS MEETINGS. Contractor shall schedule and hold regular progress meetings at least monthly and at other times as requested by County or required by progress of the Work. Contractor, Engineer, and all Subcontractors active on the Site shall be represented at each meeting. Contractor may at its discretion request attendance by representatives of its Suppliers, manufacturers, and other Subcontractors.

County shall preside at the meetings. Meeting minutes shall be prepared and distributed by the Engineer. The purpose of the meetings will be to review the progress of the Work, maintain coordination of efforts, discuss changes in scheduling, and resolve other problems which may develop.

Each week, on the same day of the week as the monthly meeting, when there is no monthly meeting, the Contractor will hold a coordination meeting to discuss planned work for that week and for periods of two additional weeks. Contractor and contractor's Superintendent, foreman, and subcontractors that are in involved with the planned work, should be in attendance with the County's RPR. Contractor will provide a planned work Schedule for each meeting and make necessary corrections and changes after the meeting and distributed to attendees.

20. SITE ADMINISTRATION. Contractor shall be responsible for all areas of the Site used by it and by all Subcontractors in the performance of the Work. Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to County or others. Contractor shall have the right to exclude from the Site all persons who have no purpose related to the Work or its inspection, and may require all persons on the Site (except County's employees) to observe the same regulations as Contractor requires of its employees.

Access to the Site will be limited to the west gate off Sand Lake Road unless specific alternate arrangements are made with the Owner. Contractor shall supply a list, and periodically update it, that contains the names of all personnel with driver licenses numbers and license plate numbers of all vehicles that will be on-site during construction. Contractor shall also supply County's Security Representative a daily list of any scheduled visitors. Only scheduled visitors will be permitted to enter upon verification of identity.

County reserves the right to direct CONTRACTOR to permanently remove any subcontractor or subcontracted employee from the site for breach of security, policy, unsafe working practice, unprofessional behavior, or failure to comply with access restrictions.

21. SECURITY. CONTRACTOR shall be responsible for protection of the Site, and all Work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Contractor shall comply with Orange County's security requirements to protect the South Water Reclamation Facility site.

The County has a contract to provide guard services at the plant site from 5:00 AM to 5:00 PM Monday through Friday. Site access through the west gate off Sand Lake Road is controlled by the guard service. The Contractor shall be required to pay for additional guard services to accommodate work outside of these hours and holidays to provide the same level of security. In addition, the Contractor shall provide the following security measures:

a. The Contractor will supply a list of all personnel that will be on Site to County's R.P.R. The list must be kept current and provided at least one day in advance of the personnel's arrival.
b. All personnel, employees and or subcontractors and suppliers that pass through the security perimeter shall wear Contractor issued photo identification badges.
c. Contractor will supply list with names, driver license, and license plate numbers of all personnel.
d. All Contractor's and subcontractor's personnel passing through the security perimeter shall have background checks to identify any historical crimes dealing with terrorism, sabotage, or other government related illegal activities at the cost of the Contractor and before entering Orange County Utilities' South Water Reclamation Facilities. Proof of background checks shall be submitted, in sealed envelopes, to County's Safety Division.
e. All project deliveries shall be inspected prior to entering the security perimeter of the Facility in order to verify contents. All delivery personnel and delivery vehicles shall be under supervision while within the security perimeter of the Facility in lieu of issuance of photo identification badges. The Contractor shall maintain staff to accept all deliveries to the site; the County will not be responsible for receipt of any deliveries.

f. If access other than the west gate off Sand Lake Road is utilized, a full time guard shall be provided at the construction gate during contractor working hours at the cost of the Contractor. All arrangements for alternative access shall be pre-arranged with the County. All alternative access must be secured and locked when not in use.

No Claim shall be made against County by reason of any act of an employee or trespasser, and CONTRACTOR shall make good all damage to County's property resulting from CONTRACTOR's failure to provide security measures as specified.

22. CONSTRUCTION ASSISTANCE REQUEST (CAR) FORM. The Contractor shall submit CAR to the Owner's Representative for any interaction requiring the involvement of the Owner's Operational Staff at SWRF, including but not limited to the following examples; existing valve actuation, process interruptions, equipment operation interruption, power interruption, flow diversions, spare parts transfers, and training. The Contractor shall not have contact with the Operations Staff without the knowledge of the Owner's Representative. The Owner's Representative reserves the right to direct the Contractor to provide a CAR at his discretion. Unless otherwise noted by the Owner's Representative, a CAR shall be submitted a minimum of seven (7) calendar days in advance of the intended operation noted within the CAR. Unless otherwise noted in the Contract Documents, for all activities affecting treatment process operation, a CAR shall be submitted a minimum of thirty (30) days in advance of the scheduled activity. Unless otherwise noted in the Contract Documents, the schedule for performing work which will require shutting down a unit process must be coordinated with the Owner by CAR submittal a minimum of sixty (60) days in advance of the scheduled activity. Reference a blank copy of the form within this section.

23. TOBACCO FREE POLICY – TOBACCO FREE CAMPUS. In order to protect the public health, safety, and welfare of citizens and employees, smoking tobacco or any other substance is prohibited in County owned or operated facilities and vehicles. Contractor's personnel will not be permitted to use tobacco products on County property, including County parking lots, break areas, and worksites. Smoking means the lighting of any cigarette, cigar or pipe, or the possession of any lighted cigarette, cigar or pipe, regardless of its composition. This requirement shall be enforced from the beginning of construction and violators will be removed from the property.

24. COUNTY'S WORK SCHEDULE. The County reserves the right to have their Resident Project Representative (RPR) present to witness and inspect all Work performed by the Contractor. Working hours for the RPR are a 10-hour period between the hours of 7:00 a.m. and 7:00 p.m., Monday through Friday. Any Work beyond the 10-hour period shall be considered overtime and shall be requested in writing 24 hours prior. Contractor, with verbal permission of the RPR, may work 24 hours a day to provide clean-up, maintenance of vehicles and equipment, and other such items without the RPR present.

Any Work required on Saturday or Sunday shall be considered overtime and shall be requested in writing 48 hours in advance. All requests must be approved by County in advance. Under emergency situations a verbal request may be made with a follow-up written request.

County observes the following holidays: New Year's Day, Martin Luther King Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

Contractor shall pay for the RPR's overtime. Overtime shall be defined as time beyond the working period between 7:00 a.m. and 7:00 p.m. on Monday through Friday, and all time on Saturdays, Sundays, and on holidays observed by the County. Hourly rates for the Resident Project Representatives shall be $51 per hour.

26. TRAINING. Unless otherwise specified, a minimum of 2 days of training shall be provided for each piece of equipment supplied, including all electrical installation, instruments, and testing equipment. Contractor shall video and audio record the training. The Contractor shall submit a C.A.R (Construction Assistance Request) form seven days prior to beginning of training. Contractor shall submit training agenda, instructor names and resumes, and training handouts to be used. Training shall be based on O&M manuals supplied by the Contractor. Manuals shall be supplied prior to training.

27. PERMITS. The Contractor shall comply with all laws, rules, regulations, and ordinances of any authority having jurisdiction over the work as required by the General Conditions. Permits obtained by the County are appended to this section. The term, "Engineer", in the building department permit, refers to the Contractor's engineer.

END OF SECTION

CONTRACTOR'S ASSISTANCE REQUEST
FOR ACCESS TO COUNTY FACILITIES

PROJECT: SOUTH WATER RECLAMATION FACILITY BUILDING IMPROVEMENTS

DATE: _____ NUMBER: _____

LOCATION/STRUCTURE: _____

_____

PURPOSE: _____

_____

_____

ADDITIONAL ASSISTANCE REQUESTED: _____

_____

_____

DATE ACCESS NEEDED: _____

DURATION OF WORK: _____

_____ _____
CONTRACTOR OCU CONSTRUCTION

COMMENTS/RESTRICTIONS: _____

_____

_____

_____

_____
PLANT SUPERVISOR

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SECTION 01027
APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENT

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Prior to submitting a monthly payment application, the Contractor's progressive As-Built Drawings, As-Built Asset Attribute Data, Gravity Main, and Pipe Deflection Tables for the period covered by the monthly payment application shall be submitted and accepted by the County.

1.02 FORMAT

A. Format and Content: Use the accepted Schedule of Values.
   1. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
      a. Generic name
      b. Related specification section
      c. Name of subcontractor
      d. Name of manufacturer or fabricator
      e. Name of supplier
      f. Dollar value
   2. Round amounts off to the nearest whole dollar. The total shall equal the Contract Amount.

1.03 PREPARATION OF APPLICATION

A. Each Application for Payment shall be consistent with previous applications for payments as certified and paid for by the County.

B. Payment Application Times: As stated in the General Conditions, Payment Applications shall be submitted monthly on a day of the month established by the County at the Pre-Construction Conference.

C. Application Preparation: Contractor shall complete every entry on the Pay Application form. The form shall be executed by a person authorized to sign legal documents on behalf of the Contractor and the signature notarized. Incomplete applications will be returned without action. The following procedure shall be followed by the Contractor:
   1. Submit applications typed on forms provided by the County.
   2. Use data on Bid Form and approved Schedule of Values. Provide dollar value in each column for each line item for portion of Work performed and for stored products.
   3. List each authorized Change Order and use additional sheets if necessary, list Change Order number and dollar amount for the original item of work.
   4. Each item shall have an assigned dollar value for the current pay period and a cumulative value for the project to-date.
   5. Submit stored material log, partial waivers of claims and mechanic liens, and Consent

of Surety with each application, as further explained below.

D. Contractor shall submit a stored material log with each application for payment that identifies the type, quantity, and value of all stored material that tracks when the stored materials were installed and deducts the installed material from the stored quantity at that time. Include original invoices for all stored materials for which payment is requested.

E. Waivers of Claims and Mechanics Lien (Waivers):
   1. The Contractor shall submit the final Application for Payment with, if not already submitted, the final waivers from every entity involved with performance of work covered by the Application that could lawfully be entitled to a payment claim or lien.
   2. Format of Waiver Forms: The Contractor shall submit executed waivers of claims and liens on forms acceptable to the County.
   3. The County reserves the right to designate which entities involved in the Work must submit waivers.

F. Transmittal of Pay Applications: Contractor shall submit six (6) executed copies of each Application for Payment to the County. One (1) copy shall include all waivers of lien and similar attachments.
   1. The Contractor shall transmit each Pay Application package with a transmittal form that lists attachments and all appropriate information related to the application. The transmittal form shall be acceptable to the County.
   2. The Contractor shall include a certification with each application stating that all previous payments received from the County under the Contract have been applied by the Contractor to discharge, in full, all obligations of the Contractor in connection with the Work covered by prior applications for payment. The Contractor shall also certify that all materials and equipment incorporated into the Work are free and clear of all liens, claims, security interest, and encumbrances.

G. Initial Application for Payment Submittal: Administrative actions and submittals that must precede or coincide with submittal of the initial Application for Payment include the following:
   1. List of Subcontractors
   2. List of principal suppliers and fabricators
   3. Schedule of Values
   4. Contractor's Construction Progress Schedule (accepted)
   5. List of Contractor's staff assignments
   6. Copies of building permits
   7. Copies of authorizations and licenses from governing authorities for performance of the Work
   8. Certificates of insurance and insurance polices
   9. Performance and Payment bonds (if required)
   10. Data needed to acquire County's insurance

H. Monthly Application for Partial Payment Submittals: Administrative actions and submittals that must precede or coincide with submittal of Monthly Applications for Partial Payment include the following, as applicable:
   1. Relevant tests
   2. Progressive As-builts (one (1) paper copy and electronic copy)
   3. Table 01050-2 Asset Attribute Data Form Examples (one (1) paper copy and electronic copy)

4. Table 01050-3 Pipe Deflection Table (one (1) paper copy and electronic copy)
5. Table 01050-4 Gravity Main Table (one (1) paper copy and electronic copy)
6. An electronic copy of all survey field notes
7. Partial Consent of Surety
8. Site photographs
9. Updated Progress Schedule: submit one (1) electronic copy and five (5) copies
10. Summary of Values
11. Pay Request
12. On-Site Storage of materials
13. Contractor Draw Schedule

I. Substantial Completion Application for Payment Submittal: Following issuance of the Certificate of Substantial Completion, Contractor shall submit an Application for Payment. This Application shall reflect any Certificates of Partial Substantial Completion issued previously for the County's occupancy of designated portions of the Work.
   1. Administrative actions and submittals that shall precede or coincide with this application include:
      a. Occupancy permits and similar approvals
      b. Warranties (guarantees) and maintenance agreements
      c. Test/adjust/balance records
      d. Maintenance instructions
      e. Meter readings
      f. Start-up performance reports
      g. Change-over information related to the County's occupancy, use, operation and maintenance
      h. Final Cleaning
      i. Application for reduction of retainage and consent of surety
      j. Advice on shifting insurance coverage
      k. List of incomplete Work, recognized as exceptions to County's Certificate of Substantial Completion

J. Final Completion Application for Payment Submittal: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
   1. Prior to submitting a request for final payment or the County issuing a Certificate of Completion for the Work, the Contractor shall submit the final Record Documents to the County for approval. Retainage funds will be withheld at the County's discretion based on the quality and accuracy of the final Record Documents.
   2. Written signed statements by the Contractor
      a. Completion of project close-out requirements
      b. Completion of items specified for completion after Substantial Completion
      c. Assurance that unsettled claims are settled
      d. Assurance that work not complete and accepted is now completed
   3. Transmittal of Record Documents to the County
   4. Proof that taxes, fees, and similar obligations have been paid
   5. Removal of temporary facilities and services has been completed
   6. Removal of surplus materials, rubbish, and similar elements
   7. Prepare Application for Final Payment as required in General Conditions

1.04 PAY APPLICATION SUBSTANTIATING DATA

A. When the County requires substantiating data for a Pay Application, submit data justifying Pay Application line item amounts in question.

B. Provide one (1) copy of data with a transmittal letter for each copy of Pay Application submittal. The Pay Application number, date, and line item by number and description shall be clearly stated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01065
PERMITS AND FEES

PART 1 - GENERAL

1.01 REQUIREMENTS

A. General
1. Upon Notice of Award, obtain and pay for all appropriate and applicable permits and licenses as provided for in the General Conditions, except as otherwise provided herein.
2. Schedule all inspections and obtain all written approvals of the agencies required by the permits and licenses.
3. Strictly adhere to the specific requirements of the governmental unit(s) or agency(cies) having jurisdiction over the Work. Whenever there is a difference in the requirements of a jurisdictional body and the Contract Documents, the more stringent shall apply.
4. A copy of the permits obtained by the County are furnished in Appendix B "Permits Obtained by County" of these specifications.
5. Unless otherwise specified, the cost of work specified in the various sections of Division 1, will not be paid for separately but the cost therefore shall be considered incidental to and included in the bid prices of the various Contract items.

B. Building Permit (Orange County)
1. The County will pay the general building permit fee and any related impact fees or assessments to be paid to Orange County for the issuance of that permit only.
2. The Contractor shall pay all fees associated with obtaining Orange County trade permits and any and all inspection fees for the Orange County Building Department providing inspections for this project. The Contractor shall apply for and obtain the building permits from Orange County and schedule and obtain final approval from the building inspectors.
3. Information on Orange County Building Department fees is included in the Instructions to Bidders in Division 0.
4. The Contractor shall be responsible for scheduling all permit inspections and obtaining inspection approval from Orange County, as required by the building and sub-discipline construction permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01070
ABBREVIATIONS AND SYMBOLS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Reference to the following standards of any technical society, organization or body shall be construed to mean the latest standard, code or specification or tentative specification adopted and published at the date of advertisement for bids, even though reference has been made to an earlier standard. Such reference is hereby made a part of the Contract the same as if herein repeated in full and in the event of any conflict between any of these specifications, standard codes or tentative specifications and the Contract Documents, the most stringent shall govern.

AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ABPA	Acoustical and Board Products Association
ACI	American Concrete Institute
AFBMA	Anti-Friction Bearing Manufacturer's Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AIEE	American Institute of Electrical Engineers
AIMA	Acoustical and Insulating Materials Association
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	American Moving and Conditioning Association
ANSI	American National Standards Institute
API	American Petroleum Institute
APWA	American Public Works Association
AREA	American Railway Engineering Association
ASA	American Standards Association (now ANSI)
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASSCBC	American Standard Safety Code for Building Construction
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWBP	American Wood Preservers Board
AWS	American Welding Society
AWWA	American Water Works Association
CRSI	Concrete Reinforcing Steel Institute
CS	Commercial Standard
DOT Spec	Standard Specification for Road and Bridge Construction –
FDOT	Florida Department of Transportation
FAC	Florida Administrative Code
FS	Federal Standard

IEEE	Institute of Electrical and Electronic Engineers
IPCEA	Insulated Power Cable Engineers Association
NACE	National Association of Corrosion Engineers
NASSCO	National Association of Sewer Service Companies
NBFU	National Board of Fire Underwriters
NBS	National Bureau of Standards
NEC	National Electrical Code
NECA	National Electrical Contractor's Association
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NPT	National Pipe Threads
NSF	National Science Foundation
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Prestressed Concrete Institute
PS	United States Products Standards
SAE	Society of Automotive Engineers
SDI	Steel Decks Institute
SJI	Steel Joists Institute
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SSPC	Structural Steel Painting Council
UL	Underwriter's Laboratories, Inc.
USASI	United States of American Standards Institute (Now ANSI)

B. UNITS OF MEASUREMENT

CU FT	cubic feet
CU IN	cubic inch(es)
CY	cubic yard(s)
DegC	degree(s) Centigrade
DegF	degree(s) Fahrenheit
F	Fahrenheit
FT	feet, foot
G	gram(s)
GA	gage
GAL	gallon(s)
GPH	gallon(s) per hour
GPM	gallon(s) per minute
GPS	gallon(s) per second
HR	hour(s)
IN	inch(es)
IPS	iron pipe size
KG	kilogram(s)
L	liter(s)
LB	pound(s)
LBF-IN	pound (force) inch
LF	linear foot, linear feet

MIN. min.	minute(s), minimum
ml	milliliter
MO	month(s)
OZ	ounce(s)
QT	quart
RH	relative humidity
SF	square foot, square feet
SQ IN	square inch(es)
YD	yard(s)
YR	year(s)

C. TERMINOLOGY

@	at
AB	anchor bolt
ADJ	adjust, adjustable
ADMIN	administration
AFG	above finished grade
AGGR	aggregate
AL	aluminum
ALT	alternate
APPX	appendix
APX	approximate
ART	article
ASPH	asphalt
ASSY	assembly
AUTO	automatic
AUX	auxiliary
AVE	avenue
AVG	average
AWG	American Wire Gauge
BAR	barrier
BCCMP	bituminous coated corrugated metal pipe
BL	base line
BLDG	building
BLKG	blocking
BM	beam
C to C	center to center
CCB	concrete block, masonry
CEM	cement
CIP	cast iron pipe, cast in place
CJ	construction joint
CL	center line, clearance
CM	Construction Manager
CMP	corrugated metal pipe
CO	cleanout
CONC	concrete
CONN	connection
CONST	construction
CONT	continuous

CONTR	contractor
CU, COP	copper
ORR	corridor
CRIT	critical
CTD	coated
CTR	center
CULV	culvert
d	delta
DBL	double
DEM	demolition, demolish
DEPT	department
DET	detail
DIA, D	diameter
DIAG	diagonal
DIM	dimension
DWG	drawing
FEM	female
FUT	future
FV	field verify
FM	force main
FH, HYD	fire hydrant
ID	inside diameter
MAS	masonry
MATL	material
MAX	maximum
MFD	manufactured
MFG	manufacturing
MFR	manufacturer
MH	manhole, metal hallide
MIN	minimum
MISC	miscellaneous
MTL	material
NAT	natural
NATL	national
NOM	nominal
NTS	not to scale
OD	outside diameter
PP	power pole
R	radius
Rd	road
REIN	reinforce
REL A	relief air
REQD	required
REV	revision
RR	railroad
R/W	right-of-way
RWM	reclaimed water main
RY	railway
SAN	sanitary

SCH	schedule
SECT	section
SLV	sleeve
SQ	square
SST	stainless steel
ST	street
STA	station
STD	standard
SURF	surface
SUSP	suspend(ed)
SYM	Symbol, symmetrical
SYS	system
TEMP	Temperature, temporary
TYP	typical
UTIL	utility
W	West
WLD	welded
WM	water main
W/O	without
WT	weight
YD	yard
YR	year
Y W	wye

END OF SECTION

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SECTION 01091
REFERENCE SPECIFICATIONS

PART 1 GENERAL

1.01 GENERAL

B. Applicable Publications: Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is specified, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of or omission from said standards or requirements.

C. Assignment of Specialists: In certain instances, specification test requires (or implies) that specific work is to be assigned to specialist or expert entities who must be engaged for the performance of the Work. Such assignments shall be recognized as special requirements over which the Contractor has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the Work. They are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of Work is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the Contractor.

1.02 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

D. Without limiting the generality of other requirements of the Specifications, all Work specified herein shall conform to or exceed the requirements of such referenced documents which are not in conflict with the requirements of these Specifications or applicable codes.

E. References herein to "Building Code" shall mean the Florida Building Code. The latest edition of the code shall apply to the Work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

F. In case of conflict between codes, reference standards, Drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the Engineer for clarification and directions prior to ordering or providing any materials or labor. The Contractor shall bid the most stringent requirements.

G. Applicable Standard Specifications: The Contractor shall construct the Work specified herein in accordance with the requirements of the Contract Documents and the referenced portions of those referenced codes, standards, and specifications listed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor participation in pre-construction conferences, progress meetings and specially called meetings.

1.02 MEETINGS CALLED BY THE CONSULTANT

A. The Consultant will schedule and administer a pre-construction conference, periodic progress meetings and specific topic meetings throughout the progress of the Work. The Consultant will:
   1. Prepare and distribute a notification of the meeting to required attendees.
   2. Establish, prepare and distribute an agenda with the notification.
   3. Make physical arrangements for the meetings.
   4. Preside at meetings.
   5. Prepare and distribute minutes of meetings including significant proceedings and decisions, within 15 working days after each meeting. Minutes will be forwarded to all participants and to parties affected by decisions made at the meeting.

B. Representatives of the Contractor, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The meeting location will generally be a central site, convenient for all parties, designated by the County.

D. All meetings shall be digitally recorded with files provided to all requesting parties.

1.03 PRE-CONSTRUCTION CONFERENCE

A. Attendance:
   1. County
   2. Consultant
   3. Contractor and superintendent
   4. Subcontractors as appropriate to the agenda
   5. Representatives of suppliers and manufacturers as appropriate to the agenda
   6. County MBE/WBE representative
   7. Other agency representatives (FDEP, EPA, City, etc.)
   8. Surveyor – recommended but required if Surveyor has not previously performed work for the County
   9. Others as requested by the County or Contractor

B. Suggested Agenda:
   1. Distribution and discussion of:
      a. List of major Subcontractors and suppliers
      b. Construction schedules
      c. Contact information
   2. Organizational arrangement of Contractor's forces and personnel, and those of Subcontractors, material and equipment suppliers, and the County
   3. Critical work sequencing
   4. Major equipment deliveries
   5. Project coordination
      a. Designation of responsible personnel
      b. Channels and procedures for communication
   6. Procedures and processing of:
      a. Field decisions
      b. Proposal requests
      c. Submittals
      d. Change orders
      e. Applications for payment/Schedule of Values
      f. Contractor quality control
      g. Submittal of Shop Drawings, project data and samples
   7. Adequacy of distribution of Contract Documents
   8. Procedures for maintaining as built and record documents
   9. Use of premises:
      a. Office, work and storage areas
      b. County's requirements
      c. Housekeeping
   10. Temporary construction facilities
   11. Temporary utilities
   12. Safety and first aid procedures
   13. Rules and regulations
   14. Security procedures
   15. Place, date and time for regular progress meetings
   16. Completion time for Contract and liquidated damages

1.04 PROGRESS MEETINGS

A. The Consultant shall schedule progress meetings at least once per month as required by progress of the Work with the first meeting approximately one (1) month after the pre-construction meeting.

B. Attendance:
   1. County
   2. Consultant
   3. Contractor
   4. Subcontractors as appropriate to the agenda
   5. Suppliers as appropriate to the agenda
   6. Others as appropriate

C. The Contractor's representative is to attend the project meetings and have the authority to act on behalf of the entity represented on field related matters. Contractor's representative is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics and provide specific information including but not limited to:
   1. Status of submittals and actions necessary to expedite them
   2. Status of activities behind schedule and actions necessary to regain the approved schedule
   3. Status of materials and equipment deliveries and action necessary to expedite materials and equipment and maintain the approved schedule
   4. Status of open RFI's and actions necessary to address them

D. To the maximum extent practicable, the Contractor is to assign the same personnel to represent the Contractor at Progress Meetings throughout the progress of the work.

E. The Contractor is to provide a current Shop Drawing submittal log at each progress meeting.

F. The Contractor is to provide copies of the updated Progress Schedule at each project meeting in accordance with the General Conditions including a 3 week look ahead schedule for upcoming events.

G. Suggested Agenda:
   1. Review and approve minutes from previous meeting
   2. Review of work progress since previous meeting to include current As-Builts
   3. Contractor's/Subcontractor's workforce and equipment
   4. Progressive As-Built Drawings
   5. Surveyor's submittals
      a. As-Built Asset Attribute Data Table (see Table 01050-2)
      b. Pipe Deflection Table (see Table 01050-3)
      c. Gravity Main Table (see Table 01050-4)
   6. Field observations, problems and conflicts
   7. Construction progress and problems which impede construction schedule
   8. Shop Drawing submittal status
   9. Requests for Information (RFI) status
   10. Change Order status
   11. Review of off site fabrication and delivery schedules
   12. Corrective measures and procedures to regain approved schedule
   13. Revisions to construction schedule
   14. Job progress and schedule for succeeding work period
   15. Coordination of schedules
   16. Maintenance of quality standards
   17. Review submittal schedule; expedite as required
   18. Pending requests for information, changes and substitutions
   19. Review proposed changes for effect on construction schedule and completion date
   20. Pay application status
   21. Other business

H. Revision to Minutes:
   1. Unless minutes are challenged, in writing, prior to the next regularly scheduled Progress Meeting, they will be accepted as properly summarizing the discussions and decisions of the meeting.
   2. Persons challenging minutes shall reproduce and distribute copies of the challenge to all indicated recipients of the particular set of minutes.
   3. Challenge to minutes shall be settled as priority portion of "old business" at next regularly scheduled meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01270
MEASUREMENT AND PAYMENT - LUMP SUM CONTRACTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

Measurement and payment provisions, schedule of values.

1.02 GENERAL MEASUREMENT AND PAYMENT PROVISIONS

A. Payment for all work done in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, and performance of all operations relative to construction of this project, will be made as a lump sum which will be complete payment for all work called for or reasonably inferable from the Contract Documents and other work will be considered incidental to the Contract and no additional compensation will be allowed.

B. The Owner reserves the right to alter the Drawings, modify incidental work as may be necessary, and increase or decrease the work to be performed to accord with such changes, including deductions or additions to the scope of work outlined in the Contract Documents. Changes in the work shall not be considered as a waiver of any conditions of the Contract nor invalidate any provisions thereof. Changes resulting in changes in the scope or quantities of Work or time or other conditions of work will be basis for consideration of a Change Order which is to be negotiated and executed before proceeding with the work. A supplemental agreement between the Contractor and the Owner will be required when such changes meet the conditions described in the Supplementary Conditions. Work which has not been authorized by a written Change Order will not be subsequently considered for additional payment.

C. The Contractor shall take no advantage of any apparent error or omission in the Drawings or Specifications, and the Engineer shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

D. If the Contractor makes a claim for an extra or additional cost and requests a Change Order be issued prior to performing the work and the Engineer and/or Owner renders a decision denying such request, the Contractor must notify the Engineer in writing within three (3) days of the time that the Contractor is informed of the Engineer's decision. Otherwise the Owner will not consider any such difference as a claim for a Change Order or additional payment or time. Any such written notice received by the Engineer from the Contractor within the 3-day period shall be just reason for the Engineer to re-evaluate his previous decision.

E. Failure on the part of the Contractor to construct any item to plan or authorized dimensions within the specification tolerances shall result in: reconstruction to acceptable tolerances at no additional cost to the Owner; acceptance at no pay; or, acceptance at reduced price, all at the discretion of the Engineer.

F. Work shall not be considered complete until all testing has been satisfactorily completed and the item of work has demonstrated compliance with plans and specifications.

G. A preliminary monthly application for payment shall be submitted to the Owner/Engineer for review five (5) days prior to the submittal for approval of the Contractor's monthly payment request.

1.03 SCHEDULE OF VALUES

A. The Contractor shall submit a complete Schedule of Values for approval prior to commencing construction. As a minimum, include those values identified in Section 01370. The Complete Schedule of Values shall be the basis for making payment applications and establishing prices for Change Orders.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 - GENERAL

Work completed without approved Shop Drawings and/or samples shall be considered installed at the Contractor's risk.

1.01 SHOP DRAWINGS AND DATA

A. Shop Drawings defined in the General Conditions, shall complement design and construction Drawings, and shall contain sufficient detail to clearly define all aspects of the Construction. These Drawings shall be complete and detailed.

B. Contractor and Supplier’s catalog sheets, brochures, diagrams, illustrations and other standard descriptive data shall be clearly marked with specification title and numbers to identify pertinent materials, product or models. Delete information which is not applicable to the Work by striking or cross-hatching.

C. If Shop Drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in the letter of transmittal. If acceptable, proper adjustment in the Contract shall be implemented where appropriate. If the Contractor fails to describe such variations, the Contractor shall not be relieved of the responsibility for executing the Work in accordance with the Contract, even though such Drawings have been reviewed.

D. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog data sheets, cuts, performance curves, diagrams, verification of conformance with applicable standards or codes, materials of construction and similar descriptive material. Materials and equipment list shall, for each item, give the name and location of the Supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

E. For all equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the Supplier's representative and service company so that service and/or spare parts can be readily obtained.

F. The Contractor will obtain an installation list from suppliers and equipment suppliers who propose to furnish equipment or products for submittal to County/Professional along with the required Shop Drawings. The installation list shall include at least 5 installations where identical equipment has been installed and has been in operation for a period of at least 1-year.

1.02 REVIEW OF SHOP DRAWINGS AND SAMPLES

A. The County /Professional's review of Shop Drawings, Data, and Samples as submitted by the Contractor will be to determine if the items(s) generally conform(s) to the information in the Contract Documents and is/are compatible with the design concept. The County/Professional's review and exceptions, if any, will not constitute an approval of

dimensions, connections, quantities, and details of the material, equipment, device, or item shown.

B. The review of drawings and schedules will be general, and shall not be construed:
   1. As permitting any departure from the Contract Documents
   2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials
   3. As approving departures from details furnished by the County/Professional, except as otherwise provided herein

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract Documents which the County/Professional finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or Contract Time, the County/Professional may return the reviewed drawings without noting an exception.

D. "Approved As Noted": Contractor shall incorporate County/Professional's comments into the submittal before release to manufacturer. The Contractor shall send a letter to the County/Professional acknowledging the comments and their incorporation into the Shop Drawing.

E. "Amend and Resubmit": Contractor shall resubmit the Shop Drawing to the County/Professional. The resubmittal shall incorporate the County/Professional's comments highlighted on the Shop Drawing.

F. "Rejected": Contractor shall correct, revise and resubmit Shop Drawing for review by County/Professional.

G. Resubmittals will be handled in the same manner as first submittals. For resubmittals the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by County/Professional on previous submissions. The Contractor shall make any corrections required by the County/Professional.

H. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Drawings or Specifications, the Contractor shall give written notice thereof to the County/Professional.

I. When the Shop Drawings have been completed to the satisfaction of the County/Professional, the Contractor shall carry out the Construction in accordance therewith and shall make no further changes therein except upon written instructions from the County/Professional.

J. No partial submittals will be reviewed. Submittals not deemed complete will be stamped "Rejected" and returned to the Contractor for resubmittal. Unless otherwise specifically permitted by the County/Professional, make all submittals in groups containing all associated items for:
   1. Systems
   2. Processes
   3. As indicated in specific Specifications Sections

All drawings, schematics, manufacturer's product data, certifications, and other Shop Drawing submittals required by a system specification shall be submitted at one time as a package to facilitate interfaces checking.

K. Only the County/Professional shall utilize the color "red" in marking Shop Drawing submittals.

L. Failure to comply with any of the above may result in the rejection of Shop Drawings.

1.03 PRODUCT DATA

A. Submit not less than 6-copies, unless approved by the County/Professional. Mark each copy to identify applicable products, models, options and other data. Supplement manufacturers' standard data to provide information unique to the Work.

1.04 MANUFACTURERS' INSTRUCTIONS

A. When required in an individual Specification Section, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing, in quantities specified for product data.

1.05 SAMPLES

A. Submit full range of manufacturers' standard colors, textures and patterns for the County's selection. Submit samples for selection of finishes within 30-days after Award of Contract. All color and finish selections must be submitted by the Contractor in a single submission, properly labeled and identified.

B. Submit samples to illustrate functional characteristics of the product, with integral parts and attachment devices. Coordinate submittal of different categories for interfacing work.

C. Submit the number of samples specified in the respective Specification section, but no less than two (2). After review one (1) will be retained by the County. Reviewed samples that may be used in the Work are indicated in the Specification Section.

D. Samples shall be delivered to the County as directed. The Contractor shall prepay shipping charges on samples. Materials or equipment for which samples are required shall not be used in the Work until approved by the County/Professional.

E. Samples shall be of sufficient size to clearly illustrate:
   1. Functional characteristics of the product, with integrally related parts and attachment devices
   2. Full range of color, texture and pattern
   3. Each sample shall have a label indicating:
      a. Name of Project
      b. Name of Contractor and Subcontractor
      c. Material or equipment represented
      d. Place of origin
      e. Name of product and brand (if any)

f. Location in Project
g. Specification title and number
h. Submittal number
i. Note: Samples of finished materials shall have additional marking that will identify them under the finished schedules.

F. The Contractor shall prepare a transmittal letter, in triplicate (3) for each shipment of samples containing the information required in paragraph herein. The Contractor shall enclose a copy of this letter with the shipment and send a copy of this letter to the County/Professional. Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify any Contract requirements.

G. Approved samples not destroyed in testing shall be sent to the County or stored at the site of the Work. Approved samples of the hardware in good condition may be incorporated in the Work if requested in writing by the Contractor and approved in writing by the County/Professional. Samples that failed testing or were not approved will be returned to the Contractor at the Contractor's expense, if so requested at time of submission.

1.06 FIELD SAMPLES

A. Provide field samples of finishes as required by individual Specifications sections. Install the sample completely and finished. Acceptable samples in place may be retained in completed Work.

1.07 DRAWINGS, PRODUCT DATA AND CERTIFICATES

A. Each letter of transmittal shall identify each and every item transmitted by title, drawing number, revision number and date.

B. The County generally will not check dimensions, quantities or schedules, except in cases where the information is lacking in the Specifications.

C. The following is applicable to submitted drawings, data and certificates:
1. Show relation to adjacent structures or materials.
2. Clearly identify field dimensions.
3. Show required dimensions and clearances.
4. Performance characteristic and capabilities shall accompany original Shop Drawing submittals.
5. Wiring diagrams and controls shall accompany original Shop Drawing submittals.
6. Installation instructions shall accompany original Shop Drawing submittals.
7. Each submittal shall identify applicable Standards, such as ASTM number or Federal Specification number.
8. All information not pertinent shall be removed from the submittal, or shall be crossed out.

D. When resubmission is required, the County/Professional will return only two (2) marked up copies. A third submission from the same manufacturer will not be accepted.

1.08 SUBSTITUTIONS

Consideration of substitutions shall be in accordance with Division 0.

1.09 AVAILABILITY OF SPECIFIED ITEMS

A. Verify prior to bidding that all specified items will be available in time for installation during Construction for orderly and timely progress of the Work.

B. In the event that specified items will not be available, notify the County/Professional prior to receipt of proposals.

1.10 OPERATING MANUALS

A. Submit all manuals in accordance with requirements of Divisions 2 through 16 of the Contract Specifications and Section 01700 "Project Closeout."

1.11 WARRANTIES, GUARANTEES AND BONDS

A. Provide as required by Technical Sections of the Specifications and Sections 01700 "Project Closeout" and Section 01740 "Warranties and Bonds."

1.12 CADD FILES

A. The Professional's CADD files will be available on a limited basis to qualified firms at the County's prerogative. The procedure for requesting such files is noted elsewhere in these documents and there is a cost associated with handling and reproduction. Recipients are cautioned that these files may not accurately show actual conditions as constructed. Users are responsible to verify actual field conditions.

B. The Professional's Drawings are to be used only for background information. If the Professional's Drawings are just reproduced and resubmitted (e.g. for ductwork drawings) they will be rejected.

C. Copies of data furnished by the County/Professional to Contractor or Contractor to County/Professional that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

D. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60-days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.

E. When transferring documents in electronic media format, the transferring party makes no representations as to long-term compatibility, usability, or readability of documents

resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

1.13 PROGRESS PHOTOGRAPHS

A. Photographs and digital pictures shall be in color. Provide 1 copy of each digital picture on each of three (3) CDs and provide 1 print of each photograph in two (2) separate albums.

B. Photographs shall be from locations to illustrate the condition of Construction and state of progress adequately.

C. Provide up to 12 digital photographs of views randomly selected by the County, taken prior to any construction and prior to each scheduled Application for Payment.

D. Deliver electronic images, prints, and negatives to the County.

E. Each print shall be single weight paper with glossy finish and the overall dimension shall be 7-1/2-inch x 10-inches (19.05 x 25.4 cm). The print shall be clear, sharp and free of distortion after the enlargement from the negative.

F. Provide loose-leaf albums for each set of photographs to hold prints with a maximum of 50-leaves per binder.

G. Each print shall be protected by flexible, transparent acetate or plastic sheet protector leaves with metal reinforced holes. Two (2) extra leaves shall be provided in each binder.

H. Capture and provide digital, ortho-rectified, true-color, aerial photographs of the complete project site prior to start of Construction and at final completion. A final 6-inch or less ground pixel resolution is required. If using traditional photography, the photos will need to be captured at an appropriate scale and scanned at a high enough dpi to yield a final ground pixel size of 6-inches or less. If captured digitally, a final 6-inches or less ground sample distance is required. The final orthorectified photos shall use a projection of NAD 27, State Plane West and all vertical reference shall be NAVD 88, US feet. All orthophoto mosaics shall meet a final accuracy of plus or minus 5-feet.

I. Provide a total of four (4) true-color, color balanced orthophoto mosaic prints. Three (3) prints each of the pre and post construction (final completion) orthophoto mosaics, for a total of six (6). Each orthophoto mosaic print shall be on double-weight paper with glossy finish and shall have overall dimensions of 36-inches x 58-inches. Two (2) copies of each of the digital orthophoto mosaics shall be supplied in Geotiff format on disk for each time period (pre and post construction). The final color balanced, true-color orthophoto mosaics will be projected in NAD 27, State Plane West and all vertical reference shall be NAVD 88, US feet and shall meet a final accuracy of plus or minus 5-feet.

J. The Contractor shall provide before and after photographs of each portion of the site. The below ground facilities shall include all equipment, walls, floor, piping, supports and entrance. At major locations, photographs shall include before, during, and after prints and all prints shall be placed in binders in ascending date order to show the Work as it

progresses.

K. Descriptive Information:
   1. Each photograph shall have a permanent title block on the back and shall contain the typed information and arrangement as follows:
      a. ORANGE COUNTY, FLORIDA
      b. (ENTER PROJECT NAME)
      c. BID No. (Enter Bid Number)
      d. CONTRACTOR: (Name of Contractor)
      e. DATE: (When photo was taken)
      f. PHOTO NO.: (Consecutive Numbers)
      g. PHOTO BY: (Firm Name of Photographer)
      h. LOCATION: (Description of Location and View)
   2. The Contractor shall provide the Professional with a written description of each photograph. This description shall be included in the binders and a copy shall be submitted with the CDs.

1.14 PROJECT RECORD DOCUMENTS

Project Record Documents shall be submitted in accordance with Section 01720 "Project Record Documents" of these specifications.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL PROCEDURES

A. Article 9 of the General Conditions contains additional provisions regarding submittals.

B. Preliminary Shop Drawing Data: Within 20-days after the Award of the Contract or before the Pre-Construction Meeting, the Contractor shall submit to the County/Professional a complete listing of manufacturers for all items for which Shop Drawings are to be submitted.

C. Shop Drawing Submittal Schedule: Within 30-days after the Notice to Proceed, the Contractor shall submit to the County/Professional a complete schedule of Shop Drawings submittals with the respective dates for submission, the beginning of manufacture, testing and installation of materials, supplies and equipment, noting those submittals critical to the progress schedule.

D. Submittal Log: An accurate updated log of submittals will be maintained by the Contractor and subject to review by the County/Professional at each scheduled progress meeting.

E. If the Contractor considers any correction indicated on the Drawings to constitute a change to the Contract Drawings or specifications, the Contractor shall give written notice thereof to the County/Professional. This does not constitute a change order until accepted by the County.

F. Shop Drawing and submittal data shall be reviewed by the County/Professional for each original submittal and first resubmittal; thereafter review time for subsequent resubmittals shall be charged to the Contractor. The Contractor shall reimburse the County for services rendered by the County/Professional at the rate multiplied by the County's Professional multiplier based on the fee schedule provided to the County for this Project. If a County engineer is performing any portion of the review, this fee is based upon the hourly rate of the engineer times the County's multiplier for overhead, benefits, and expenses. The Contractor agrees that the County shall deduct such charges from the Contract Amount by a deductive Change Order.

G. Contractor Shop Drawing and Sample submittals shall include 5 copies in addition to any other copies that the Contractor wants returned. The County will retain 5 copies of approved submittals.

H. Identify Project, Project Number, date, dates of previous submittals, Contractor, Sub-Contractors, suppliers with their addresses, pertinent Drawings by sheet and detail number, and Specification Section number, as appropriate. Identify all deviations from the Contract Documents. Provide space for Contractor and Professional review stamps.

I. Contractor's delivery of Shop Drawings for review shall follow a reasonable sequence, as is necessary to support the dates on the Progress Schedule and avoid an overload of Shop Drawings awaiting review at any one time. Coordinate submittal of related items.

J. Submit Shop Drawings per the schedule of Shop Drawing submittals, inserted in 1 loose-leaf binder, with tabs and index to the County/Professional. All individual submittal sheets inserted in said binder must be clearly marked and referenced to proper paragraph and subparagraph of specifications. Cross out any items on sheets which constitute information not pertaining to equipment specified. Clearly mark all components that are provided as "optional" by manufacturer. Shop Drawings shall be approved by the Contractor prior to submittal to the County/Professional. Shop Drawings will be reviewed by the County/Professional. After County/Professional approval, reproduce and distribute in accordance with requirements herein.

K. All submissions of Shop Drawings, brochures and catalog cuts shall be accompanied by a transmittal letter listing the Drawings submitted by number and title.

L. When engineering calculations and/or professional certification of performance criteria of materials, systems, and/or equipment are required, the County is entitled to rely upon the accuracy and completeness of such calculations and certifications submitted by the Contractor. Calculations, when required, shall be submitted in a neat, clear and in an easy to follow format. Such calculations and/or certifications shall be signed and sealed by a Professional Engineer registered in the State of Florida.

M. Distribute copies of reviewed submittals to concerned parties. Instruct recipients to promptly report any inability to comply with provisions.

N. Prior to submission of Shop Drawings and samples, the Contractor shall stamp and sign the submittals. Any submission which, upon examination by the County, shows evidence of not having been thoroughly checked, or is not in compliance with the provisions of this Section will be returned to the Contractor for completion before it will be considered for review.

O. Notify the County of the need for making any changes in the arrangement of piping, connections, wiring, manner of installation, etc., which may be required by the material or equipment Contactor proposes to supply.

P. On resubmittals, direct specific attention in writing or on the revised Drawings or sample to revisions other than the corrections required by County on previous submissions.

Q. All drawings, schematics, manufacturer's product data, certifications and other drawing submittals required for a system specification shall be submitted at one time as a package to facilitate interface checking.

R. The County will distribute Shop Drawings as follows for the indicated action taken:

SHOP DRAWING SUBMITTAL DISTRIBUTION

Representative Party	No Exception Taken or Make Correction Noted			Rejected or Revise & Resubmit		
	Submittal Transmittal	Shop Drawing	Review Comment Sheet	Submittal Transmittal	Shop Drawing	Review Comment Sheet
Engineer	2 Copies	File Copy	1 Copy	Original	File Copy	1 Copy
Contractor (see Note 1)	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	All Copies Except Engineers	1 Copy
County	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Inspector	2 Copies	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy
Project Record Data (see Note 2)	1 Copy	1 Copy Each Submittal	1 Copy	1 Copy	None	1 Copy

NOTES:
1. Contractor shall distribute additional copies to Subcontractors as required.
2. Stored by Contractor to be furnished to County upon closeout.

S. All Shop Drawings shall be accompanied with a transmittal letter providing the following information:
   1. Project Title and Contract Number
   2. Date
   3. Contractor's name and address
   4. The number of each Shop Drawing, project data, and sample required
   5. Notification of Deviations from Contract Documents
   6. Submittal Log Number conforming to specification section numbers
      a. Submit each specification section separately.
      b. Identify each Shop Drawing item required under respective specification section.
      c. Identify resubmittal using specification section followed by A (first resubmittal), B (second resubmittal)…etc.

3.02 CONTRACTOR'S REVIEW

A. Contractor’s Responsibility for Coordination: Where the dimension, size, shape, location, capacity or other characteristic affects another item, and where the Contractor selects, fabricates or installs related or adjacent products to be used, the Contractor shall be responsible for coordination of related items. The Contractor shall insure that a proper exchange of information takes place prior to or during preparation of each submittal and that submittals reflect such coordination. The notation "verify" or "coordinate" on the Drawings indicates the necessity for Contractor coordination in the particular instances used.

B. Contractor’s Checking: When checking submittals from Subcontractors and suppliers, the Contractor shall mark all sets, indicating his corrections and comments in blue or green. Copies marked in red may be returned for revision.

C. The Contractor is responsible to deliver and pick-up all submittals in a timely manner at the County/Professional's designated office. The Contractor is responsible for all related costs and expenses for the transmittal of such submittals.

3.03 COUNTY’S / PROFESSIONAL’S REVIEW

A. Corrections or comments made on Shop Drawings during review do not relieve the Contractor from compliance with the requirements of Drawings and Specifications. This check is only for review of general conformance with the design concept of this Project and general compliance with information given in Contract Documents. Any substitutions or changes shall be properly noted.

B. No action will be taken on "rough-in" Shop Drawings for plumbing and electrical connections when the items of equipment are not included in the same submittal.

C. Review Time:
   1. On a normal basis, each submittal will be returned to the Contractor within 15 working days of the date it is received. Some submittals may require additional time.
   2. If, for any reason, the above schedule cannot be met, the Contractor will be so informed within a reasonable period and the Schedule of Submittals revised. If the specific submittal affects the critical path, the Contractor shall immediately notify the County/Professional in writing. In the event of separate submittals of individual components of a system, these submittals may be held until all components of the system are submitted, and the Contractor will be so notified.

END OF SECTION

SECTION 01310
PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 REQUIREMENT

A. The Contractor will submit precedence method cost loaded Critical Path Method (CPM) Progress Schedules to the County depicting the approach to prosecution and completion of the Work. This requirement includes, but is not limited to the Contractor's approach to Activity cost loading, recovering schedule and managing the effect of changes, substitutions and Delays on Work sequencing.

B. The Progress Schedule shall show how the Contractor's priorities and sequencing for the Work (or Work remaining) conform to the Contract requirements and the sequences of Work indicated in or required by the Contract Documents; reflect how the Contractor anticipates foreseeable events, site conditions and all other general, local and prevailing conditions that may affect cost, progress, schedule, furnishing and performance of the Work; and show how the Contractor's Means and Methods translate into Activities and logic.

C. The Progress Schedule will consist of the Initial Submittal, Payment Submittals and Revision Submittals. Upon acceptance by the County, the Initial submittal will become the As-Planned Schedule for the Work. Revision submittals upon acceptance will become the As-Planned Schedule for the Work remaining to be completed as of the submittal date for that Revision.

D. References to the Critical Path Method (CPM) are to CPM construction industry standards that are consistent with the requirements of this Section.

1.02 GLOSSARY OF TERMS

A. The following terms, whether or not already defined elsewhere in the Contract Documents, have the following intent and meanings within this Section:
   1. Activity Value (Value): That portion of the Contract Price representing an appropriate level of payment for the part of the Work designated by the Activity.
   2. As-Planned Schedule: The first, complete Initial Progress Schedule submitted by the Contractor with the intent to depict the entire Work as awarded and accepted by the County or returned as no resubmittal required.
   3. Contract Float: Days between the Contractors anticipated date for completion of the Work, or of a specified portion of the Work, if any, and the corresponding Contract Time.
   4. CPM Schedule: The Progress Schedule based on the Critical Path Method (CPM) of scheduling. The term Critical Path means any continuous sequence of Activities in the Progress Schedule controlling, because of their sum duration, the Early Date of a pertinent, specified Contract Time.
   5. Early/Late Dates: Early/late times of performance, based on CPM calculations, for an Activity in the Progress Schedule. Early Dates will be based on proceeding with all or part of the Work on the date when the corresponding Contract Time commences to run. Late Dates will be based on completing all or part of the Work on the

corresponding Contract Time, even if the Contractor plans early completion.

6. Milestones: Key, pre-determined points of progress in the completion of a facility, denoting interim targets in support of the Contract Times. Milestones may pinpoint targets for key excavation and substructure events, significant deliveries, critical path transition from superstructure to piping and electrical rough in and building enclosure. Also, hook-up of mechanical and electrical equipment, availability of power for testing, equipment shakedown, training of County personnel, start□-up, Substantial Completion and other events of like import.
7. Official Schedule: The Initial or most recent Revision Submittal accepted by the County or returned as no resubmittal required and the basis for Payment Submittals until another Revision Submittal is submitted and accepted. The accepted Initial Submittal is also the As-Planned Schedule.
8. Payment Submittal: A monthly Progress Schedule update reflecting progress and minor adjustments on the Activities, sequencing and restraints for Work remaining.
9. Total Float: Days by which an activity may slip from its Early Dates without necessarily extending a pertinent Contract Time. Total Float at least equals Contract Float. Total Float may also be calculated and reported in working Days. When an activity is delayed beyond Early Dates by its Total Float it becomes a Critical Path activity and if delayed further will impact a Contract Time.

1.03 QUALITY ASSURANCE

A. The Contractor may self-perform the Work covered by this Section or employ a Subcontractor, subject to the County's consent. Employment of a scheduling Subcontractor shall not in any way alter or reduce the Contractor's obligations under the Contract Documents.

B. The Contractor will obtain a written interpretation from the County, if the Contractor believes that the selection of activities, logic ties and/or restraints requires a written interpretation of the Contract Documents. With each submission, the Contractor will point out by specific, written notation, any Progress Schedule feature that may reflect variations from any requirements of the Contract Documents.

C. It is the Contractor's responsibility to obtain information directly from each Subcontractor and Supplier when scoping their respective Activities, Values, logic ties and restraints.

D. Neither Acceptance nor Review of any Progress Schedule will relieve the Contractor from the obligation to comply with the Contract Times and any sequence of Work indicated in or required by the Contract Documents and to complete, within the Contract Times, any Work omitted from that Progress Schedule.

E. Neither Acceptance nor Review of any Progress Schedule will imply approval of any interpretation of or variation from the Contract Documents, unless expressly approved by the County through a written interpretation or by a separate, written notation on the returned Progress Schedule Submittal.

1.04 MILESTONES AND SCHEDULE RECOVERY

A. The County will select Milestones and Milestone Dates on the basis of the As-Planned Schedule. As the Official Schedule is revised, Milestone Dates will be revised accordingly. Milestone Dates will serve as target dates.

B. Whenever any Activity slips by 14 or more Days from the Late Date for an activity in the Official Schedule, Milestone Dates selected by the County, or a pertinent Contract Time, the Contractor will deliver a Revision Submittal documenting the Contractor's schedule recovery plan and/or a properly supported request for an extension in the Contract Time. The narrative will identify the Delay and actions taken by the Contractor to recover schedule, whether by adding labor, Subcontractors or construction equipment, activity re-sequencing, expediting of submittals and/or deliveries, overtime or shift Work, and so forth. Activity shortening and overlapping shall be explained as to their basis (and be supported by increases in resources).

C. Upon evaluation of that Revision Submittal, if the County determines there is sufficient cause, the County may withhold liquidated damages or provide a notice of intent to do so, if schedule is indeed not recovered, and/or may give a notice of default.

1.05 PROGRESS SCHEDULE SOFTWARE

A. The scheduling software employed by the Contractor to process the Progress Schedule will be the current version of Primavera P6.0®, or Primavera® Contractor 5.0 CPM scheduling software.

B. If the Contractor intends to use companion schedule reporting, analysis or graphics software tools, the Contractor will furnish to the County descriptive materials and samples describing such software tools.

1.06 NON-PERFORMANCE

A. The County may refuse to recommend all or any part of any payment, if the Contractor fails, refuses or neglects to provide the required Progress Schedule information on a timely basis. Partial payments without a properly updated Progress Schedule shall be returned to the Contractor as non-conforming.

B. If justified under the circumstances, the County also may prepare alternate Progress Schedules, as appropriate, and deduct from the Contract Amount all related costs by Change Order and/or take other action commensurate with the breach.

1.07 REPORTS, SCHEDULES AND PLOTS

A. Schedule Reports will include Activity (ID) code and description, duration, calendar, Early Dates, Late Dates and Total Float. Separate Schedule Reports will tabulate, for each Activity, all preceding and succeeding logic types and lead times, whether CPM Plots displaying logic ties are appended or not.

B. CPM Schedule Plots will be plotted on a suitable time scale and identify the Contract Times, Critical Paths, phases and work areas on 24-inch x 36-inch or smaller sheets.

Activities will be shown on the Early Dates with Total Floats noted by Late Date flags. For Payment and Revision Submittals plot a target comparison based on the current Official Schedule.

C. The Activity Value report will tabulate Activity code and description and Activity Value, percent complete and earned value as calculated by the scheduling software. Cash flow plots shall be provided showing the monthly and cumulative actual and planned earned values with curves shown for Early and Late Dates in the schedules. For Payment and Revision Schedule submittals, the cash flow curves shall also plot the most current Official Schedule planned earnings curves.

D. Each submittal shall include listings of all added and deleted activities, logic, constraints, Activity Value changes and update information vs. the previous Progress Schedule submittal. This list may be manually prepared or generated by accessory software that will generate such listings.

1.08 NARRATIVE REQUIREMENTS

A. The Initial Submittal narrative will describe the Contractor's approach to prosecution of the Work and the basis for determination of activity durations, sequence and logic, including the Contractor's management of the site, e.g., lay down, staging, parking, etc.; Contractor's phasing of the Work; use of crewing and construction equipment; identification of non-work County/Professional's, shifts, weekend Work and multiple calendars applied to activities and an explanation of the basis for restraint dates.

B. Revision and Payment Submittal narratives will explain any changes to the approach or planning referred to in Paragraph A above on account of any change, delay, schedule recovery, substitution and/or Contractor-initiated revision occurring since the previous submittal.

C. Each narrative will list the Critical Path Activities and compare Early and Late Dates against Contract Times and Milestone Dates. Narratives shall also recap progress and Days gained or lost vs. the current Official Schedule, and identify delays, their extent and causes.

D. The Initial Submittal narrative will describe all delays occurring since Contract Award and all pending and anticipated "or equal" and substitution proposals. Payment and Revision Submittal narratives will describe any new delays and shall certify that the Contractor has not been delayed, as of the cut off date, by any acts or omissions of the County, except as otherwise specifically stated.

1.09 ACTIVITY REQUIREMENTS

A. Separate activities will identify permits, design when included in the Work, construction, Submittal preparation and review (and resubmission and re-review), deliveries (site or storage), testing, start-up, commissioning and Punch List.

B. Activities will be detailed to the extent required to show the transition of trade Work. Activities will delineate the progression of the Work.

C. Activities will not combine separate or non-concurrent items of Unit Price or lump sum Work.

D. Activity durations will equal the Work Days required to sufficiently complete the Work designated by the Activity, (i.e., when finish-to-start successors could start, even if the Activity is not quite 100% complete). Installation Activities will last from 10 to 40 workdays. Submittal review activity durations shall conform to specified timeframes.

E. Activities will be assigned consistent descriptions and identification codes. Sort codes will group Activities by meaningful schemes.

F. Activities will be assigned Activity Values as appropriate and needed to reasonably allocate the Contract Amount to the time periods that they will be earned and eligible for payment based on the Progress Schedule and Schedule of Values. Separate pay activities may be used to simplify cost loading of the Progress Schedule. When used, pay activities shall be loaded with the cost of Work that is included, at no cost, in related (generally, concurrent) CPM activities. Pay activities shall not control the rate of progress; however, their start and finish dates shall be consistent with those of their related CPM activities to ensure accurate Early Date and Late Date cash-flow plots.

1.10 FLOAT TOLERANCES AND FLOAT OWNERSHIP

A. Refer to Division 0 for float requirements. See sections entitled "Contract Float" and "Progress Schedule"

1.11 SUBMITTALS

A. Each Progress Schedule Submittal will consist of a narrative, 5 copies of the required reports and plots and an optical ROM data disk with the Contractor's corresponding schedule and schedule layout files in Primavera ".XER" format.

B. The County will review Progress Schedule Submittals and return a review copy within 14-days after receipt and the Contractor shall, if required, resubmit within 7-days after return of the review copy.

C. Requirements for the Initial Submittal:
   1. Within 20-days after receipt of Notice to Proceed and prior to commencing Work on the Project, prepare and submit to the County the Initial Submittal of the Progress Schedule for the Work. The Initial Submittal will show the Work as awarded, without delays, Change Orders or substitutions.
      a. Activity Values will prorate Schedule of Values costs and/or pay items through to Activities. Provide a cross-reference listing with two parts; a part that will list each activity with the respective amounts allocated from each Schedule of Values and Unit Price Item making up the total value of each activity and a second part that will list the Schedule of Values and Unit Price Items with the respective amounts allocated from each activity that make up the total value of each item.
   2. After the As-Planned Schedule is established, the County will select Milestones and record the Milestone Early and Late Dates. As the Official Schedule evolves, Milestone Dates will be revised accordingly.
   3. If the County refuses to endorse the Initial Submittal (or a resubmission) as

"Resubmittal Not Required," the As-Planned Schedule will not be established. In that event, the Contractor will continue to submit Payment and Revision Submittals reflecting progress and the Contractor's approach to remaining Work. The County will rely on the available Payment and Revision Submittals, subject to whatever adjustments it determines appropriate.

D. Requirements for Payment Submittals:
   1. Payment Submittals with progress up to the closing date and updated Early Dates and Late Dates for progress and remaining Activities will be due with each Progress Payment. As-built data will consist of actual dates, percent complete, earned payment, changes, Delays and other significant events occurring before the closing date.
   2. Activity percent complete and earned value should indicate a level of completion that corresponds to the Application for Progress Payment for the same period. The earned value should be calculated by the scheduling software as Activity Value times percent complete. Explanation should be provided whenever the cumulative earned value of activities in a Payment Submittal is not within 10% of the value of Work completed as represented in the corresponding Application for Progress for Payment.
   3. At the Contractor’s option, a Payment Submittal may overlay minor adjustments on activities and sequencing for Work remaining. This excludes Activity re-scoping to reflect Delays, changes, schedule recovery or substitutions.

E. Requirements for Revision Submittals:
   1. Revision Submittals will be submitted when necessary because of major changes or delays affecting activities, sequencing or restraints for Work remaining and/or to put forth a schedule recovery plan. Revision Submittals may also be required because of Contractor-initiated re-planning, or when Contractor plans to perform Work ahead or out-of-sequence that will require additional testing or inspection personnel, or when requested by the County when Work is performed out-of-sequence from the current Official Schedule such that the number of Days gained or lost can not be determined or the scheduled dates of completion of the Work in a Payment Submittal are not viewed as reliable.
   2. If requesting a time extension, the Revision Submittal should show the impact of the delay after incorporating reasonable mitigation to minimize the impact and illustrate how the number of Days requested time extension was determined. The delay should be determined as the change in the forecast Contract Completion Date(s) resulting solely from delays that entitle the Contractor to a time extension as provided in the General Conditions. Any and all Contractor slippage and delay occurring prior to and concurrent with the delay potentially entitling the Contractor to a time extension shall be incorporated in the Revision and explained such that the concurrent and non-concurrent periods of delay are indicated. If the Contractor does not follow the procedures contained in this Section or, if the Contractor's analysis is not verifiable by an independent, objective evaluation by the County using the electronic files and data furnished by the Contractor, any such extension in Contract Time will not be granted.

F. Retrospective Delay Analysis.
   1. If the County/Professional refuses to endorse any Revision Submittal as "Resubmittal Not Required," the Contractor and County will use the latest Official Schedule when evaluating the effect of Delays on Contract Time and/or Contract Price. The procedure to be used will consist of progressively updating the latest Official Schedule at key closing dates corresponding to starting and finishing dates of the delays and/or dates the delays became critical or dates the Critical Path may have changed for other reasons. For each Progress Schedule iteration, slippage between actual Milestone Dates and Initial Milestone Dates will be correlated to Delays occurring solely in that iteration.
   2. For each iteration, revisions in Activities, logic ties and restraints affecting Work after the closing date will be included in that Progress Schedule only if they meet any of the following conditions. First, they are Progress Schedule revisions that the County consented to contemporaneously (i.e., before the closing date) in writing. Second, they reflect comments or objections raised by or on behalf of the County and that were actually confirmed by the as-built progress. Lastly, they represent Contractor's schedule recovery plans or other Progress Schedule revisions that were actually confirmed by the as-built progress.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01370
SCHEDULE OF VALUES

PART 1 – GENERAL

1.01 DEFINITION

A. Schedule of Values: Schedule that divides the Contract Amount into pay items, such that the sum of all pay items equals the Contract Amount for the Work, or for any portion of the Work having a separate specified Contract Amount.

1.02 REQUIREMENT

A. The Schedule of Values established as provided in the General Conditions will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to the County. Progress payments on account of Unit Price Work will be based on the number of units completed and shall be prorated by the percent complete on the number of units installed not meeting all requirements of the Contract including testing

B. No payment will be made for Work performed on a lump sum contract or a lump sum item until the appropriate Schedule of Values is approved by the County.

C. The equitable value of Work deleted from a lump sum contract or lump sum item shall be determined from the approved Schedule of Values.

1.03 SUBMITTALS

A. Submit 3 copies of a Preliminary Schedule of Values within 15-days after the recommended award of the Contract.

B. Submit 3 copies of a proposed final Schedule of Values within 20-days after receipt of Notice to Proceed as per the General Conditions.

C. Submit the Schedule of Values, typed, on EJCDC 1910-8-E form or Orange County forms or spreadsheets provided by County. The Contractor's standard form or electronic media printout will be considered for acceptability by the County.

D. List installed value of each major item of Work and each subcontracted item of Work as a separate line item to serve as a basis for computing values for Progress Payments. Round off values to nearest dollar.

E. Coordinate listings with the Progress Schedule.

F. For items on which payments will be requested for stored materials or equipment, list sub-values for cost of stored products with taxes paid and provide corresponding schedule of value item number. Stored materials quantities shall not exceed installed quantities on bid tab or as required by the Contract Documents.

G. Submit a sub-schedule for each separate stage of Work specified in Section 01010 "Summary of Work."

H. The sum of values listed shall equal the total Contract Amount for the Work or the Contract Amount for a part of the Work with a separate Contract Amount provided for by the Contract Documents.

I. When the County requires substantiating information, submit data justifying line item amounts in question.

1.04 UNIT PRICE CONTRACTS

A. For unit price contracts, the bid item prices on the Project Bid Schedule shall be used as the basis for the schedule of values. The Contractor shall resubmit the bid item prices in the format described herein, and may, at its option, or if requested by the County, divide the items in the Project Bid Schedule into sub-items to provide a more detailed basis of payment.

1.05 LUMP SUM CONTRACTS

A. For lump sum contracts, if the Work involves separate facilities, e.g. multiple pump stations, the cost of the Work shall be separated by each facility and into schedule of value items. Break principal subcontract amounts down into these items; The lump sum cost for each facility shall be submitted individually and split into the schedule of values listed in items 1 through 12.
   1. Mobilization/Demobilization at 5% of the base bid for the pump station.
   2. Project Record Documents at 1% of the base bid for the pump station.
   3. Indemnification at $100.00
   4. Preconstruction Video
   5. Administration Building (including Architecture, Mechanical, Electrical and Fire Alarm System Replacement)
   6. Maintenance Building (including Architecture, Mechanical, Electrical and Fire Alarm System Replacement)
   7. West Electrical Building (including Architecture, Mechanical, and Electrical)
   8. Generator Building (Fire Alarm System Replacement)
   9. Chlorine Building (Fire Alarm System Replacement)
   10. Digester Building (Fire Alarm System Replacement)
   11. Dewatering Building (Fire Alarm System Replacement)
   12. Start-up and testing

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01380
AUDIO – VISUAL DOCUMENTATION

PART 1 - GENERAL

1.01 PURPOSE AND DESCRIPTION OF WORK

A. The purpose of the audio - visual documentation is to provide the County with regularly documented audio - visual records of the Construction process from the existing conditions through final completion.

1.02 PRE-CONSTRUCTION VIDEO REQUIREMENTS INCLUDED

A. The Contractor shall employ a professional videographer to take a Pre-Construction video of the entire site including the areas of adjacent properties within 100-feet of the limits of Work and shall be made within 30-days of Work beginning. Special attention shall be made to show the existing paved roads, shoulders, signs, and other existing features.

B. The Contractor shall submit a quality audio-video recording documenting Pre-Construction field conditions for the entire project. When the Work includes construction of water, wastewater, reuse, or other lines in the vicinity of any street or road, the Contractor shall take digital audio-video recordings of existing conditions along both sides of the street or road. The Pre-Construction video shall be submitted to the County and accepted prior to commencing any Work or using any Contractor laydown areas.

C. Electronic digital photography shall also be used as necessary to record and facilitate resolution of on-site issues through the transmission of electronic photographs by e-mail from the site to the Professional's and County's offices.

PART 2 - PRODUCTS

2.01 AUDIO-VIDEO RECORDING

A. Each audio-video recording shall be saved on appropriate DVD media viewable on standard DVD players or computer.

B. Each DVD shall contain the following information and arrangement at the beginning as a title screen:

Orange County, Florida
PROJECT NAME
PROJECT NUMBER
CONTRACTOR: (Name of Contractor)
DATE: (When photo was taken)
VIDEO BY: (Firm Name of Videographer)
LOCATION: (Description of Location(s) and View(s))

C. Each DVD recording section shall begin with an audio description of the County's name, Contract name and number, Contractor's name, date and location information such as street name, direction of travel, viewing side, etc.

D. Information appearing on the video recording must be continuous and run simultaneously by computer generated transparent digital information. No editing or overlaying of information at a later date will be acceptable.

E. Digital information to appear in the upper left corner shall be as follows:
   1. Name of Contractor
   2. Day, date and time
   3. Name of Project & Specification Number

F. Time must be accurate and continuously displayed on the video record

G. Written documentation must coincide with the information on the DVD so as to make easy retrieval of locations at a later date.

H. The video system shall have the capability to transfer individual frames of video electronically into hard copy prints or photographic negatives.

I. Audio shall be recorded at the same time as the video recording and shall have the same information as on the viewing screen. Special commentary shall be given for unusual conditions of buildings, sidewalks and curbing, foundations, trees and shrubbery, structures, equipment, pavement, etc.

J. All DVDs and boxes shall bear labels with the following information:
   1. DVD Number
   2. County's Name
   3. Date of Recording
   4. Project Name and Number
   5. Location and Standing Limit of Video

2.02 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall employ a competent photographer to take construction record photographs periodically during the course of the Work.

B. Prints: Date imprinted 8-inch x 10-inch high resolution glossy single weight color print paper; 5 sets, bound in 3-ring binders to be provided to the County with each respective Application for Payment and distributed by the County as follows:
   1. County (2 sets)
   2. Engineer (1 set)
   3. Contractor (1 set)
   4. Project Record Data (1 set stored by Contractor to be furnished to County upon Closeout)

PART 3 - EXECUTION

3.01 VIDEO VIEWS REQUIRED

A. Complete coverage shall include all surface features within 100-feet of the Work area to be used by the Contractor and shall be supported by appropriate audio description made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, headwalls, and retaining walls, equipment, structures, pavements, manholes, vaults, handrails, etc. located within the work zone. Video coverage shall extend to the maximum height of all structures within this zone.

B. The video recorder shall take special efforts to point out and provide audio commentary on cracking, breakage, damage, and other defects in existing features.

C. All video recording shall be done during times of good visibility. No video recording shall be done during periods of visible precipitation, or when more than 10% of the ground area is covered with standing water, unless otherwise authorized by County.

D. Prior to commencement of audio-video recording, the Contractor shall notify the County in writing within 48-hours of the audio-video recording. The County may provide a designated representative to accompany and observe all video recording operations. Audio-video recording completed without a County Representative present will be unacceptable unless specifically authorized by the County.

3.02 AUDIO-VIDEO REQUIREMENTS

A. Major Locations:
   1. The Contractor shall provide color digital video of each major facility and structures and facilities adjacent to the Construction before construction starts.
   2. All videos shall be recorded with character generator operating with date, time, and location on screen. During video recording, the Contractor shall narrate video explaining what is being shown. All master videos shall be delivered to the County.
   3. The audio and video portions of the recording shall maintain viewer orientation. To this end, overall establishing views of all visible house and business addresses shall be used. In areas where the proposed construction location will not be readily apparent to the video recording viewer, highly visible yellow flags shall be placed, by the Contractor, in such a fashion as to clearly indicate the proposed centerline of Construction. When conventional wheeled vehicles are used as conveyances for the recording system, the vertical distance between the camera lens and the ground shall not exceed 10-feet. The camera shall be firmly mounted such that transport of the camera during the recording process will not cause an unsteady picture.
   4. All video recording shall be done during time of good visibility. No video recording shall be done during precipitation, mist or fog. The recording shall only be done when sufficient sunlight is present to properly illuminate the subjects of recording and to produce bright, sharp video recordings of those subjects.
   5. The average rate of travel during a particular segment of coverage shall be directly proportional to the number, size and value of the surface features within that construction area's zone of influence. The rate of speed in the general direction of travel of the vehicle used during taping shall not exceed 44-feet per minute.

3.03 PHOTOGRAPHS

A. A minimum of 3 views (top, upstream, and downstream) each shall generally be taken prior to backfilling pipelines or structures. Photographs shall be provided for:
   1. Utility conflicts/relocations
   2. Manholes
   3. Pump stations
   4. Boring and jacking
   5. Directional drilling pipe entrance and exit
   6. Valve installation
   7. Air release valve installation
   8. Fire hydrant assembly

B. Photo Identification
   1. Name of Project
   2. Name of Structure
   3. Orientation of View
   4. Date & Time of Exposure
   5. Film numbered identification of exposure

END OF SECTION

SECTION 01400
QUALITY CONTROL

PART 1 - GENERAL

1.01 SITE INVESTIGATION AND CONTROL

A. Contractor shall verify all dimensions in the field and check field conditions continuously during construction. Contractor shall be solely responsible for any inaccuracies built into the Work due to Contractor's failure to comply with this requirement.

B. Contractor shall inspect related and appurtenant Work and report in writing to County any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor at Contractor's sole cost and expense.

1.02 INSPECTION OF THE WORK

A. The Work shall be conducted under the general observation of representatives of the County acting on behalf of the County to ensure strict compliance with the requirements of the Contract Documents. Such inspection may include mill, plant, shop, or field inspection, as required. The County shall be permitted access to all parts of the Work, including plants where materials or equipment are manufactured or fabricated. Inspection by the County are in addition to the inspections required of Contractor by his QC Representatives.

B. The presence of the County, however, shall not relieve the Contractor of the responsibility for the proper execution of the Work in accordance with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the County. Further, no requirement of this Contract may be waived or modified except by change order or formal (written) substitution approval.

C. All materials and articles furnished by the Contractor shall be subject to rigid inspection, and no materials or articles shall be used in the Work until they have been inspected and accepted by the County. No Work shall be backfilled, buried, cast in concrete, hidden, or otherwise covered until it has been inspected. Any Work so covered in the absence of inspection shall be subject to uncovering. Where uninspected Work cannot be uncovered, such as in concrete cast over reinforcing steel, all such Work shall be subject to demolition, removal, and reconstruction under proper inspection and no additional payment will be allowed therefore.

D. The Contractor is responsible for the Quality of his own work and shall designate a qualified individual, to be approved by the County, who will ensure that all work is performed in strict accordance with the Contract Documents. This quality representative shall inspect the work for the Contractor and provide to the County and the Contractor a report outlining all work accomplished, all inspections, and all testing performed for all days when work is performed. The objective of this report is to provide "Objective Evidence of Compliance" by the Contractor with the requirements of the Contract.

1.03 TIME OF INSPECTION AND TESTS

A. Samples and testing required under these Specifications shall be furnished and prepared in ample time for the completion of the necessary tests and analyses before said articles or materials are to be used. Except as otherwise provided in the Contract Documents, performance of the required tests will be by the Contractor and all costs therefore will be borne by the Contractor at no cost to the County. Whenever the Contractor is ready to backfill, bury, cast in concrete, hide, or otherwise cover any Work under this Contract, the County shall be notified not less than 24-hours in advance to request inspection before beginning any such Work of covering. Failure of the Contractor to notify the County at least 24-hours in advance of any such inspections shall be reasonable cause for the County to order a sufficient delay in the Contractor's schedule to allow time for such inspection, any remedial, or corrective work required, and all costs of such delays, including its impact on other portions of the Work, shall be borne by the Contractor.

1.04 SAMPLING AND TESTING

A. When not otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered. However, the County reserves the right to use any generally accepted system of inspection which, in the opinion of the County, will ensure the County that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief form the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any technical or qualitative requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the County shall reserve the right to make independent investigations and tests as specified in the following paragraph and, upon failure of any portion of the Work to meet any of the qualitative requirements of the Contract Documents, shall be reasonable cause for the County to require the removal or correction and reconstruction of any such Work.

D. In addition to any other inspection or quality assurance provisions that may be specified, the County shall have the right to independently select, test, and analyze, at the expense of the County, additional test specimens of any or all of the materials to be used. Results of such tests and analyses shall be considered along with the tests or analyses made by the Contractor to determine compliance with the applicable specifications for the materials so tested or analyzed provided that wherever any portion of the Work is discovered, as a result of such independent testing or investigation by the County which fails to meet the requirements of the Contract Documents, all costs of such independent inspection and investigation and all costs of removal, correction, reconstruction, or repair of any such Work shall be borne by the Contractor.

1.05 RIGHT OF REJECTION

A. The County shall have the right at all times and places to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site. If the County or inspector, through an oversight or otherwise, has accepted materials or Work which is defective or which is contrary to the Contract Documents, such material, no matter in what stage or condition of manufacture, delivery, or erection, may be rejected by County.

B. Contractor shall promptly remove rejected articles or materials from the site of the Work after notification or rejection.

C. All costs of removal and replacement of rejected articles or materials, as specified herein, shall be borne by the Contractor.

D. If the Contractor fails to remove or replace defective work after notification to do so, the County may have the work removed and replaced by others and deduct all costs from the Contractor's pay requests.

1.06 TESTING LABS

A. All geotechnical testing laboratory services for field testing will be paid by the County. The lab(s) shall function as independent lab(s) and report independently to the County and the Contractor. The test lab(s) may not approve or allow any deviation from the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01560
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Work specified in this Section consists of designing, providing, maintaining and removing temporary erosion and sedimentation controls as necessary to protect the Work and prevent sedimentation from the Contractor's activities from entering water bodies or enter other parts of the County's or other property owners sites outside the Construction limits.

B. Temporary erosion controls include, but are not limited to; grassing, mulching, netting, watering and reseeding on-site surfaces and soil and borrow area surfaces, and providing interceptor ditches at end of berms and at those locations which will ensure that erosion during Construction will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

C. Temporary sedimentation controls include, but are not limited to; silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the regulatory agencies having jurisdiction.

1.02 REQUIREMENTS

A. The Contractor is responsible for providing effective temporary erosion and sediment control measures during Construction or until final controls become effective.

B. The Contractor shall be responsible for filing Notice of Intent for Construction Activities with regulatory agencies (SJRWMD, SFWMD, and FDEP) as required by law, if thresholds are expected to be exceeded.

C. The areas of unstabilized soil cover shall be minimized at all times to limit erosion and sedimentation.

1.03 SUBMITTALS:

A. The Contractor shall prepare and submit an Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) for County review and approval. The Plan shall be in effect throughout the Construction duration.

PART 2 - PRODUCTS

2.01 EROSION CONTROL

A. Seed: Scarified Argentine Bahia.

B. Sod: Bermuda grass, Argentine Bahia grass, Pensacola Bahia grass or St. Augustine. Grassing and Sodding Materials: As specified in Section 981 FDOT Specification for Road & Bridge Construction.

C. Netting: Polypropylene mesh netting 5/8-inch x 3/4-inch (16 x 19mm) mesh with interwoven curlex fibers as manufactured by American Excelsior Company or equal. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

2.02 SEDIMENTATION CONTROL

A. Bales: Clean, synthetic hay type. Minimum dimensions of 14-inch by 18-inch by 36-inches at the time of placement.

B. Netting: Fabricated of material in conformance with Section 985 FDOT Specification for Road & Bridge Construction.

C. Sediment Control Fencing (Silt Fencing): As manufactured by American Excelsior Company or equal.

D. Filter stone: Crushed stone conforming to Florida Department of Transportation Specifications.

E. Concrete block: Hollow, non-load bearing type.

F. Concrete: Exterior grade not less than 1-inch thick.

G. Turbidity Barriers: Floating or staked as required.

PART 3 - EXECUTION

3.01 TEMPORARY EROSION CONTROL

A. See Section 02578 "Solid Sodding."

3.02 SEDIMENTATION CONTROL

A. Install and maintain silt fences and dams, traps, barriers, and appurtenances as shown on the approved descriptions and working Drawings. Replace deteriorated hay bales and dislodged filter stone. Repair portions of any devices damaged at no additional expense to the County.

B. Install all sediment control devices in a timely manner to ensure the control of sediment. At sites where exposure to sensitive areas is likely, complete installation of all sediment control devices before starting earthwork.

C. Use approved temporary erosion control features to correct conditions that develop during Construction that were not foreseen when the Erosion and Sedimentation Control Plan was first approved.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Regulatory agency having jurisdiction, the County or the Professional, the Contractor shall immediately take whatever steps necessary to correct the deficiency at its own expense to protect the Work and any adjacent property to the site, as well as to prevent contamination of any river, stream, lake, tidal waters, reservoir, canal or other water impoundments.

B. The side slope areas with unstabilized or unprotected soil cover shall be minimized at all times to limit erosion and sedimentation.

C. Incorporate permanent erosion control features into the Project at the earliest practical time.

D. Remove temporary erosion and sedimentation controls when the Work is complete and in accordance with the Erosion and Sedimentation Control Plan (Stormwater Pollution Prevention Plan) and the Notice of Intent for Construction Activities filed with regulatory agencies.

3.04 MAINTENANCE OF EROSION AND CONTROL FEATURES

A. Provide routine maintenance of permanent and temporary erosion control features, at no expense to the County, until the Project is complete and accepted.

END OF SECTION

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SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall furnish, install, and maintain all sign materials including sign posts, weighted stands, brackets, any required mounting hardware, and miscellaneous materials required for temporary signs for the purpose of:
   1. Project Identification.
   2. Informational signs to direct traffic
   3. On-site safety signs as appropriate for the Work

B. Remove temporary signs on completion of Construction prior to obtaining Certificate of Occupancy and Substantial Completion.

C. Allow no other signs to be displayed without written approval of the County.

1.02 SUBMITTALS

A. Submit complete Shop Drawings identifying locations, material, layout, sign content, font type and size, and sample colors. Make sign and lettering to scale, clearly indicating condensed lettering if used. The sign details will be submitted to the County for approval prior to fabrication.

B. Submit method of erection to include materials, fasteners, and other items to assure compliance with the requirements for wind pressures as required by the authorities having jurisdiction.

C. Submit signs in accordance with any details provided in the Drawings.

D. Prior to erection obtain and submit all required permits from the authorities having jurisdiction.

1.03 PROJECT IDENTIFICATION SIGN

A. Provide 1 painted sign at the site, or at each end of the Work if a linear project, or at each of the separate sites of Work, if applicable. The sign will be not less than 32-square feet area, with a minimum dimension of 4-feet and painted graphics with content to include:
   1. Title of Project
   2. Orange County Government name and logo
   3. Names and titles of the Board of County Commissioners, County Administrator, Director of Orange County Utilities Department, the Consulting Engineer, and the Contractor

B. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County. The sign must be located 5-feet from all rights-of-way and 20-feet from all property lines.

1.04 INFORMATIONAL SIGNS

A. All signs and other traffic control devices shall conform to the requirements for shape, color, size, and location as specified in the latest Manual on Uniform Traffic Control and Safe Streets and Highways and the Florida Manual of Traffic Control and Safe Practices for Street and Highway Construction, Maintenance and Utility Operations. Information as to the above may be obtained from FDOT Division engineers.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: New construction grade lumber, structurally adequate and suitable for exterior application and specified finish.

B. Sign Panels: New A-B Grade, exterior type, APA DF plywood with inset hardwood edges and mitered corners, standard large sizes to minimize joints.
   1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles, minimum 3/4-inch.

C. Rough Hardware: Galvanized steel, of sizes and types to enable sign assemblies to resist wind pressures as required by the authorities having jurisdiction but not less than a wind velocity of 50-mph.
   1. Use minimum 1/2-inch diameter button head carriage bolts to fasten sign panels to supporting structures. Bolt heads to be painted to match sign face.

D. Paint: Exterior quality, as specified in Division 9 or as a minimum as specified herein.
   1. Primer and finish coat: exterior, semi-gloss, alkyd enamel.
   2. Colors for structure, framing, sign surfaces, and graphics: As shown on the Drawings or as selected by the County.

E. Safety Sign Number Tags
   1. Removable aluminum or galvanized steel, with 4-inch high, blue numerals and steel tag hooks.

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Install project identification signs within 10-days of the Notice to Proceed date. Failure to erect the signs may be reason to delay approval of the initial Application for Payment.

B. Paint exposed surfaces of supports, framing, and surface material; one (1) coat of primer and two (2) coats of finish paint.

C. Set signs plumb and level and solidly brace as required to prevent displacement during the Construction period. If mounted on posts, sink posts 3-feet to 4-feet below grade, leaving a minimum of 8-feet of each post above grade for mounting the sign.

D. Install informational signs at a height for optimum visibility, on ground mounted poles or attached to temporary structural surfaces.

3.02 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing, or sign.

B. Relocate informational signs as required by the progress of the Work.

C. Poorly maintained, defaced, damaged, or dirty signs shall be replaced, repaired, or cleaned without delay.

D. Special care must be taken to ensure that construction materials and dust are not allowed to obscure the face of a sign.

E. Signs not in effect shall be covered or removed.

3.03 REMOVAL

A. Remove signs, framing, supports, and foundations at Substantial Completion of the Work.

B. Leave areas clean and patch as required to remove any traces of temporary signs.

END OF SECTION

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SECTION 01590
TEMPORARY FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractor provision of temporary utilities to include electricity, lighting, internet connectivity, heat, ventilation, telephone service, water, and sanitary facilities.

B. Contractor provision of temporary controls to include barriers, enclosures and fencing, and water control.

C. Contractor provision of temporary facilities to include access roads, parking, and temporary buildings.

D. Contractor provision of field offices for the County.

E. Restrictions on the use of existing adjacent facilities.

1.02 TEMPORARY ELECTRICITY

A. Provide and pay for power service required for Construction and testing from local utility source.

B. Provide temporary electric feeder from existing electrical service at location as directed by utility company. Power consumption will not disrupt the County's need for continuous service. Coordinate with the County before making taps or disturbing existing service.

C. Provide separate metering and pay for cost of energy used until substantial completion. If electric service is turned over to and paid for by the County prior to substantial completion, reimburse the County for energy used up to substantial completion.

D. Provide power outlets for Construction operations, with branch wiring and distribution boxes located as required. Provide OSHA approved flexible power cords as required.

E. Contractor-installed permanent convenience receptacles may be used during Construction.

1.03 TEMPORARY LIGHTING

A. Provide and maintain adequate lighting for Construction operations to achieve a minimum lighting level of one (1) watt/sq ft.

B. Provide and maintain two (2) foot-candle lighting to exterior staging and storage areas after dark for security purposes.

C. Provide and maintain 0.25-watt/sq ft H.I.D. lighting to interior Work areas after dark for security purposes.

D. Provide branch wiring from power source to distribution boxes with lighting conductors,

pigtails, and lamps as required.

E. Maintain lighting and provide routine repairs.

F. Permanent building lighting may be used during Construction.

1.04 TEMPORARY HEAT AND COOLING

A. Provide and pay for heating and cooling as required to maintain specified conditions for Construction operations or as required for proper conduct of operations included in the Work.

B. Prior to operation of permanent equipment for temporary purposes, verify that installation is approved for operation, equipment is lubricated and temporary filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

C. Maintain minimum ambient temperature of 50°F and maximum relative humidity of 50% in areas where Construction is closed in and final finishes are to be placed, unless indicated otherwise in specifications.

1.05 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

1.06 TEMPORARY WATER SERVICE

A. Provide, maintain, and pay for suitable quality water service required for Construction operations. Coordinate with the County if water supply is not separately metered. Pay all costs and expenses associated with such use.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections.

1.07 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures on-site. Maintain daily in clean and sanitary condition. Adjacent County office building toilet facilities are not to be used by Contractor.

1.08 BARRIERS

A. Provide barriers to prevent unauthorized entry to Construction areas and to protect existing facilities and adjacent properties from damage from Construction operations.

B. Provide barricades required by governing authorities for public rights-of-way.

C. Provide protection for plant life designated to remain. Replace damaged plant life.

D. Protect non-owned vehicular traffic, stored materials, site and structures from damage.

1.09 FENCING

A. Unless directed otherwise in other sections of the Contract Documents, provide a 6-foot high fence completely around Construction site; provided with hinged vehicular and pedestrian gates with locks. Fencing will be galvanized, 2-inch mesh, chain link with solid top rail. Provide line posts and end posts as needed to maintain stretched and uniform fencing with no sags.

B. Fencing plan will be approved by the County for each phase of the project. Submit fencing layout diagram prior to the Pre-Construction meeting.

C. Provide visual fabric barrier at least 6-foot high on all fencing separating parking areas from Construction activities. Submit barrier fabric for approval before starting fencing. Barrier fabric will be capable of retaining physical integrity and color during the entire Construction period.

1.10 ACCESS ROADS

A. Provide and maintain uninterrupted public access to existing buildings. Construction activities will not interfere with access. If Contractor fails to maintain public access after 2 written notices within a 24-hour period, the County reserves the right to correct such situation and back charge the Contractor.

B. Construct and maintain temporary roads accessing public thoroughfares to serve Construction area.

C. Extend and relocate access roads as Work progress requires. Provide detours necessary for unimpeded traffic flow.

D. Provide and maintain access to fire hydrants, free of obstructions.

E. Designated existing on-site roads may be used for Construction traffic. Repair or restore any damaged areas caused as a result of Construction activity. Such repair will be to a like-new condition.

1.11 PARKING

A. Provide temporary surface parking areas to accommodate Construction personnel.

B. Do not allow Construction vehicle parking on existing pavement unless approved by County.

1.12 REMOVAL OF TEMPORARY UTILITIES, FACILITIES, AND CONTROLS

A. Remove all temporary utilities, equipment, facilities, and materials prior to submitting Final Application for Payment.

B. Remove temporary underground installations to minimum depth of 2-feet and re-grade site.

C. Clean and repair damage caused by installation or use of temporary Work.

D. Restore any existing facilities used during Construction to original condition, unless otherwise directed in other sections of Contract Documents. Restore existing landscaping, drainage, paving, etc. to an "as-was" condition, unless otherwise directed in other sections of Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01610
DELIVERY, STORAGE AND HANDLING

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section specifies the general requirements for the delivery, handling, storage and protection for all items required in the construction of the Work.

B. Deliver, handle and store products in accordance with manufacturer's recommendations and by methods and means that will prevent damage, deterioration, and loss including theft and protect against damage from climatic conditions. Control delivery schedules to minimize long-term storage of products at the site and overcrowding of construction spaces. In particular, provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss. Damaged or defective items, in the opinion of the County, will be replaced at no cost to the County.

1.02 REQUIREMENTS

A. The Contractor is responsible for all material, equipment and supplies sold and delivered to the County under this Contract until final inspection of the Work and acceptance thereof by the County.

B. All materials and equipment to be incorporated in the Work will be handled and stored by the Contractor before, during and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.

C. All materials and equipment, which in the opinion of the County, have become so damaged as to be unfit for the use intended or specified, will be promptly removed from the site of the Work, and the Contractor will receive no compensation for the damaged materials or equipment or for its removal.

D. In the event any such material, equipment and supplies are lost, stolen, damaged or destroyed prior to final inspection and acceptance, the Contractor will replace same without additional cost to the County.

1.03 DELIVERY

A. Transport and handle items in accordance with manufacturer's instructions.

B. The County and the Contractor's project superintendent must be on-site to accept all deliveries shipped directly to the job site. If the project superintendent is not present for a delivery, that delivery may be rejected by the County. If any delivery is rejected due to non-availability of the Contractor's project superintendent, delivery shall be rescheduled at no additional cost to the County.

C. Schedule delivery to reduce long-term on-site storage prior to installation and/or operation. Under no circumstances will materials or equipment be delivered to the site more than 1-month prior to installation without written authorization from the County.

D. Coordinate deliveries in order to avoid delay in, or impediment of, the progress of the Work.

E. Schedule deliveries to the site not more than 1-month prior to scheduled installation without written authorization from the County.

F. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.

G. All items delivered to the site will be unloaded and placed in a manner that will not hamper the Contractor's normal construction operation or those of Subcontractors and other Contractors and will not interfere with the flow of necessary traffic.

H. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Maintain packaged materials with seals unbroken and labels intact until time of use.

I. Immediately on delivery, inspect shipments with the County to ensure compliance with requirements of Contract Documents and accepted submittals, and that products are properly protected and undamaged. If the Contractor does not notify the County regarding the delivery and the County rejects any part of the delivery, there will be no additional cost to the County for the material to be returned. For items furnished by others (i.e. County), perform inspection in the presence of the County. Provide written notification to the County of any problems.

J. Promptly remove damaged material and unsuitable items from the job site, and promptly replace with material meeting the specified requirements, at no additional cost to the County.

1.04 STORAGE AND HANDLING

A. Provide equipment and personnel to handle products by methods recommended by the manufacturer to prevent soiling or damage to products or packaging, with seals and labels intact and legible.

B. The Contractor is responsible for securing a location for on-site storage of all material and equipment necessary for completion of the Work. The location and storage layout will be submitted to the County at the Pre-Construction conference.

C. Manufacturer's storage instructions will be carefully studied by the Contractor and reviewed with the County. These instructions will be carefully followed and a written record of this kept by the Contractor.

D. All material delivered to the job site will be protected from dirt, dust, dampness, water, and any other condition detrimental to the life of the material from the date of delivery to the time of installation of the material and acceptance by the County.

E. When required or recommended by the manufacturer, the Contractor will furnish a covered, weather protected storage structure providing a clean, dry, non-corrosive environment for all mechanical equipment valves, architectural items, electrical and instrumentation equipment, and special equipment to be incorporated into this Project.

F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.

G. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within 7-days after written notice to do so has been given, the County retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contract Amount. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.

1.05 SPECIFIC STORAGE AND HANDLING

(Additional specific storage and handling requirements may be found in the specification sections addressing the material requirements.)

A. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) will be stored in a weather tight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the County. The building will be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
   1. All equipment will be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer. Mechanical equipment to be used in the Work, if stored for longer than 90-days, will have the bearings cleaned, flushed and lubricated prior to testing and startup, at no extra cost to the County.
   2. Moving parts will be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor will start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
   3. Lubricants will be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants will be put into the equipment at the time of acceptance. Prior to acceptance of the equipment, the Contractor will have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer will be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment will be judged to be defective. It will be removed and replaced at the Contractor's expense.

4. Electric motors provided with heaters will be temporarily wired for continuous heating during storage. Upon installation of the equipment, the Contractor will start the equipment, at least half load, and once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

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

C. Cement and lime will be stored under a roof and off the ground and will be kept completely dry at all times.

D. Brick, block and similar masonry products will be handled and stored in a manner to minimize breakage, chipping, cracking and spilling to a minimum.

E. Precast Concrete will be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping or cracking.

F. All structural and miscellaneous steel and reinforcing steel will be stored off the ground or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water and to minimize rusting. Beams will be stored with the webs vertical.

G. Metals will be stored dry, all under cover and vented to prevent build-up of humidity, all off ground to provide air circulation.

H. Lumber will be stacked to provide air circulation. Store materials for which maximum moisture content is specified in an area where moisture content can be maintained.

I. Gypsum wallboard systems will be stored to protect all metal studs, furring, insulation boards, batts, accessories and gypsum board to prevent any type of damage to these materials. Rusted material components, damp or wet insulation or gypsum boards will not be accepted.

J. Acoustical materials will be delivered to the job site in unbroken containers labeled and clearly marked. Materials will not be removed from containers until ready to install, but will be stored in dry area with cartons neatly stacked. Before installation, acoustical board will be stored for not less than 24-hours in the Work area at the same temperature and relative humidity.

K. Linear items will be stored in dry area with spacers to provide ventilation. Stack linear items to prevent warping, complying with manufacturer's instructions.

L. Paints and other volatile materials will be stored within approved safety containers. No glass jugs will be permitted. Storage areas will be equipped with not less than 2 fire extinguishers (C02 type) sufficient to discharge a distance of 25-feet when fully charged and have current tags. No other building materials will be stored in this area. Used rags will be removed daily. Clean rags will be stored in metal closed containers.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

The term "Project Closeout" is defined to include requirements near the end of the Contract Time, in preparation for Substantial Completion acceptance, occupancy by the County, release of retainage, final acceptance, final payment, and similar actions evidencing completion of the Work. Time of closeout is directly related to "Substantial Completion"; therefore, the time of closeout may be either a single period for the entire Work or a series of time periods for individual elements of Work that has been certified as substantially complete at different dates. This time variation, if any, will be applicable to the other provisions of this section.

1.02 SCOPE OF WORK

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
   1. Final Cleaning
   2. Substantial Completion
   3. Final Acceptance

1.03 RELATED WORK

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

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

C. Section 01720 "Project Record Documents"

D. Section 01740 "Warranties and Bonds"

1.04 PREREQUISITES FOR SUBSTANTIAL COMPLETION.

When the Contractor considers the Work as substantially complete, submit to the County a written notice stating so and requesting an inspection to determine the status of completion. The Contractor will attach to the notice a list of items known to be incomplete or yet to be corrected. Complete the following before requesting the County’s inspection for certification of substantial completion.

A. In the progress payment request that coincides with or is the first request following, the date substantial completion is claimed, show 100% completion or list incomplete items, the value of incomplete Work, and reasons for the Work being incomplete. Inspection procedures include supporting documentation for completion as indicated in these Contract Documents.

B. Submit a statement showing an accounting of changes to the Contract Sum.

C. Submit specific warranties, workmanship/maintenance bonds, maintenance agreements, final certifications and similar documents in accordance with Section 01740 "Warranties and Bonds."

D. Obtain and submit lien releases enabling the County's full, unrestricted use of the Work and access to services and utilities.

E. Consult with County before submitting Record Documents in accordance with Section 01720 "Project Record Documents."

F. Submit Operation and Maintenance Manuals.

G. Make final changeover of permanent locks. Submit keys and keying schedule.

H. Deliver tools, spare parts, extra stock, and similar items.

I. Complete final cleaning requirements necessary for Substantial Completion.

1.05 FINAL CLEANING.

Complete the following cleaning operations prior to Substantial Completion or Owner occupancy.

A. Remove from job site all tools, surplus materials, construction equipment, storage sheds, debris, waste and temporary services.

B. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Structures:
   1. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
   2. Remove all traces of splashed materials from adjacent surfaces.
   3. Ensure exterior surfaces have a uniform degree of cleanliness.
   4. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges and other foreign matter.
   5. Remove paint droppings, spots, stains and dirt from finished surfaces.
   6. Remove labels that are not permanent labels.
   7. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
   8. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Leave concrete floors broom clean.
   9. Wipe surface of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
   10. Clean permanent filters of ventilating systems and replace disposable filters if units were operated during construction. Clean ducts, blowers and coils if units were operated without filters during construction.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor will submit the proposed format, content and tab structure for all Operating and Maintenance Manuals for the County's review and approval. The tab structure for Operating and Maintenance Manuals will follow specification division format as accepted by the Construction Specification Institute. After the County approves the proposed format, content, and tab structure for the Operating and Maintenance Manuals, the Contractor will create and deliver 5 complete sets.

B. Operation and Maintenance documentation is required for each piece of mechanical, electrical, communications, instrumentation and controls, pneumatic, hydraulic, conveyance, and special construction. If required by the technical specifications, provide Operation and Maintenance documentation for any other product not listed in the foregoing.

C. The requirements of this Section are separate, distinct and in addition to product submittal requirements that may be established by other Sections of the Specifications. Owner's manuals, manufacturer's printed instructions, parts lists, test data and other submittals required by other Sections of the Specifications may be included in the Operating and Maintenance Manuals provided that they are approved and are formatted in a manner consistent with the requirements of this Section.

D. Deliver Operation and Maintenance Manuals directly to the County.

E. Operating and Maintenance Manual documents must include, but are not limited to, table of contents, approved submittals, manufacturer's operating and maintenance instructions, brochures, Shop Drawings, performance curves and data sheets annotated to indicate equipment actually furnished (e.g. identifying impeller size, model, horsepower, etc), procedures, wiring and control diagrams, records of factory and field tests and device/controller settings and calibration, program lists or data compact discs, maintenance and warranty terms and contact information, spare parts listings, inspection procedures, emergency instructions, and other Operating and Maintenance documentation that may be useful to the County. The material and equipment data required by this Section must include all data necessary for the proper installation, removal, normal operation, emergency operation, startup, shutdown, maintenance, cleaning, adjustment, calibration, lubrication, assembly, disassembly, repair, inspection, trouble-shooting, and warranty service of the equipment or materials.

F. The Contractor must bind the Operating and Maintenance Manual documents in heavy-duty, 3-ring vinyl-covered binders including pocket folders for folded sheet information. Mark binder identification on both the front and spine of each binder. Binder information must list the project title, identify separate structures or locations as applicable, identify the general subject matter covered in the manual and must include the words "OPERATING AND MAINTENANCE INSTRUCTIONS".
   1. The Contractor must submit the Operating and Maintenance documents on three-hole punched, 8-1/2-inch x 11-inch sheets or on three-hole punched sheets that are foldable in multiples of 8-1/2-inch x 11-inch. The three-hole punched edge will be the left 11-inch edge.
   2. The Contractor may request waivers to the size requirement for specific instances. The Contractor's waiver request must be in writing to the County. The Contractor's waiver request must include a justification for seeking the waiver.

G. The Contractor must provide an electronic version of the complete and final Operating and Maintenance Manuals in original electronic file format on compact disc or DVD. The Contractor must also provide one (1) electronic pdf file of each bound Operating and Maintenance Manual that represents each Manual's content. The electronic pdf file must match the Operating and Maintenance Manual content and organizational structure.

1.07 SUBSTANTIAL COMPLETION INSPECTION PROCEDURES

A. Upon receipt of the Contractor's request for inspection, the County will either proceed with inspection or advise the Contractor of incomplete prerequisites.

B. Following the initial inspection, the County will either prepare the certificate of Substantial Completion, or advise the Contractor of Work which must be performed before the certificate will be issued. The County will repeat the inspection when requested in writing and when assured that the Work has been substantially completed.

C. Results of the completed inspection will form the initial "punch list" for final acceptance.

1.08 PREREQUISITES FOR FINAL ACCEPTANCE.

Complete the following before requesting the County's final inspection for certification of final acceptance, and final payment. List known exceptions, if any, in the request.

A. Submit the final payment request with final releases and supporting documentation not previously submitted and accepted. Include certificates for insurance for products and completed operations where required.

B. Submit written certification that:
   1. The County's final punch list of itemized Work to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance.
   2. The Contract Documents have been reviewed and Work has been completed in accordance with Contract Documents.
   3. Equipment and systems have been tested in the presence of the County and are operational.
   4. Work is completed and ready for final inspection.

C. Submit consent of surety.

D. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

1.09 FINAL ACCEPTANCE INSPECTION PROCEDURES

A. The County will re-inspect the Work upon receipt of the Contractor's written notice that the Work, including punch list items resulting from earlier inspections, has been completed, except for those items for which completion has been delayed because of circumstances that are acceptable to the County.

B. Upon completion of re-inspection, the County will either prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled, which are required for final acceptance.

C. If necessary, the re-inspection procedure will be repeated.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The purpose of the Project Record Documents is to provide the County with factual information regarding all aspects of the Work, both concealed and visible. The West Electrical Building shall be as-built and include new openings and other major information.

1.02 DEFINITIONS

A. As-Built Drawings: Drawings prepared by the Contractor's Surveyor depicting the actual location of installed utilities for the completed Work.

B. Record Documents: All documents in subsections 1.04 and 2.02 in this specification.

1.03 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of the Record Documents to one person on the Contractor's staff as approved by the County.

B. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of specifications and each sheet of Drawings and other documents where such entry is required to show progress and changes properly.

C. Make entries within 24-hours after receipt of information has occurred.

1.04 RECORD DOCUMENTS AT SITE

A. Maintain at the site and always available for County’s use one (1) record copy of:
   1. Construction Contract, Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents
   2. Change Orders, Verbal Orders, and other modifications to Contract
   3. Written instructions by the County as well as correspondence related to Requests for Information (RFIs)
   4. Accepted Shop Drawings, Samples, product data, substitution and "or-equal" requests
   5. Field test records, inspection certificates, manufacturer certificates and construction photographs
   6. Paper copies of the Progressive As-Built Drawings
   7. Current Surveyor’s tables for the Assets Attribute Data, Pipe Deflection Data, and Gravity Main Data

B. Maintain the documents in an organized, clean, dry, legible condition and protected from deterioration, loss and damage until completion of the Work, transfer of all record data to the final As-built Drawings for submittal to the County.

C. Store As-Built Documents and samples in Contractor's office apart from documents used for construction. Do not use As-Built document for construction purposes. Label each document "AS-BUILT" in neat large printed letters. File documents and samples in accordance with CSI/CSC format.

D. Record information concurrently with construction progress. Do not conceal any Work until required information is recorded.

PART 2 - PRODUCTS

2.01 AS-BUILT DRAWINGS

A. Maintain the electronic As-Built Drawings to accurately record progress of Work and change orders throughout the duration of the Contract.

B. Date all entries. Enter RFI No., Change Order No., etc. when applicable.

C. Call attention to the entry by highlighting with a "cloud" drawn around the area affected or other means. In the event of overlapping changes, use different colors for entries of the overlapping changes.

D. Design call-outs shall have a thin strike line through the design call-out and all As-Built information must be labeled (or abbreviated "AB") and be shown in a bolder text that is completely legible.

E. Make entries in the pertinent other documents while coordinating with the County for validity.

F. Entries shall consist of graphical representations, plan view and profiles, written comments, dimensions, State Plane Coordinates, details and any other information as required to document field and other changes of the actual Work completed. As a minimum, make entries to also record:
   1. Details, not on original Contract Drawings, as needed to show the actual location of the Work completed in a manner that allows the County to find it in the future.
   2. The Contractor shall mark all arrangements of conduits, circuits, piping, ducts and similar items shown schematically on the construction documents and show on the As-Built Drawings the actual horizontal and vertical alignments and locations.
   3. Major architectural and structural changes including relocation of doors, windows, etc. Architectural schedule changes according to Contractor’s records and Shop Drawings.

2.02 RECORD DOCUMENTS

A. Three (3) paper copy sets and three (3) digital media sets of the following final Record Documents below.

C. Digital sets of the final Record Documents including but not limited to:
   1. Scanned digital copies of the final As-Built Drawings
   2. Final Record Documents

3. Digital file of As-Built Drawing in the Engineer's current version of AutoCAD file (dwg) format

D. Scanned Documents: Scan Record Documents reflecting changes from the Contract Documents.

E. The scanned "As-Built" Drawing sets shall be complete and include the title sheet, plan/profile sheets, cross-sections, and details. Each individual sheet contained in the printed set of the As-Built Drawings shall be included in the electronic drawings, with each sheet being converted into an individual tif (tagged image file). The plan sheets shall be scanned in tif format Group 4 at minimum of 400 dpi resolution to maintain legibility of each drawing. Then, the tif images shall be embedded into a single pdf (Adobe Acrobat) file representing the complete plan set. Review all Record Documents to ensure a complete record of the Project.

F. Provide an encompassing digital AutoCAD file that includes all the information of the As-Built Drawings and any other graphical information in the As-Built Drawings. It shall include the overall Work, utility system layout and associated parcel boundaries and easements. Feature point, line and polygon information for new or altered Work and all accompanying geodetic control and survey data shall be included. The surveyor's certified As-Built Asset Attribute Data shall be added to the As-Built Drawings and Surveyor shall electronically seal the data in a comma-delineated ASCII format (txt).

PART 3 - EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. Pre-construction Meeting: It is recommended that the Surveyor attend the Pre-construction meeting.

3.02 CONSTRUCTION PROGRESS MEETINGS

A. Contractor shall provide progressive Record Documents described below:
   1. Construction Contract, As-Built Drawings, Specifications, General Conditions, Supplemental Conditions, Bid Proposal, Instruction to Bidders, Addenda, and all other Contract Documents.
   2. Specifications and Addenda: Record manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed as well as any changes made by Field Order, Change Order or other.
   3. Change orders, verbal orders, and other modifications to Contract.
   4. Written instructions by the County as well as correspondence related to Requests for Information (RFIs).
   5. Accepted Shop Drawings, samples, product data, substitution and "or-equal" requests.
   6. Field test records, inspection certificates, manufacturer certificates and construction photographs.

7. As-Built Asset Attribute Data Form: Surveyor shall obtain field measurements of vertical and horizontal dimensions of constructed improvements. The monthly submittal shall include the Surveyor's certified statement regarding the constructed improvements being within the specified accuracies as described in Specification Section 01050 "Surveying and Field Engineering", Table 01050-1 Minimum Survey Accuracies or if not, indicating the variances.
8. Gravity Main Table: Surveyor shall prepare and update a Gravity Main Table to include as a minimum the pipe segment identification, pipe lengths, manhole inverts and tops, and slopes for gravity mains. Surveyor shall certify the data entered are correct and indicate if the minimum slopes have not been met.
9. Pipe Deflection Table: Surveyor shall input the type of pipe, pipe manufacturer, PVC manufacturer deflection allowance, allowable angle of offset and radius of curvature, laying length of pipe, and coordinates. Surveyor shall certify the data entered are correct and indicate if the deflection allowance, offset or radius of curvature exceeds the manufacturer's recommendations.

3.03 FINAL RECORD DOCUMENTS SUBMITTAL

A. Submit the Final Record Documents within 20-days after Substantial Completion.
   1. Participate in review meetings as required and make required changes and promptly deliver the Final Record Documents to the County.

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.

B. General closeout requirements are included in Section 01700 "Project Closeout."

C. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.

D. Refer to Section 07540 TPO Roofing System for specific roof warranties.

E. All HVAC equipment requires non-prorated, 5-year warranty.

1.03 DEFINITIONS

A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the County.

B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the County.

1.04 SUBMITTALS

A. Submit written warranties to the County prior to requesting a Substantial Completion Inspection as outlined in Section 01700 "Project Closeout." If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the County.

B. When a designated portion of the Work is completed and occupied or used by the County, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the County within 15-days of completion of that designated portion of the Work.

C. When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the County for approval prior to final execution.

D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties including but not limited to the TPO Roofing System and all HVAC Equipment.

E. Prior to Substantial Completion Inspection, submit to the County two (2) copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, Subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-inch by 11-inch three-hole punched paper.
   2. Table of Contents will be neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified and the name of the product or work item.
   3. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer, supplier and manufacturer.
   4. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address and telephone number of the Contractor.
   5. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.05 WARRANTY REQUIREMENT

A. The Contractor will warrant all equipment in the Contractor's one-year warranty period even though certificates of warranty may not be required. For all major pieces of equipment, the Contractor shall submit a warranty from the equipment manufacturer. "Major" equipment is defined as a device having a 5 HP or larger motor or which lists for more than $1,000.00.

B. In the event that an equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at Substantial Completion, the Contractor will obtain from the manufacturer a warranty of sufficient length commencing at the time of equipment delivery to the job site, such that the warranty will extend to at least 1-year past substantial completion.

C. If an individual specification section requires a particular warranty more stringent than that required by this Section or the General Conditions, the more stringent requirements will govern for the applicable portion of the Work.

D. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

E. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty will be equal to the original warranty with an equitable adjustment for depreciation.

F. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the County has benefited from use of the Work through a portion of its anticipated useful service life.

G. County's Recourse: Written warranties made to the County are in addition to implied warranties, and will not limit the duties, obligations, rights and remedies otherwise available under the law, nor will warranty periods be interpreted as limitations on time in which the County can enforce such other duties, obligations, rights, or remedies.

H. Rejection of Warranties: The County reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

I. The County reserves the right to refuse to accept Work for the project where a special warranty, certification, or similar commitment is required on such work or part of the Work, until evidence is presented that entities required to counter-sign such commitments are willing to do so.

J. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and Subcontractors required to countersign special warranties with the Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 DELIVERABLES

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and Subcontractors, and bind into a commercial quality standard 3-ring binder; submit 5 copies of the warranties and bonds to the County for review.
   1. The warranties and bonds shall include:
      a. Equipment or product description
      b. Manufacturer's name, principal, address and telephone number
      c. Contractor, name of responsible principal, address and telephone number
      d. Local supplier's or representatives name and address
      e. Scope of warranty or bond

f. Proper procedure in case of failure
g. Instances which might affect the validity of warranty or bond
h. Date of beginning of warranty, bond or service and maintenance contract
i. Duration of warranty, bond or service maintenance contract

B. Warranties
1. Furnish an extended warranty for sanitary sewer main liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.
2. Furnish an extended warranty for sanitary lateral liner certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for 1-year from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the Contractor's expense in a manner acceptable to the County.

END OF SECTION

SECTION 02225
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

1.02 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.03 SUBMITTALS

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

PART 2 EXECUTION

2.01 SCOPE

A. Remove the entire roof membrane, existing damaged skylights and exterior louvers as designated on the construction drawings.
B. All known asbestos products have been previously remediated by the County. See Appendix A for the pre-remediation report.

2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.

4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
5. Do not close or obstruct roadways or sidewalks without permit.
6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

2.03 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

E. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

F. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

G. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 REFERENCE:

A. General Provisions of the Contract, including General, Special and Supplementary Conditions and Division One General Requirements, apply to work specified in this Section.

1. 04340 - Reinforced Unit Masonry

1.02 WORK INCLUDES:

A. All labor and materials required for cast-in-place concrete shown on the drawings or specified herein. Coordinates with respective contractors. Concrete for grouting of concrete unit masonry.

1.03 QUALITY ASSURANCE:

A. Codes and Standards

1. Comply with the provisions of the most recent edition of the following codes, specifications and standards, except as otherwise shown or specified.

a. ACI 318 "Building Code Requirements for Reinforced Concrete."

b. ACI 301, "Specifications for Structural Concrete for Buildings."

c. ACI 302, "Recommended Practice for Concrete Floor or Slab Construction."

d. ACI 304 "Recommended Practice for Measuring Mixing, Transporting and Placing Concrete."

e. ACI 305 "Recommended Practice for Hot Weather Concreting."

f. ACI 307 "Recommended Practice for Cold Weather Concreting."

g. ACI 309 "Recommended Practice for Consolidation of Concrete."

h. CRSI Manual of Standard Practice.

i. CRSI Placing Reinforcing Bars.

j. ASTM C476, "Standard Specification for Grout for Reinforced or Non-Reinforced Masonry."

k. ASTM C-31, Making and Curing Concrete Compression and Flexure Strength Test Specimens in Field.

l. ASTM C-33, Concrete Aggregates.

m. ASTM C-39, Compressive Strength of Molded Concrete Cylinders.

n. ASTM C-94, Ready-Mixed Concrete.

o. ASTM C-143, Slump of Portland Cement Concrete.

p. ASTM C-150, Portland Cement

q. ASTM C-172, Sampling Fresh Concrete.

1.04 QUALITY CONTROL:

A. Do not commence placement of concrete until mix designs have been approved by the Architect/Engineer.

B. Any concrete work which does not conform to the specified requirements, including strength, tolerance and finishes shall be corrected by the Contractor at his expense and as directed by the Architect/Engineer.

1.05 DIMENSIONAL TOLERANCES FOR FORMED SURFACES:

A. Variation from the level or from the grades specified in the contract documents:

1. In slabs

In any 10 ft. of length.....1/4 in.
In any bay or in any 20 ft. of length.....3/8 in.
Maximum for the entire length.....3/4 in.

B. Variation in the sizes and location of sleeves, floor openings, and wall openings.....+1/4 in.

1.06 SUBMITTALS:

A. Concrete Mix Report

1. For each proposed concrete mix, submit two copies of the test mix report. Submit report at least 15 days prior to start of concrete pouring.

B. Material Certificates

1. Provide material certificates signed by material manufacturer, certifying that each material complies with the specified requirements.

C. Test Reports

1. Submit results of all compression, slump and air content tests performed during mix design and throughout the duration of the project as required by the Specifications.

2. Submit sieve analysis of coarse and fine aggregate intended for use in the project.

3. Submit a copy of State Certification that the concrete batching and weighing equipment has been inspected and approved.

4. Submit letters from the cement and aggregate suppliers certifying that furnished materials meet appropriate ASTM Standards.

1.07 TESTING:

A. Concrete shall be sampled and tested for Quality Control during placement of concrete.

B. Failure to detect defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate Architect/Engineer for final acceptance.

C. Required Sampling and Testing

1. Samples, for strength tests of each concrete mix shall be taken not less than once a day nor less than once for each 50 cu. yd. of concrete.

E. Evaluation of Test Results

1. For evaluation each specified concrete mix shall be represented by at least five strength tests.

F. The strength level of the concrete will be considered satisfactory if both of the following requirements are met.

1. The average of all sets of three consecutive strength tests (average of two cylinders) exceeds specified strength.

2. No individual strength test (average of two cylinders) falls below the specified strength by 500 psi.

G. If the strength level does not meet the above requirements, the Architect/Engineer shall consider the concrete to be deficient and shall have the right to reject the work or require load tests on the structure in the areas the tests represent at no cost to the Owner.

H. Report tests results in writing to the Architect/Engineer and the Contractor on the same day that tests are made. Reports of compressive strength tests shall contain:

1.08 TESTING SERVICES:

A. The Owner will employ an independent testing laboratory meeting the requirements of ASTM E329 and approved by the Architect/Engineer to perform the following services:

1. Sample concrete at placement and make slump, air content, temperature and compression tests as described above.

2. Report tests results to the Architect/Engineer.

B. Contractor Responsibilities

1. Pay for additional testing and inspection of materials or concrete occasioned by their failure by test or inspection to meet specification requirements.

2. Provide the necessary testing services for the qualification of proposed materials and the establishment of mix designs; and for any other testing services required by the Contractor.

3. Furnish any necessary labor to assist the designated testing agency in obtaining and handling samples.

4. Advise the testing agency sufficiently in advance of operations to allow for completion of tests.

5. Provide and maintain for the sole use of the testing agency adequate facilities for safe storage and proper curing of concrete test specimens as required by ASTM C31.

6. The use of Testing Services shall in no way relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIAL:

A. Portland Cement

1. ASTM C150, Type I (Normal)

B. Aggregate

1. ASTM C 33, and as herein specified. Provide aggregates from a single source for all exposed concrete.

a. Fine Aggregate: Clean, sharp sand, free from loam, clay, lumps or other deleterious substance.

2. Coarse Aggregate For Normal Weight Concrete: Comply with ASTM C33 size #57. Clean, uncoated, processed aggregate of crushed stone or washed gravel containing no clay, mud, loam or foreign matter. Use of pit or bank run gravel is not permitted. Aggregate shall meet ASTM C33 Size No. 56 or 57.

3. Where contractor elects to place concrete by pumping he shall provide a pump with sufficient capacity to place this size of aggregate.

4. ASTM C404 for masonry grout. Maximum aggregate size shall be 3/8".

C. Water:

1. Water shall be fresh and potable. Water shall be obtained from city water system. The Contractor shall pay for the quantity of water used during construction and also furnish, install and maintain a water meter if required by the Water Department.

2. Air-Entraining Admixtures - ASTM C260

a. "Darex" by W.R. Grace

b. "SikaAer" by Sika Chemical Co.

c. "MBVR" by Master Builders

d. "Air-Mix" by Euclid

e. "Sealtight" by W.R. Meadows

D. Water Reducing Admixture - ASTM C494 Type A

1. "Pozzolith 300 Series" by Master Builders

2. "WRDA/HYCOL" by Grace

3. "Plastocrete 161" by Sika

4. "Eucon-WR-75" by Euclid

E. High Range Water Reducing Admixture (Superplasticizer)

1. Admixtures shall meet the requirements of ASTM C494 Type F and shall contain no chloride ions.

2. Acceptable Products
   a. "Melmet" by American Admixtures
   b. "WRDA 19" by W.R. Grace Co.
   c. "Sikament" by Sika Chemical Co.

3. Dosage and use of any mix containing this admixture shall be in strict accordance with the manufacturers direction and only with the written permission of the Engineer.

4. A representative of the admixture manufacturer shall be present to observe the products use and to assure that it is being used in accordance with the manufacturers directions.

F. Water Reducing, Retarding Admixture

1. Shall comply with ASTM C494 Type D.

2. Acceptable Products

   a. "Daratard 17" by W.R. Grace & Company
   b. "Pozzolith 100XR" by Master Builders, Inc.
   c. "Lubricon R" by American Admixture
   d. "Plastocrete 161R" by Sika Chemical Co.

G. Calcium Chloride

1. Do not use calcium chloride in any concrete.

2.02 RELATED MATERIALS

A. Vapor Barrier:

1. Provide water-vapor cover over sub-grade materials as shown on the drawings. Use only materials which are resistant to decay when tested in accordance with ASTM E154.

B. Preformed Joint Fillers:

1. Provide preformed strips, non-staining, non-extruding and resilient bituminous type complying with ASTM D1751.

2. Thickness to be as indicated on drawings. If no thickness is indicated use 1/2".

C. Waterproof Sheet for Curing:

1. Conform to ASTM C171.

2. Polyethylene film thickness shall be at least 4 mils.

D. Membrane Curing Compound:

1. Conform to ASTM C171, Class B, Clear 100% resin type.

2. Do not use on any surface which will later receive paint, sealer, hardener, carpeting, tile or other bonded covering.

3. Acceptable Products:

a. Sealtight AR-30 W.R. Meadows
b. Kurez Euclid Chemical
c. Horncure W.R. Grace
d. Hydrocide Resin Sonneborn

E. Curing/ Sealing Compound:

1. Sodium Silicate Sealer

a. Acceptable Products

a. 1) Cure Hard Meadows
2) Eucosil Euclid Chemical
3) WB-309 Grace
4) Sonosil Sonneborn
5)Acurion Anti-Hydro Waterproofing

2. Verify compatibility of finish with curing/sealing compounds.

F. Bonding Agent (Epoxy Type) ASTM C881:

1. Sikadur Hi-Mod	Sika Chemical
2. Thiopoxy	W.R. Grace
3. Epoxy #452	Euclid Chemical

G. Non-shrink, Non-metallic grout:

1. Five Star	U.S. Grout

2. Euco NS Euclid Chemical
3. Masterflow 713 Master Builders

H. Water Stop:

1. Provide rubber or PVC flat, center build type water stops as shown on drawings.

PART 3 EXECUTION

3.01 GENERAL

A. Proportioning

1. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with the latest edition of ACI 211.1.

2. Contractor shall provide all testing services for approval of mixes.

3. The Contractor shall furnish the Architect/Engineer for approval a mix design for each class of concrete at least 15 days prior to start of work.

B. Report to Include

1. Total weight of water, cement, coarse aggregate fine aggregate and admixtures to be used.

2. Slump.

3. Percent of Air.

4. Results of Compression Test for 6 cylinders cast and broken 7, 14 and 28 days.

5. Grain size curves for both aggregates.

C. Do not begin production until mixes have been approved by Architect/Engineer.

D. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301-72. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least 30 consecutive tests in one group or the statistical average for 2 groups totaling 30 or more tests, representing similar materials and project conditions.

E. The proper proportions of cement, aggregate and water to obtain the required strength shall be determined from ACI 211.1 "Recommended Practice for Selection Proportions for Normal and Heavy Weight Concrete".

1. Strength requirements shall be 4000 and 3000 pounds per square inch.

2. In all cases, not more than 6 gallons of water per each sack of cement will be allowed.

3. The minimum weight of cement per yard for various strengths are listed below:

a. 4,000 pounds per square inch concrete - 587 pounds of cement per yard minimum.

b. 3,000 pounds per square inch concrete - 517 pounds of cement per yard minimum.

4. Unit weight for normal weight concrete shall be 150 pcf $\pm$ 5%.

5. Air content for mixes requiring air entrainment shall be 3.5% $\pm$ 1.5%.

6. Slump at the point of placement shall be not less than 4" and not more than 6".

7. Water/cement ratio not to exceed 0.4.

F. Concrete containing a high range water-reducing admixture (superplasticizer) shall have an initial slump or 1-1/2 to 2 inches and a final slump not to exceed 8 inches after addition of the admixture.

G. Mix design adjustments may be requested by the Contractor when characteristics of material, job conditions, weather, test results, or other circumstances warrant, at no additional cost to Owner and as approved by the Architect/Engineer. Laboratory test data for revised mix and designs and strength results must be submitted to and accepted by the Architect/Engineer before using it in the work.

H. Ready-Mix Concrete shall be mixed and delivered in accordance with ASTM C94, "Specifications for Ready-Mix Concrete" and shall meet other applicable requirements of this Section.

3.02 AIR-ENTRAINING ADMIXTURE:

A. Use air-entraining admixture in all concrete exposed directly to the elements, such as foundation and retaining walls, exterior slabs-on-grade, concrete canopies and walkways.

B. Add air-entraining admixture in accordance with manufacturer's recommendations.

3.03 WATER REDUCING ADMIXTURE

A. Use water-reducing admixtures in all concrete and in strict compliance with the manufacturer's directions.

B. Admixture to increase cement dispersion, or provide increased workability for low-slump concrete, any be used at the Contractor's option subject to the Architect/Engineer's acceptance.

C. The reduced water content shall be taken into account when proportioning mixes.

3.04 MIXING

A. Unless otherwise approved by the Architect/Engineer use ready mix concrete conforming to ASTM C494.

B. Place concrete no more than 90 minutes after initial mixing.

C. Tempering: All concrete shall be placed within 1-1/2 hours after introduction of water to the mix. Under no conditions may additional water be added that will exceed the quantity of water called for in the design mix. Submit time stamped batching tickets on delivery of concrete to job site. All concrete where the quantity of water has exceeded the design mix will be removed and replaced with proper concrete at no cost to the Owner.

D. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

1. When the air temperature is between 85 degrees Fahrenheit and 90 degrees Fahrenheit reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is over 90 degrees Fahrenheit, reduce the mixing and delivery time to 60 minutes.

3.05 PLACING CONCRETE

A. Pre-Placement Inspection

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts and contractors to permit the installation of their work; cooperate with other trades in setting such work, as required.

2. The Contractor shall notify the Inspector at least 24 hours in advance of concrete placement for a particular portion of the building. Placement of reinforcing shall occur in such sequence that the Inspector has sufficient time to inspect the correctness of the reinforcing within placement area & retains the right to require necessary revisions be made before concrete is placed.

B. PLACEMENT

1. Clean out all chips, saw dust, dirt and other foreign matter from forms and assure that inside of forms are free of frost. Remove any dirt, debris, and water from trenches and other excavations. Remove any dirt, debris and mud from tops of footings or pile caps before pouring walls.

2. Deposit concrete in forms in horizontal layers not deeper than 18 inches and in a manner to avoid inclined construction joints.

3. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified.

4. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

5. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use vibrators designed to operate with vibratory element submerged in concrete.

6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Do not insert vibrators into lower layers of concrete that have begun to set. Limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

7. Dropping the concrete a distance of more than 6 feet or depositing a large quantity at any point and running or working it along the forms will not be permitted. An "elephant trunk" shall be used for all wall pours, which are over 6 feet high.

C. Cold Weather Placing

1. Protect concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.

2. When air temperature has fallen to or is expected to fall below 40 degrees Fahrenheit, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55 degrees Fahrenheit, and not more than 80 degrees Fahrenheit at point of placement.

3. Do not use frozen materials or materials containing ice or snow.

4. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

5. Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators.

D. Hot Weather Placing

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.

2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees Fahrenheit. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated to the total amount of mixing water.

3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperatures immediately before embedment in concrete.

4. Wet forms thoroughly before placing concrete.

5. Do not use retarding admixtures without the written approval of the Architect/Engineer.

6. Place concrete in column forms before beam and slab steel is in place. Place column concrete in not more than 36 inch lifts before vibrating.

7. Slabs and Beams: Thoroughly clean beam and slab forms after placing column concrete. Do not place concrete in roof or wall beams or slabs until concrete in columns have been in place at least 4 hours. Place concrete for slabs and beams continuously in layers not over 12 inches deep. Arrange the work so that the joints will be located at points indicated.

8. Place slabs on fill carefully to avoid damage to vapor barrier.

E. Compaction

1. Compact concrete in layers by internal vibrating equipment, supplemented by hand rodding and tamping as required. Do not use vibrators to move the concrete laterally inside the forms.

2. Internal vibrators should maintain a speed of at least 5,000 impulses per minute when submerged in concrete (at least one spare vibrator in working condition should be maintained at the site at all times).

3. Limit duration of vibration to the time necessary to produce satisfactory consolidation without causing segregation, but in no case more than 15 seconds per square foot of exposed surface. Move vibrator constantly and place in each specific spot only once.

F. Placing Concrete Slabs

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

2. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

3. Bring slab surfaces to the correct level with a straight-edge and strike-off. Use bull floats and darbies to smooth the surface, leaving it free of humps or hollows.

4. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

5. Concrete to be placed on grade shall be placed over 10 mil polyethylene film.

   a. This film shall be laid continuously and in as large of pieces as possible.

   b. Any holes or perforations caused by pipes, conduits, ducts and general construction activity shall be securely taped to make the film vapor tight.

6. Floor slabs shall be level or pitched to drains as required.

7. All top of slab elevations shall be determined by the use of preset runners supported at the proper elevation.

G. Joints

1. Construction Joints

   a. Construction joints not shown on the drawings shall be located so as not to impair the strength and appearance of the structure, and at locations approved by the Architect/ Engineer.

   b. Provide keyways at least 1-1/2 inches deep in all construction joints in walls and slabs. Accepted bulkheads designed for this purpose may be used in slabs.

   c. Place construction joints perpendicular to main reinforcement.

   d. Roughened construction joints where indicated on the drawings shall be clean, free of laitance and intentionally roughened to a full amplitude of 1/4 inch by raking. Remove laitance entirely by high pressure water blasting.

e. Continue all reinforcement across construction joints. Welded wire fabric in slabs on grade may stop at those joints, which are shown on the drawings.

2. Isolation Joints in Slabs-on-Grade

a. Locate where indicated or detailed on Drawings to points of contact between the slabs on ground and vertical surfaces, such as foundations, curbs, etc.

b. Install preformed joint filler according to manufacturer's recommendations. Filler shall be closely fitted to wall faces and to slab edges.

c. Reinforcement shall not extend through isolation joints.

3. Weakened-Plane (Control) Joints

a. Locate where required and as indicated on the drawings.

b. Form weakened-plane joints in fresh concrete by grooving top portion with a recommended jointing tool and finishing edges with an edger.

c. If joints are saw-cut cutting shall be started as soon as the concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw; and cutting shall be completed before shrinkage stresses become sufficient to project cracking.

d. Form or cut joints to a depth of 1/3 of slab or wall thickness.

H. Expansion Joints

1. Locate as shown on drawings.

2. Joints in on-grade walkways maximum at 20 feet o.c., at every change in thickness, direction and at center line of drives. Score and tool between expansion joints in equal bays at not over 5 feet o.c.

3. Joints shall be straight and smooth. They shall have hardened before fresh concrete is deposited against them.

I. Other Embedded Items

1. All sleeves, inserts, anchors, and embedded items required for adjoining work shall be placed prior to concreting.

2. All Contractors whose work is related to the concrete or must be supported by it shall be given ample notice and opportunity to introduce and/or furnish embedded items before the concrete is placed.

3.06 FINISHES

A. Formed Surfaced

1. Patching: Immediately after stripping forms, patch all defective areas with mortar similar to the concrete mix; coarse aggregate should be omitted. Bulges, minor honeycomb and other minor defects, as designated by the Architect, shall be patched only where exposed to view. Clean, dampen and fill tie holes with patching mortar.

a. Defective Areas as judged by the Architect and Engineer, including those resulting from leakage of forms, excessive honeycomb, large bulges and large offsets at form joints shall be chipped away to a depth of at least 1/4 inch, and the surfaces that are to be patched shall be coated with an epoxy polysulfide adhesive. The patching mortar shall be pressed in for a complete bond and finished to match adjacent areas, or where defective areas impair the strength of the member in question (as judged by the Architect), the member should be removed or gunited as determined by the Architect and Engineer.

B. Unformed Surfaced - Flatwork (Interior)

1. Grade and screen the surfaces to the exact elevation or slope shown or required. After screening, tamp mixture thoroughly to drive the coarse aggregate down from the surfaces and apply the applicable finish indicated hereinafter. Always slope exterior walks away from the building a minimum of 1/4 inch per foot unless noted otherwise on the drawings. Provide control joints as indicated on drawings.

2. Trowel Finish: For all interior floor surfaces

3. Definition of Finish Types:

a Float Finish: After concrete has been placed, struck off and consolidated and leveled, concrete shall not be worked further until water sheen has disappeared and/or when mix has stiffened sufficiently to permit proper operations or a power-driven float. Consolidated with power drive float, check trueness of surface, fill low spots and cut down high spots to achieve Class B tolerance. Refloat to uniform, smooth, granular texture.

b. Trowel Finish: Finish same as above for floated finish and in addition, steel trowel the surface to produce a smooth, glassy, impervious surface free of trowel marks to a Class A tolerance. On surfaces intended to support floor coverings, defects of sufficient magnitude to show through the floor covering shall be removed by grinding.

4. Tolerances: Finishes as indicated above should be as follows:

   a. Class A - true planes within 1/8 inch to 10 feet.

   b. Class B - true planes within 1/4 inch to 10 feet.

   c. Tolerances should be measured by placing a 10-foot straightedge anywhere in any direction.

5. Sealer: Apply 2 coats Thompson's Waterseal (or equal) after concrete has cured as follows:

   a. Where indicated on the finish schedule.

   b. To floor slabs receiving ceramic tile (except shower rooms scheduled to receive waterproofing barrier membrane), application of sealer shall be made no more than 48 hours prior to installation of tile Contractors to coordinate.

6. It shall be the Contractors responsibility to provide the proper substrate to receive floor finishes as required by manufacturers thereof.

3.07 CONCRETE CURING AND PROTECTION

A. General

1. Protect freshly placed concrete from premature drying and excessive cold or heat, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

2. For concrete not in contact with forms, one of the following curing methods shall be applied immediately after completion of placement and finishing. Floors to receive hardener or mortar bonded topping shall be cured in accordance with #3 listed below under Curing Methods.

3. Curing shall be continued for at least seven days. Curing may be terminated in less than seven days if cylinder tests show that the concrete has reached 2/3 of the specified design strength.

4. For concrete surfaces placed against forms the concrete shall be cured by one of the following methods after form removal until the end of the time period specified above.

B. Curing Methods

1. Membrane Curing Compound: To be used on all exterior flatwork.

   a. May not be used on surfaces to receive paint, sealer, hardener, carpeting, tile, or other bonded coating.

b. Spray or roll apply material as specified and in accordance with manufacturers directions immediately after any water sheen which may develop after finishing has disappeared from the concrete surface.

c. The compound shall form a uniform, continuous fill that will not check, crack or peel.

d. It is the Contractors responsibility to determine that the curing compound used will not leave discoloration on concrete exposed to view.

e. Recoat areas which are subject to heavy rainfall within 3 hours after initial application; maintain continuity of coating and repair damage during curing period.

2. Curing/Sealing Compound

a. All interior concrete floors and slabs except those to receive hardener or mortar bonded topping, shall be cured/sealed in this manner. Spray or roll apply the specified materials in accordance with the manufacturers directions immediately after any water sheen which may develop after finishing has disappeared from the concrete surface.

b. The compound shall form a uniform continuous film that will not check, crack or peel.

c. It is the Contractors responsibility to determine that the curing/sealing compound uses is compatible with any carpet, tile or specific brand of paint to be used.

3. Waterproof Sheet Material

a. Cover concrete surfaces with waterproof sheet material conforming to ASTM C171, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed with waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

4. Application of burlap mats kept continuously wet.

3.08 FLOOR HARDENER

A. Those areas noted to receive floor hardener shall be treated with materials as specified and in accordance with manufacturers directions.

B. Concrete shall be cured using waterproof sheet material or continuously wet burlap as described above. No curing or sealing compound may be applied to areas to receive hardener.

3.09 PATCHING CONCRETE

A. Any concrete work not formed as shown on the drawings or which for any reason is out of alignment or level, or shows defective surfaces, shall be considered as not conforming with the intent of the specifications and shall be removed unless the Architect/Engineer grant permission to patch a defective area.

B. Immediately after removing the forms, all concrete surfaces shall be inspected. Any pockets showing unsolidified materials, or any other defective areas permitted by the Architect/Engineer to be patched, and all holes and honeycombed areas shall be patched before the concrete is thoroughly dry. The patching shall be made of the same material and of the same proportions as used for the concrete, except that the coarse aggregate shall be omitted and white cement shall be substituted for a part of the dry Portland cement to match color of surrounding concrete.

C. The mortar shall be thoroughly compacted into place and screened off so as to leave the patch slightly higher than the surrounding surface. It shall be left undisturbed for a period of one to two hours to permit shrinkage before being finally finished. Patches shall be finished in such a manner and texture as to match the adjoining surface.

D. Patches shall be bonded with a re-wetable bonding agent.

3.10 EPOXY MORTAR REPAIR

A. The areas to be patched shall have all loose, unsound concrete removed and then cleaned by sandblasting, vacuumed and/or blown clean with oil-free compressed air. The sound concrete remaining shall then be scrubbed with the epoxy binder only (without aggregate) just prior to the placement of the epoxy mortar.

B. The epoxy mortar shall be mixed and placed in accordance with the manufacturer's printed instructions. Such instructions shall be supplied to the Contractor by the supplier of the epoxy system.

C. Do not apply mortar in layers greater than 1" thick. Maximum thickness for outdoor applications is 1/2".

3.11 EPOXY GROUTING OF BOLT AND REINFORCING BARS

A. Drill holes in concrete 1/4" larger than the diameter of the bolt or bar and to the depth required. Holes to be blown free of dust and to be dry prior to placing epoxy grout.

B. Use epoxy grout in accordance with these specifications and the manufacturers directions.

C. Fill hole 1/3 with epoxy grout, insert bolt or bar and move up and down several times while filling hole.

D. No load shall be applied to the bar or bolt for at least 24 hours.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in place construction. Provide other miscellaneous concrete filling shown or required to complete the work.

3.13 MINIMUM REQUIREMENTS FOR SIDEWALKS

A. Where the drawings do not specify thickness, reinforcement, or jointing, the following minimum requirements shall be met:

1. Minimum thickness shall be 4 (four) inches.

2. Minimum reinforcement shall be woven wired fabric 6 x 6 - W1.4 x W1.4 placed at slab mid-depth.

B. Sidewalks shall be formed or sawn into squares.

1. For sidewalks less than ten feet in width longitudinal spacing of formed or sawn joints shall be equal to sidewalk width.

2. For sidewalks greater than ten feet in width spacing of formed or sawn joints shall not exceed ten feet in either direction.

3. Sawn joint depth shall be one and one-half inches in depth.

4. Formed joints shall be keyed together. Key shall be at slab mid-depth and be 1-1/2" x 1-1/2" at mid-depth of slab.

5. Expansion joints shall be installed at no greater than fifty (50') foot intervals or at any change in direction or width of walk, at locations where walk abuts other concrete or masonry construction. An expansion joint is defined as wood or metal formed at one side, the two surfaces separated by a ½" preformed expansion joint filler.

C. Sidewalk concrete shall have a minimum 28-day compressive strength of 4,000 pounds per square inch.

END OF SECTION

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SECTION 04340

REINFORCED UNIT MASONRY SYSTEM

PART 1 - GENERAL

1.01 GENERAL

A. Work Includes: Structural load bearing concrete masonry units, defined as all concrete masonry walls shown on the drawings.

1.02 QUALITY ASSURANCE

A. Codes and Standards

1. ANSI/ASTM A82 - Cold-Drawn Steel Wire for Concrete Reinforcement
2. ANSI/ASTM C55 - Concrete Building Brick
3. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
4. ASTM A525 - Steel Sheet, Zinc Coated, (Galvanized) by the Hot-Dip Process
5. ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement
6. ASTM C90 - Hollow Load Bearing Concrete Masonry Units
7. IMIAC - International Masonry Industry All-Weather Council; Recommended Practices and Guide Specifications for Cold Weather Masonry Construction
8. ACI 531 - Building Code Requirements for Concrete Masonry Structures.
9. ASTM E 514, "Standard Test method for Water Penetration and Leakage through Masonry."
10. ASTM C 1357, "Standard Test Method for Evaluating Masonry Bond Strength."
11. ASTM C 1314, "Standard Test Method for Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry."
12. ASTM C 1148, "Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar."
13. ASTM C 426, "Standard Test Method for Drying Shrinkage of Concrete Masonry Units."

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with General Conditions of the Contract for Construction. Submit shop drawings indicating bars sizes, spacings, locations, quantities of reinforcement, bending and cutting schedules, supporting and spacing devices.

B. Submit product data for masonry units and fabricated wire reinforcement. Submit samples under provisions of Section 01300. Submit manufacturer's certification that products meet or exceed specified requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Masonry units delivered to the site must comply with acceptable moisture content limitations. Store units above ground. Store on platform, which permits air circulation. Cover and protect units against moisture.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCT

2.01 MASONRY UNITS

A. Hollow load bearing masonry conforming to ASTM C-90-90, Grade N of standard sizes as shown on drawings. No broken or chipped block permitted. Moisture content should not exceed 50% of total absorption. Net cross sectional area - 50% of gross.

B. Standard masonry unit shall be square ended block such that cores align vertically for unobstructed grouting. The only exception is listed below

C. Masonry units: Nominal modular size as shown on the drawings. Provide special units for bond beams and lintels.

2.02 MORTAR

A. Conform to "Tentative Specifications for Mortar for Unit Masonry" ASTM C-270, Type S, property specifications. All ingredients shall meet appropriate ASTM Specifications. Water: Potable.

B. Mixing: All mortar shall be thoroughly mixed for a period of at least five minutes after all materials are in mixer designed for this purpose. These requirements shall not be waived except for minor jobs and then only upon the written approval of the Owner's Representative.

C. Time Limit: All mortar to be used and placed in final position within 2-/12 hours after mixing with air temperature is 80 degrees F or higher and within 3-1/2 hours when air temperatures is less than 80 degrees F. Mortar not used within these time limits shall be discarded.

D. Retempering: Mortar that has stiffened within the allowable time limit because of evaporation of moisture may be retempered to restore workability by adding water.

2.03 REINFORCEMENT AND ANCHORAGE

A. Joint Reinforcement: Ladder type; hot-dip galvanized after fabrication cold-drawn steel conforming to ANSI/ASTM A82, 3/18 inch side rods with 9 gage cross ties. Finish to be galvanized with 0.4 ounces of zinc Class 1. Use 3 wire Type (tripod) in cavity walls and 2 wire in single width walls. Provide prefabricated corner and tee units.

B. Acceptable Manufacturers: Hohmann & Barnard, Duro-Wall, Masonry Reinforcing Corporation of America, TY-Wall, AA Wire Products Company.

PART 3 - EXECUTION

3.01 PREPARATION

A. Direct and coordinate placement of metal anchors supplied to other Sections. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.02 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness. Lay concrete masonry units in running bond. Course one unit and one mortar joint to equal 8 inches. Form concave mortar joints.

3.03 PLACING AND BONDING

A. Lay all masonry units in a "full" bed of mortar. Buttering corners of joints or excessive furrowing of mortar joints are not permitted. Remove excess mortar as work progresses. Interlock intersections and external corners.

B. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace. Perform jobsite cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Cut mortar joints flush where ceramic or quarry wall tile is scheduled, cement parging is required.

3.04 REINFORCEMENT AND ANCHORAGES

A. Install horizontal joint reinforcement at a maximum spacing inches o.c. Place masonry joint reinforcement in first horizontal joints above and below openings. Extend minimum 16 inches each side of opening. Lap joint reinforcement ends minimum 12 inches.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch (13 mm) of dimensioned position. Embed anchors embedded in concrete. Embed anchorages in every second block joint.

C. Reinforce joint corners and intersections with a vertical #4 bar grouted in the cell at the intersection and one cell each side of the intersection.

3.05 REINFORCEMENT AND GROUTING

A. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed. Place mortar in masonry unit bed joints back 1/4 inch (6 mm) from edge of unit grout spaces, bevel back and upward. Reinforce masonry unit cores with reinforcement bars and grout.

B. Retain vertical reinforcement in position at top and bottom and at intervals not exceeding 192 bar diameters. Lap splices in deformed reinforcing bars shall be 48 bar diameters minimum. Grout spaces less than 2 inches in width with fine grout using low lift grouting techniques. Grout space 2 inches or greater in width with course grout using high or low lift grouting techniques.

C. When grouting is stopped for more than one hour, terminate grout 1-1/2 inches below top of upper masonry unit to form a positive key for subsequent grout placements.

D. Low Lift Grouting: Place first lift of grout to a height of 16 inches and rod for grout consolidation with a 1 inch by 2 inch wood stick or a mechanical vibrator. Place subsequent lifts in 8-inch increments and rod for grout consolidation.

E. High Lift Grouting: Provide clean out opening no less than 4 inches high and 12 square inches in area at the bottom of each cell to be grouted by cutting one face shell of masonry unit below the top of floor slab so that repair is not visible in the finished construction. Do not use high lift grouting until masonry units have been in place 72 hours. Remove mortar fins protruding more than 1/2 inch into the grout space by dislodging the projections with a rod or stick as the work progresses or by washing the grout space at least twice a day during erection using a high-pressure stream of water.

F. Clean masonry cells or mortar droppings and other foreign materials. Request the Inspector to inspect the cells. Allow 3 days advance notice of inspection. After cleaning and cell inspection, seal openings. Pump grout into spaces. Maintain water content in grout to intended slump without aggregate segregation.

G. Limit grout lift to 60 inches and rod for grout consolidation. Wait a minimum of 30 minutes and a maximum of 60 minutes before placing next lift. The first lift shall be consolidated using mechanical vibrators. After the required waiting period, place the second lift and consolidated with the vibrator extending 12 to 18 inches into the previous lift. Do not insert vibrators into lower pours that are in a semi-solidified state. Repeat the waiting, pouring, and consolidating process until the top of the grout pour is reached. Reconsolidate the top our after the required waiting period.

3.06 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control and expansion joints. Form control joint with a sheet building paper bond breaker, fitted to one side of the hollow contour end of the block unit. Fill the resultant elliptical core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant. Size control joint in accordance with Section 07900 for sealant performance. Form expansion joint as detailed.

3.07 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Coordinate with other Sections of work to provide correct size, shape and location. Obtain Architect/Engineer approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired. Cutting may only be done with a power saw.

3.08 CLEANING

A. Clean work under provisions of Section 01700. Remove excess mortar and mortar smears. Replace defective mortar. Match adjacent work. Clean soiled surfaces with cleaning solution. Use non-metallic tools in cleaning operations.

3.09 PROTECTION OF FINISHED WORK

A. Protect finish installation. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

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SECTION 05310

STEEL DECK

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

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

1.02 SUMMARY:

A. This Section includes steel deck units for roof applications.

1.03 SUBMITTALS:

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Product data including manufacturer's specifications and installation instructions for each type of decking and accessories.

a. Provide test data for mechanical fasteners used in lieu of welding for fastening deck to supporting structures.

2. Shop drawings showing layout and types of deck units, anchorage details, and conditions requiring closure strips, supplementary framing, sump pans, cant strips, cut openings, special jointing, and other accessories.

1.04 QUALITY ASSURANCE:

A. Codes and Standards: Comply with provisions of the following codes and standards, except as otherwise indicated:

1. American Iron and Steel Institute (AISI), "Specification for the Design of Cold-Formed Steel Structural Members."

2. American Welding Society (AWS), D1.3 "Structural Welding Code - Sheet Steel."

3. Steel Deck Institute (SDI), "Design Manual for Composite Decks, Form Decks and Roof Decks."

B. Qualification of Field Welding: Use qualified welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS.

1. Welded decking in place is subject to inspection and testing. Owner will bear expense of removing and replacing portions of decking for testing purposes if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

C. Underwriters' Label: Provide metal floor deck units listed in Underwriters' Laboratories "Fire Resistance Directory", with each deck unit bearing the UL label and marking for specific system detailed.

1. Provide cellular floor deck units listed in UL "Electrical Construction Materials Directory" with each cellular metal floor deck unit bearing UL labels and marking. Provide units that will permit use of standard header ducts and outlets for electrical distribution systems.

D. FM Listing: Provide steel roof deck units that have been evaluated by Factory Mutual System and are listed in "Factory Mutual Approval Guide" for "Class I" fire-rated construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the work include but are not limited to the following:

B. Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Bowman Metal Deck Div., Cyclops Corp.
2. Consolidated Systems, Inc.
3. Epic Metals Corp.
4. Marlyn Steel Products, Inc.
5. H. H. Robertson Co.
6. Roll Form Products, Inc.
7. Roof Deck, Inc.
8. United Steel Deck, Inc.
9. Vulcraft Div., Nucor Corp.
10. Wheeling Corrugating Co.

2.02 MATERIALS

A. Steel for Galvanized Metal Deck Units: ASTM A 446, grade as required to comply with SDI specifications.
B. Miscellaneous Steel Shapes: ASTM A 36.

C Shear Connectors: Headed stud type, ASTM A 108, Grade 1015 or 1020, cold-finished carbon steel, with dimensions complying with AISC specifications.

D. Shear Connectors: Strap type, ASTM A 570, Grade D, hot-rolled carbon steel.

E. Sheet Metal Accessories: ASTM A 526, commercial quality, galvanized.

F. Galvanizing: ASTM A 525, G60.

G. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

H. Paint: Manufacturer's baked-on, rust-inhibitive paint, for application to metal surfaces that have been chemically cleaned and phosphate chemical treated.

I. Flexible Closure Strips: Manufacturer's standard vulcanized, closed-cell, synthetic rubber.

2.03 FABRICATION

A. General: Form deck units in lengths to span three or more supports, with flush, telescoped, or nested 2-inch laps at ends and interlocking or nested side laps, of metal thickness, depth, and width as indicated.

B. Roof Deck Units: Provide deck configurations that comply with SDI "Specifications and Commentary for Steel Roof Deck."

C. Cellular Metal Floor Deck Units:

1. Fabricate flat-bottom units with top fluted section cells combined on a lower flat plate, of metal thickness, depth, and width of unit, number of cells per unit, and width of cells as indicated.

2. Fabricate double-cell units with top fluted section cells combined with matching fluted bottom section, of metal thickness, depth, and width of units, number of cells per unit, and width of cells as indicated.

5. Provide sufficient welds, forming sheets into cellular floor deck units to develop full horizontal shear strength at plane where steel sheets are joined.

D. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6 inches wide.

E. Metal Closure Strips: Fabricate metal closure strips, for cell raceways and openings between decking and other construction, of not less than 0.045-inch min. (18 gage) sheet steel. Form to provide tight-fitting closures at open ends of cells or flutes and sides of decking.

PART 3 EXECUTION

3.01 INSTALLATION:

A. General: Install deck units and accessories in accordance with manufacturer's recommendations, shop drawings, and as specified herein.

B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or contract side lap interlocks.

C. Align deck units for entire length of run of cells and with close alignment between cells at ends of abutting units.

D. Place deck units flat and square, secured to adjacent framing without warp or deflection.

E. Do not place deck units on concrete supporting structure until concrete has cured and is dry.

F. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

G. Do not use floor deck units for storage or working platforms until permanently secured.

H. Fastening Deck Units:

1. Fasten roof deck units to steel supporting members by not less than 5/8-inch-diameter puddle welds or elongated welds of equal strength, spaced not more than 12 inches at every support, and at closer spacing where indicated. In addition, secure deck to each supporting member in ribs where side laps occur.

2. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.

a. Use welding washers where recommended by deck manufacturer.

3. Mechanically fasten side laps of adjacent deck units between supports, at intervals not exceeding 36 inches o.c., using self-tapping No. 8 or larger machine screws.

4. Uplift Loading: Install and anchor roof deck units to resist gross uplift loading of 45 lbs. psf at eave overhang and 30 lbs. psf for other roof areas, unless otherwise stated on drawings.

a. Keep the interiors of cells that will be used as raceways free of welds having sharp points or edges.

I. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown.

J. Reinforcement at Openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking, and support of other work shown.

K. Hanger Slots or Clips: Provide UL-approved punched hanger slots between cells or flutes of lower element where floor deck units are to receive hangers for support of ceiling construction, air ducts, diffusers, or lighting fixtures.

1. Hanger clips designed to clip over male side lap joints of floor deck units may be used instead of hanger slots.

2. Locate slots or clips at not more than 14 inches o.c. in both directions, not over 9 inches from walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3. Provide manufacturer's standard hanger attachment devices.

L. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units, except where taped joints are required.

M. Shear Connectors: Weld shear connectors to supports through decking units in accordance with manufacturer's instructions. Do not weld shear connectors through two layers (lapped ends) of decking units. Weld only on clean, dry deck surfaces.

N. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking and in voids between decking and other construction. Weld into position to provide a complete decking installation.

5. Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure. Install with adhesive in accordance with manufacturer's instructions.

O. Touch-Up: After decking installation, wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.

5. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

END OF SECTION

SECTION 05400

COLD FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud ceiling framing.

1.02 RELATED REQUIREMENTS

B. Section 07900 - Joint Sealers

C. Section 09260 – Gypsum Board Assemblies

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.

C. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.

1.04 SUBMITTALS

A. Product Data: Provide data on standard framing members; describe materials and finish, product criteria and limitations.

B. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.

2. Marino\Ware: www.marinoware.com.

3. The Steel Network, Inc: www.SteelNetwork.com.

4. Substitutions: Refer to General Requirements for submittal procedures.

2.02 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.03 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.

1. Gage: 20; unless noted otherwise.

2. Stud Depth: 4 and 6 inch; ; unless noted otherwise.

3. Provide components fabricated from ASTM A1008/A1008M, Designation SS steel.

2.04 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

2.05 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Power actuated.

PART 3 EXECUTION

3.01 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

3.02 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.03 SHEATHING

A. Sheathing: Secure with long dimension perpendicular to studs, with ends over firm bearing and staggered, using self-tapping screws.

END OF SECTION

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SECTION 05502
ALUMINUM LADDER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated aluminum ladder.

1.02 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

D. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.

E. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2012.

F. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012.

G. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

J. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata.

1.03 SUBMITTALS

A. See Section 01300 - For submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

1.04 QUALITY ASSURANCE

A. Design Ladder under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.

E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED ITEMS

A. Ladders: Aluminum; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.

1. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).

2. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.

3. Space rungs 7 inches (175 mm) from wall surface.

2.04 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed aluminum items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for aluminum items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

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SECTION 06100
ROUGH CARPENTRY

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Preservative treated wood materials.

B Concealed wood blocking, nailers, and supports.

1.03 REFERENCES

A. AFPA T10 - Wood Frame Construction Manual; American Forest and Paper Association; 2001.

B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Preservers' Association; 2007.

D. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

1.04 SUBMITTALS

A. Product Data: Provide technical data on wood preservative materials and application instructions.

B. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Lumber: Comply with PS 20 and approved grading rules and inspection agencies.

B. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

1.06 DELIVERY, STORAGE AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.02 EXPOSED DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

2.03 EXPOSED BOARDS

A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.

B. Moisture Content: Kiln-dry (15 percent maximum).

C. Surfacing: S4S.

D. Species: Southern Pine.

E. Grade: No. 2, 2 Common, or Construction.

2.04 ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:

1. Manufacturers:

a. Chemical Specialties, Inc: www.treatedwood.com.

b. Substitutions: See Section 01600 - Product Requirements.

C. Preservative Pressure Treatment of Lumber Above Grade: AWPA Use Category UC3B, Commodity Specification A (Treatment C2) using waterborne preservative to 0.25 lb/cu ft retention.

1. Kiln dry lumber after treatment to maximum moisture content of 19 percent.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION – GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

D. Specifically, provide the following non-structural framing and blocking:

1. Joints of rigid wall coverings that occur between studs.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 CLEANING

A. Waste Disposal:

1. Comply with applicable regulations.

2. Do not burn scrap on project site.

3. Do not burn scraps that have been pressure treated.

4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 07240
EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Materials and installation of Air and Moisture Barrier and EIFS System.

1.02 DESIGN REQUIREMENTS

A. Wind Load

1. Design for maximum allowable system deflection, normal to the plane of the wall, of L/240.

2. Design for wind load in conformance with FBC code requirements.

B. Moisture Control

1. Prevent the accumulation of water behind the EIF system, either by condensation or leakage through the wall construction, in the design and detailing of the wall assembly.
   a. Provide flashing to direct water to the exterior where it is likely to penetrate components in the wall assembly, including, above window and door heads, beneath window and door sills, at roof/wall intersections, decks, abutments of lower walls with higher walls, above projecting features, and at the base of the wall.
   b. Air Leakage Prevention—provide continuity of Air Barrier System at foundation, roof, windows, doors and other penetrations through the system with connecting and compatible Air Barrier components to minimize conservation and leakage caused by air movement.
   c. Vapor Diffusion and Condensation-- perform a dew point analysis of the wall assembly to determine the potential for accumulation of moisture in the wall assembly as a result of water vapor diffusion and condensation. Adjust insulation thickness and/or other wall assembly components accordingly to minimize the risk of condensation. Avoid the use of vapor retarders on the interior side of the wall in warm, humid climates.

C. Impact Resistance

1. Provide ultra-high impact resistance to a minimum height of 6'-0" (1.8 m) above finished grade at all areas accessible to pedestrian traffic and other areas exposed to abnormal stress or impact. Indicate the areas with impact resistance other than “Standard” on contract drawings.

D. Color Selection

1. Select finish coat with a light reflectance value of 20 or greater. (The use of dark colors is not recommended with EIFS Systems that incorporate expanded polystyrene [EPS]. EPS has a service temperature limitation of approximately 160° F [71°C]).

E. Joints

1. Design minimum 3/4 inch (19 mm) wide expansion joints in the EIFS where they exist in the substrate or supporting construction, where the EIFS adjoins dissimilar construction or materials, at changes in building height, and at floor lines in multi-level wood frame construction.

2. Design minimum 1/2 inch wide sealant joints at all penetrations through the EIFS (windows, doors, etc.).

3. Specify compatible backer rod and sealant that has been evaluated in accordance with ASTM C 1382, "Test Method for Determining Tensile Adhesion Properties of Sealants When Used in Exterior Insulation and Finish System (EIFS) Joints," and that meets minimum 50% elongation after conditioning.

4. Design joints so that Air Barrier continuity is maintained across the joint and drain. Joints to the Exterior.

F. Grade Condition

1. Do not specify EIFS below grade (unless designed for use below grade and permitted by code) or for use on surfaces subject to continuous or intermittent water immersion or hydrostatic pressure.

G. Trim, Projecting Architectural Features and Reveals

1. All trim and projecting architectural features must have a minimum 1:2 [27°] slope along their top surface. All horizontal reveals must have a minimum 1:2 [27°] slope along their bottom surface. Increase slope for northern climates to prevent accumulation of ice/snow and water on surface. Where trim/feature or bottom surface of reveal projects more than 2 inches from the face of the EIFS wall plane, protect the top surface with waterproof base coat. Periodic inspections and increased maintenance may be required to maintain surface integrity of EIFS on weather exposed sloped surfaces. Limit projecting features to easily accessible areas and limit total area to facilitate maintenance and minimize maintenance. Refer to Sto details 1.04a and 1.04b.

2. Do not use EIFS on weather exposed projecting ledges, sills, or other projecting features unless supported by framing or other structural support and protected with metal coping or flashing. Refer to Sto detail 10.61.

H. Insulation Thickness

1. Minimum EPS insulation thickness is 1 inch

2. Maximum EPS insulation thickness is 12 inches when installed in accordance with ESR 1748 (including architectural features).

1.03 QUALITY ASSURANCE

A. Manufacturer requirements

1. Member in good standing of the EIFS Industry Members Association (EIMA).

2. System manufacturer for a minimum of twenty (25) years.

3. Manufacturing facilities ISO 9001-2000 certified Quality System.

B. Contractor requirements

1. Engaged in application of EIFS for a minimum of three (3) years.

2. Knowledgeable in the proper use and handling of Sto materials and listed by Sto as having attended Sto EIFS continuing education.

3. Employ skilled mechanics who are experienced and knowledgeable in EIFS application, and familiar with the requirements of the specified work.

4. Successful completion of minimum of three (3) projects of similar size and complexity to the specified project.

5. Provide the proper equipment, manpower and supervision on the job site to install the system in compliance with Sto's published specifications and details and the project plans and specifications.

C. Insulation board manufacturer requirements

1. Recognized by Sto as capable of producing insulation board to meet system requirements, and hold a valid licensing agreement with Sto.

2. Listed by an approved agency.

3. Label insulation board with information required by Sto, the approved listing agency and the applicable building code.

D. Mock-up Testing

1. Construct full-scale mock-up of typical EIFS/window wall assembly with specified tools and materials and test air and water infiltration and structural performance in accordance with ASTM E 283, E 331 and E 330, respectively, through independent laboratory. Mock-up shall comply with requirements of project specifications. Where mock-up is tested at job site maintain approved mock-up at site as reference standard. If tested off-site accurately record construction detailing and sequencing of approved mock-up for replication during construction.

E. Inspections

1. Provide independent third party inspection where required by code or contract documents.

2. Conduct inspections in accordance with code requirements and contract documents.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in their original sealed containers bearing manufacturer's name and identification of product.

B. Protect coatings (pail products) from freezing and temperatures in excess of 90°F (32° C). Store away from direct sunlight.

C. Protect Portland cement based materials (bag products) from moisture and humidity. Store under cover off the ground in a dry location.

1.05 COORDINATION/SCHEDULING

(The work in this section requires close coordination with related sections and trades)

A. Provide site grading such that EIFS terminates above finished grade a minimum of 6 inches (152 mm) or as required by code.

B. Coordinate installation of foundation waterproofing, roofing membrane, windows, doors, and other penetrations to provide a continuous Air and Moisture Barrier.

C. Provide protection of rough openings before installing windows, doors, and other penetrations through the wall and provide sill flashing.

D. Coordinate installation of windows and doors so Air and Moisture Barrier components are connected to them to provide a continuous Air and Moisture Barrier.

E. Install window and door head flashing immediately after windows and doors are installed.

F. Install diverter flashings wherever water can enter the wall assembly to direct water to
the exterior.

G. Install copings and sealant immediately after installation of the EIF system and when
EIFS coatings are dry.

H. Attach penetrations through EIFS to structural support and provide water tight seal at penetrations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide EIFS System, Air/Moisture Barrier and accessories from single source manufacturer or approved supplier.

B. The following are acceptable manufacturers:
1. Sto Corp.— EIFS
2. Plastic Components, Inc.---Accessories

2.02 AIR/MOISTURE BARRIER

A. StoGuard™ "Gold Coat — 2 coat fluid applied air/moisture barrier applied after cracks are repaired on surface of exiting masonry per manufacturers recommendations

2.03 ADHESIVE

A. Cementitious Adhesives

1. Sto Primer/Adhesive--acrylic based adhesive mixed with portland cement (for use over exterior grade plywood, concrete, masonry or cement plaster surfaces.)

2.04 INSULATION BOARD

A. Nominal 1.0 lb/ft^3 Expanded Polystyrene (EPS) Insulation Board in compliance with ASTM E 2430 and ASTM C 578 Type I requirements.

2.05 BASE COAT

A. Cementitious Base Coats

1. Sto Primer/Adhesive--acrylic based base coat mixed with portland cement.

2.06 REINFORCING MESHES

A. Standard Mesh

1. Sto Mesh--nominal 4.5 oz./yd^2, symmetrical, interlaced open-weave glass fiber fabric made with alkaline resistant coating for compatibility with Sto materials (*achieves Standard Impact Classificatio*n).

2.07 PRIMER

A. Sto Primer Smooth – acrylic based tintable primer for roller or spray application.

2.08 FINISH COAT

A. Sto Essence DPR Finish--acrylic based textured wall coating with graded marble aggregate and dirt pick-up resistance technology

2.09 JOB MIXED INGREDIENTS

A. Water--Clean and potable.

B. Portland cement – ASTM C 150 Type I, Type II, or Type I-II.

2.10 ACCESSORIES

A. Starter Track---Rigid PVC (polyvinyl chloride) plastic track Part No. STDE as furnished by Plastic Components, Inc., 9051 NW 97^{th} Terrace, Miami, Florida, 33178 (800-327-7077).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Air/Moisture Barrier and EIFS in compliance with manufacturer's published instructions.

3.02 PROTECTION

A. Provide protection of installed materials from water infiltration into or behind them.
B. Provide protection of installed materials from dust, dirt, precipitation, freezing and continuous high humidity until they are fully dry.

END OF SECTION

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SECTION 07631
GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.02 RELATED REQUIREMENTS

A. Section 07620 - Sheet Metal Flashing and Trim.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2010.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2010.

D. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2012.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012.

1.04 DESIGN REQUIREMENTS

A. Conform to SMACNA Architectural Sheet Metal Manual for sizing components for rainfall intensity determined by a storm occurrence of 1 in 5 years.

B. Conform to applicable code for size and method of rain water discharge.

1.05 SUBMITTALS

A. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

B. Product Data: Provide data on prefabricated components.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gutters and Downspouts:

1. ATAS International, Inc: www.atas.com.
2. Cheney Flashing Company: www.cheneyflashing.com.
3. SAF: www.saf.com.

2.02 MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick.

1. Finish: Plain, shop pre-coated with modified silicone coating.
2. Color: As scheduled.

2.03 COMPONENTS

A. Gutters: rectangular style profile; seamless

B. Downspouts: rectangular profile; seamless

C. Connectors: Furnish required connector pieces for PVC (polyvinyl chloride) components.

D. Anchors and Supports: Profiled to suit gutters and downspouts.

1. Anchoring Devices: In accordance with CDA requirements.
2. Gutter Supports: Brackets.
3. Downspout Supports: Brackets.

2.04 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.05 FACTORY FINISHING

A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.02 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 1/16 inch per foot.

C. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

D. Connect downspouts to downspout boots as noted on Civil drawings w/ connection watertight.

E. Connect downspouts to storm sewer system. Grout connection watertight.

END OF SECTION

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SECTION 07900
JOINT SEALERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sealants and joint backing.

1.02 REFERENCES

A. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.

B. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2010.

C. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.

1.03 SUBMITTALS

A. See Section 01600 - Product Requirements, for submittal procedures.

B. Product Data: Provide data indicating sealant chemical characteristics.

C. Manufacturer's Installation Instructions: Indicate special procedures.

1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.06 COORDINATION

A. Coordinate the work with all sections referencing this section.

1.07 WARRANTY

A. Correct defective work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Polyurethane Sealants:

1. Bostik, Inc: www.bostik-us.com.

2. Pecora Corporation: www.pecora.com.

3. BASF Construction Chemicals, Inc: www.chemrex.com.

B. Polysulfide Sealants:

1. Pecora Corporation: www.pecora.com.

2. BASF Construction Chemicals, Inc: www.chemrex.com.

C. Acrylic Sealants:

1. Tremco, Inc: www.tremcosealants.com.

D. Silicone Sealants:

1. GE; Momentive Performance Materials: Silicone II: http://www.momentive.com/

2.02 SEALANTS

A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.

B. General Purpose Exterior Sealant for joints in vertical and sloping surfaces; Polyurethane and Polysulfide; single component.

1. Color: Standard colors matching finishing surfaces.

C. Self-leveling - General Purpose Exterior Sealant for joints on horizontal surfaces; Polyurethane and Polysulfide; single component.

1. Color: Standard colors matching finished surfaces.

D. Silicone Sealant: ASTM C920, Grade NS, Class 25 minimum; Uses NT, A, G, M, O; single component, neutral curing, non-sagging, non-staining, fungus resistant, non-bleeding

1. Color: Standard colors matching finished surfaces.

2.03 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 25 to 50 percent larger than joint width.

C. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter which might impair adhesion of sealant.

B. Clean and prime joints in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.

D. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C 1193.

C. Perform acoustical sealant application work in accordance with ASTM C 919.

D. Install bond breaker where joint backing is not used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

F. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

3.04 CLEANING

A. Clean adjacent soiled surfaces.

3.05 PROTECTION OF FINISHED WORK

A. Protect sealants until cured.

END OF SECTION

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SECTION 08116
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush aluminum doors with aluminum face sheets.

B. Aluminum frames.

C. Flush door panels.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

C. AAMA 701/702 - Combined Voluntary Specifications for Pile Weatherstrip and Replaceable Fenestration Weatherseals; 2011.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

I. ASTM C365/C365M - Standard Test Method for Flatwise Compressive Properties of Sandwich Cores; 2016.

J. ASTM E1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes; 2017.

1.04 SUBMITTALS

A. See Section 01300 - For submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods, finishing, hardware preparation, accessories, installation, and maintenance instructions.

C. Shop Drawings: Include elevations of each opening type.

1. Verify dimensions by field measurements before fabrication and indicate on shop drawings.

D. Selection Samples: Complete set of color and finish options, using actual materials, for Architect's selection.

E. Verification Samples: Actual pieces of products in each finish specified, not less than 6 inches (150 mm) square or 6 inches (150 mm) long for linear components. For finishes subject to color variation, include not less than two samples illustrating extreme range to be anticipated.

F. Test Report: Submit certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum components in manufacturer's standard protective packaging, palleted, crated, or banded together.

B. Inspect delivered components for damage and replace. Repaired components will not be accepted.

C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.

D. Protect materials and finish from damage during handling and installation.

1.07 FIELD CONDITIONS

A. Do not begin installation of interior aluminum components until space has been enclosed and ambient thermal conditions are being maintained at levels consistent with final project requirements.

1.08 WARRANTY

A. See Section 01700 – Project Closeout.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide ten year manufacturer warranty for defects in workmanship and materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flush Aluminum Doors with Aluminum Face Sheets:

1. Basis of Design: Cline Aluminum Doors, Inc; Series 100BE: www.clinedoors.com/sle.

2. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.

3. Special-Lite, Inc: www.special-lite.com/sle.

B. Aluminum Frames:

2.02 DOORS AND FRAMES

A. Flush Aluminum Doors with Aluminum Face Sheets: Aluminum internal framing and faces; no steel components.

1. Thickness: 1-3/4 inches (44 mm), nominal.

2. Facing: Seamless aluminum sheet, 0.040 inch (1 mm) thick, smooth texture, laminated to 1/8 inch (3.2 mm) tempered hardboard.

3. Finish: Class I - Natural anodized.

4. Texture: Smooth.

5. Weatherstripping: Replaceable pile type; at jambs and head of exterior doors.

B. Aluminum Frames for Doors, Sidelights, or Transoms: Extruded aluminum, non-thermally broken hollow or C-shaped sections; no steel components.

1. Finish: Same as doors.

C. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.

1. Provide the following clearances:

a. Hinge and Lock Stiles: 1/8 inch (3.2 mm).

b. Between Meeting Stiles: 1/4 inch (6.4 mm).

c. At Top Rail and Bottom Rail: 1/8 inch (3.2 mm).

2.03 COMPONENTS

A. Flush Door Panels: Without visible seams on face sheet.

1. Framing and Hardware Backup: Extruded aluminum tubing, 1/8 inch (3.2 mm) minimum thickness.

2. Perimeter Edges: Extruded aluminum cap.

3. Core: Rigid honeycomb core of marine grade organic material coated with phenolic resin, minimum compression strength of 94.8 psi (4.53 kPa), when tested in accordance with ASTM C365/C365M.

4. Laminating Adhesive: Manufacturer's standard low-VOC materials.

B. Frames: Extruded aluminum shapes, not less than 0.062 inch (1.6 mm) thick, reinforced at hinge and strike locations.

1. Corner Brackets: Extruded aluminum, fastened with stainless steel screws.

2. Trim: Extruded aluminum, not less than 0.062 inch (1.6 mm) thick, removable snap-in type without exposed fasteners.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

B. Wind-Borne-Debris Resistance: Identical full-size glazed assembly without auxiliary protection, tested by independent agency in accordance with ASTM E1996 and Wind Zone 4 - Additional Protection for Large and Small Missile impact and pressure cycling at design wind pressure.

2.05 MATERIALS

A. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy 5005, temper H14, stretcher leveled.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), alloy 6063, temper T5, or alloy 6463, temper T5.

2.06 FINISHES

A. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness 0.7 mils (0.018 mm).

2.07 ACCESSORIES

A. Replaceable Weatherstripping: AAMA 701/702 wool pile.

B. Fasteners: Aluminum, non-magnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components.

C. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, non-magnetic stainless steel or steel hot-dip galvanized in compliance with ASTM A123/A123M.

D. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil (0.76 mm) thickness per coat.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.

B. Verify that frames installed by other trades for installation of doors of this section are in strict accordance with recommendations and approved shop drawings and within tolerances specified in manufacturer's instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Perform cutting, fitting, forming, drilling, and grinding of frames as required for project conditions.

B. Replace components with damage to exposed finishes.

C. Separate dissimilar metals to prevent electrolytic action between metals.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.

B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.

C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.

D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

3.04 CLEANING

A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.

B. Do not use abrasive, caustic, or acid cleaning agents.

3.05 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION

SECTION 09220
PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portland cement plaster for installation over gypsum at ceilings

1.02 RELATED REQUIREMENTS

B. Section 09900 – Paint

1.03 REFERENCE STANDARDS

B. ASTM C150 - Standard Specification for Portland Cement.

C. ASTM C206 - Standard Specification for Finishing Hydrated Lime.

D. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.

E. ASTM C926 - Standard Specification for Application of Portland Cement-Based Plaster.

F. PCA EB049 - Portland Cement Plaster/Stucco Manual; Portland Cement Association.

1.04 SUBMITTALS

A. Product Data: Provide data on plaster materials, characteristics and limitations of products specified.

B. Samples: Submit two samples, 4x4 inch in size illustrating finish color and texture.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

1.06 FIELD CONDITIONS

A. Do not apply plaster when substrate or ambient air temperature is under 50 degrees F or over 80 degrees F.

B. Maintain minimum ambient temperature of 50 degrees F during installation of plaster and until cured.

PART 2 PRODUCTS

2.01 PORTLAND CEMENT PLASTER ASSEMBLIES

A. Interior Ceiling: 7/8" thick over Lathe and Gyspsum.

2.02 PLASTER MATERIALS

A. Portland Cement, Aggregates, and Other Materials: In accordance with ASTM C926.

B. Portland Cement: ASTM C150, Type I.

1. For finish coat: Gray color.

C. Masonry Cement: ASTM C91 Type N.

D. Lime: ASTM C206, Type S.

E. Aggregate: Natural sand, within the following sieve sizes and percentage retained limits:

1. No. 4: 0.

2. No. 16: 5 to 30.

3. No. 50: 65 to 95.

F. Water: Clean, fresh, potable and free of mineral or organic matter that could adversely affect plaster.

G. Metal Lath – as specified in Section 09206 - Metal Lath for Security Application

2.03 PLASTER MIXES

A. Over Metal Lath: Three Coat Application, mixed and proportioned in accordance with manufacturer's instructions

B. Mix only as much plaster as can be used prior to initial set.

C. Mix materials dry, to uniform color and consistency, before adding water.

D. Protect mixtures from freezing, frost, contamination, and excessive evaporation.

E. Do not retemper mixes after initial set has occurred.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify the suitability of existing conditions before starting work.

3.02 PLASTERING

* Apply plaster in accordance with ASTM C926.

A. Three-Coat Appliation over Metal Lath

1. First Coat; nominal thickness 3/8”
2. Second Coat; nominal thickness 3/8”
3. Finish Coat; nominal thickness 1/8”

B. Moist cure base coats.

C. Apply second coat immediately following initial set of first coat.

D. After curing, dampen previous coat prior to applying finish coat.

E. Finish Texture: texture at ceiling to match existing.

F. Avoid excessive working of surface. Delay troweling as long as possible to avoid drawing excess fines to surface.

G. Moist cure finish coat for minimum period of 48 hours.

END OF SECTION

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SECTION 09260
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal channel ceiling framing.

C. Gypsum wallboard.

D. Joint treatment and accessories.

E. Textured finish system.

1.02 RELATED REQUIREMENTS

A. Section 05400 - Cold Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 07900 - Joint Sealers: Acoustic sealant.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 2013.1.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2013.1.

C. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2012.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2013.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2011.

F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2011.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007 (Reapproved 2013).

I. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2010a.

J. ASTM C1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2008b.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009.

M. ASTM E413 - Classification for Rating Sound Insulation; 2010.

N. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2013.

O. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.04 SUBMITTALS

A. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.

2. Marino: www.marinoware.com.

3. Phillips Manufacturing Company: www.phillipsmfg.com.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (240 Pa).

1. Studs: "C" shaped with flat or formed webs with knurled faces.

2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C shaped.

4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm); 1 1/2" "Z" furring at perimeter walls.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum: www.americangypsum.com.

2. CertainTeed Corporation: www.certainteed.com.

3. Lafarge North America Inc: www.lafargenorthamerica.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.

2. Thickness:

a. Ceilings: 5/8 inch (16 mm).

2.04 ACCESSORIES

A. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated.

1. Types: As detailed or required for finished appearance.

B. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

C. Textured Finish Materials: Latex-based compound; plain.

D. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.

E. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C954; steel drill screws for application of gypsum board to loadbearing steel studs.

F. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members at 16 inches on center.

3.03 BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

3.05 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

3.06 TEXTURE FINISH

A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions.

B. Texture Required: to match existing.

END OF SECTION

SECTION 09510
SUSPENDED ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Supplementary acoustical insulation above ceiling.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including Contractual Conditions and Divisions 1 Specification Sections, apply to this section.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

E. UL (FRD) - Fire Resistance Directory; current edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two full size samples illustrating material and finish of acoustical units.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.06 QUALITY ASSURANCE

A. Fire-Resistive Assemblies: Complete assembly listed and classified by UL (FRD) for the fire resistance indicated.

B. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Panels:

1. Armstrong World Industries, Inc : www.armstrong.com.

2. CertainTeed Corporation : www.certainteed.com.

3. USG : www.usg.com.

B. Suspension Systems:

1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels Type Fine Fissured HIgh NRC: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:

1. Size: 24 by 48 inches and 24 by 24 inches.

2. Thickness: 3/4 inches.

3. Composition: Wet felted.

4. Light Reflectance (LR) 0.83 per ASTM E1477

5. Noise Reduction Coefficient (NRC) 0.70 per ASTM C423 (E-400 mounting)

6. Ceiling Attenuation Class (CAC) 35 per ASTM E1414

7. Flame Spread Classification per ASTM E84: Class A

8. Humidity Resistance: Warranted to withstand relative humidity of up to 90% at 104ºF without sagging, warping or delaminating for 10-year

2.03 SUSPENSION SYSTEM(S)

A. Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System : Formed galvanized steel, commercial quality cold rolled ; heavy-duty.

1. Profile: Tee; Match Existing.

2. Construction: Double web.

3. Finish: White (Aluminum Capped).

2.04 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application , seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.

1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Lay out system to a balanced grid design with edge units no less than 50 percent of acoustical unit size.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

   1. Use longest practical lengths.

   2. Overlap and rivet corners.

K. Form expansion joints per manufacturers standard details and as approved by the architect . Form to accommodate plus or minus 1 inch movement. Maintain visual closure.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:

1. Cut to fit irregular grid and perimeter edge trim.

2. Make field cut edges of same profile as factory edges.

3. Double cut and field paint exposed reveal edges.

H. Where round obstructions occur, provide preformed closures to match perimeter molding.

I. Install hold-down clips on each panel to retain panels tight to grid system; comply with fire rating requirements.

J. Install hold-down clips on panels within 20 ft of an exterior door.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09900

PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

Painting of plaster, metal, masonry, EIFS and other surfaces designated to be painted except factory-applied finishes.

1.02 RELATED SECTIONS

A. Section 07900 - Joint Sealant

1.03 REFERENCES

A. American Water Works Association, Inc. (AWWA) latest edition:

1. AWWA D100 - Welded Steel Tanks For Water Storage
2. AWWA D102 - Coating Steel Water Storage Tanks

B. Steel Structures Painting Council (SSPC) latest edition Specifications:

1. SSPC-SP 1 - Solvent Cleaning
2. SSPC-SP 2 - Hand Tool Cleaning
3. SSPC-SP 3 - Power Tool Cleaning
4. SSPC-SP 5 - White Metal Blast Cleaning
5. SSPC-SP 6 - Commercial Blast Cleaning
6. SSPC-SP 7 - Brush Off Blast Cleaning
7. SSPC-SP10 - Near White Blast Cleaning
8. Steel Structures Painting Manual - Volume 2

C. OSHA

1. 1926 Subpart C – General Safety and Health Provisions
2. 1926 Subpart D – Occupational Health and Environmental Controls
3. 1926 Subpart E – Personal Protective and Life Saving Equipment
4. 1926 Subpart F – Fire Protection and Prevention
5. 1926 Subpart H – Material Handling, Storage, Use, and Disposal

6. 1926 Subpart Z – Toxic and Hazardous Substances

1.04 DEFINITIONS

A. Coating = emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, whether used as prime, intermediate, or finish coats.

B. DFT = abbreviation for Dry Film Thickness.

1.05 SYSTEM DESCRIPTION

A schedule of coating colors will be provided by the E/A after award. The Contractor shall base his bid on ceilings of a color different than walls and an average of two wall colors per room or area. Colors other than those shown in the manufacturer's standard color charts may be required for building finishes. Strong colors may be selected for doors, piping, equipment, and miscellaneous features. Exterior building or structure colors will be limited to two plus trim.

1.06 SUBMITTALS

A. Within 30 days after award of the Contract, the Contractor shall notify the E/A, in writing, the name of the paint manufacturer for the Project.

B. Prior to submitting shop drawings for any item requiring shop or field applied primer or finish coatings, submit to the E/A a Painting Schedule, indicating major items to be painted, preparation, paint manufacturer, product designation, and dry mill thickness. This submittal shall include the manufacturer's written recommendation of the type paint for each item to be painted.

C. Upon request submit three 8-1/2 inch x 11-inch samples of requested colors for approval by the E/A.

1.07 QUALITY ASSURANCE

A. Unless otherwise specified, all work and materials for the preparation and coating of all metal surfaces shall conform to the applicable requirements specified in the Steel Structures Painting Manual, Volume 2, Systems and Specifications Revised, latest edition, published by the Steel Structures Painting Council.

B. It is the intent of this Specification that the Contractor use one paint manufacturer throughout, unless otherwise approved by the E/A. Products shall be manufactured by one of the following, or equal:

1. Tnemec - Tnemec Co., Inc., North Kansas City, Missouri.

2. Porter - Porter Paint Company, Louisville, Kentucky.

3. Glidden-Glidden Coatings and Resins, Cleveland, Ohio.

4. Induron-Induron Coatings Inc., Birmingham, Alabama

C. Manufacturers other than the above shall submit product data for all products specified in this Section to the E/A for approval. No request for substitution will be considered which decreases the dry film thickness and/or the number of coats to be applied, or which offers a change from the generic type of coating specified. Bidders desiring to use paints other than those specified shall submit their proposal based on the specified materials, together with the information noted above, and indicate the sum which will be added to or deducted from the base bid, should the alternate materials be acceptable.

1.08 PAINTING CONFERENCE

A. At the request of the Owner/Engineer the Contractor shall schedule a conference of the painter, Owner, a technical representative of the paint supplier, and the E/A to discuss painting requirements and finalize color selections before painting is started.

B. Prior to painting any surface the Contractor shall schedule a meeting with the painter and an Owners/Engineers representative to inspect the surface preparation and verify that the surface is ready for painting. Failure to inspect a surface prior to coating could result in the rejection of the coating.

1.09 SAMPLES

A. Paint colors will be selected by the Engineer with final approval by the Owner. Compliance with all other requirements is the exclusive responsibility of the Contractor.

B. Samples of each finish and color shall be submitted to the Engineer for approval before any work is started.

C. Samples shall be prepared so that an area of each sample indicates the appearance of the various coats, For example, where three coat work is special, the sample shall be divided into three areas: one showing application of one coat only, one showing the application of two coats, and the third showing the application of three coats.

D. Such samples when approved in writing shall constitute a standard, as to color and finish only, of acceptance or rejection of the finish work.

E. For piping, valves, equipment, and miscellaneous metal work, provide sample chips or color charts of all paint selected showing color, finish and the general characteristics.

F. Rejected samples shall be resubmitted until approved.

G. Before proceeding with room painting, the Contractor shall finish paint one complete room. After approval, this sample room shall serve as a standard for texture and workmanship throughout the project.

1.10 DELIVERY AND STORAGE

A. All materials shall be delivered to the job in original sealed and labeled containers of the paint manufacturer, and shall be subject to inspection by the E/A. Labels shall show name of manufacturer, type of coating, formulation, color and instructions for reducing.

B. Storage areas out side of the structures being constructed will be submitted by the Contractor for the E/A to review for the storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. The Contractor shall take all safety precautions in accordance with Section 7 of AWWA D102, NFPA Bulletin No. 101 and all federal, state and local regulations. Proper containers outside of the buildings/structures shall be provided and used by the Contractor for painting wastes.

C. Exercise every precaution in the storing of paints, solvents, cleaning fluids, rags, and similar materials as to eliminate the risk of spontaneous combustion or other hazardous conditions.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials used in the work except oils, thinners and driers, shall be of the brands and qualities specified.

B. All cleaners, thinners, driers and other additives and surface pretreatment materials shall only be those approved for use by the manufacturer of the coatings.

C. Do not dilute paints except as recommended by the paint manufacturer.

D. Paint containing lead or chromate is not allowed.

E. Protective coatings for surfaces which will be in contact with potable water shall be listed by NSF International as approved for potable water contact in accordance with ANSI/NSF Std. 61, Section 5 Protective (Barrier) Materials.

F. Emulsion and alkyd paint shall contain a mildewcide and both the paint and mildewcide shall conform to OSHA and Federal requirements, including Federal Specification TT-P-19.

2.02 PAINT SYSTEMS GUIDE

A. The following table illustrates the general features of the standard coating systems and is provided as a general guideline, and may be superseded by specific coating requirements outlined within this specification or on the Drawings:

System No.	Generic Type	Surface Material	Finish	Typical Function
1	Epoxy / Polyurethane	Ferrous Metal, Non-galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing
2	Polyurethane	Ferrous Metal, galvanized	Gloss	Exterior metals not subject to immersion or frequent splashing
3	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
4	Alkyd	Ferrous Metal, galvanized	Semi-gloss	Interior metals not subject to immersion or frequent splashing or condensation
5	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Interior metals subject to condensation
6	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Interior metals subject to condensation
7	Epoxy	Ferrous Metal, Non-galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
8	Epoxy	Ferrous Metal, galvanized	Semi-gloss	Metals subject to immersion or frequent splashing
9	Epoxy	Concrete	Semi-gloss	Interior
10	Epoxy	Concrete	Tile-like gloss	Interior walls of washrooms
11	Acrylic	Concrete	Low sheen	Precast concrete ceilings, beams, columns
12	Elastomeric	Concrete	Low sheen	Exterior concrete
13	Epoxy	Masonry	Semi-gloss	Interior masonry

System No.	Generic Type	Surface Material	Finish	Typical Function
14	Epoxy	Masonry	Tile-like gloss	Interior walls of washrooms
15	Elastomeric	Masonry	Low sheen	Exterior masonry
16	Acrylic	Masonry	Low sheen	Interior masonry
17	Acrylic	Drywall, plaster	Low sheen	Interior drywall, plaster
18	Acrylic	Plaster, stucco	Low sheen	Exterior plaster, stucco
19	Alkyd	Wood	Gloss	Exterior wood
20	Alkyd	Wood	Semi-gloss	Exterior wood
21	Alkyd	Wood	Gloss	Interior wood
22	Alkyd	Wood	Semi-gloss	Interior wood
23	Acrylic	Wood	Low sheen	Interior wood
24	Acrylic	Canvas wrapped insulation	Semi-gloss	Canvas wrapped insulated piping
25	Coal Tar Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in non-potable water
26	Coal Tar Epoxy	Concrete	Semi-gloss	Concrete in non-potable water or below grade
27	Epoxy	Ferrous Metal	Semi-gloss	Metals submerged in potable water
28	Epoxy	Concrete	Semi-gloss	Concrete submerged in potable water
29	Sealer, Hardener	Concrete	Semi-gloss	Concrete Floors

2.03 COATING SYSTEMS

A. System No. 1

1. System No. 1 shall be used for exterior non-galvanized ferrous metals that are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:

a. Exposed exterior piping, valves and fittings.

b. Exterior mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 1 surface preparation shall be SP 6.

3. System No. 1 shop primer shall be one coat of one of the following, or equal:

a. Induron P-14 Armorguard Primer at 3.0 - 5.0 mils DFT

b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT.

c. Glidden 5205 Glid-Guard Tank and Structural Primer at 2.0 mils DFT

4. System No. 1 field touch-up shall be the same material as Shop Primer.

5. System No. 1 intermediate coats shall be two (2) coats of one of the following, or equal:

a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT

b. Tnemec Series N69 @ 4.0-6.0 mils DFT

c. Glidden Life Master Pro High Performance Acrylic No.6900 at 1.5 mils DFT

6. System No. 1 finish shall be one full coat of High Gloss aliphatic polyurethane, of one of the following, or equal:

a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT

b. Tnemec Series 72 Endra-Shield (gloss) @ 2.5-4.0 mils DFT

c. Glidden Life Master Pro High Performance Acrylic No. 6900 Series at 1.5 mils dry coat.

B. System No. 2

1. System No. 2 shall be used for exterior galvanized ferrous metals which are not subject to immersion or frequent splashing of water or wastewater, including but not limited to the following:

a. Exposed galvanized piping and fittings.

b. Exposed galvanized conduit, equipment, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 2 surface preparation shall be SSPC-SP1 Followed by Hand or Power Tool Cleaning to scarify.

3. System No. 2 primer shall be one coat of one of the following, or equal:

a. Tnemec Series N69 @ 3.0-5.0 mils DFT

4. System No. 2 finish shall be two 1 coat of one of the following or equal:

a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT per coat

b. Tnemec Series 72 Endrua-Shield @ 2.0-3.0 mils DFT .

c. Porter I.A.-24 Gloss Finish at 1.5 mils DFT per coat.

d. Glidden 4550 Series Glid-Guard Alkyd Industrial Enamel at 2.0 mils DFT per coat.

C. System No. 3

1. System No. 3 shall be used for interior, non-galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:

a. Interior piping, valves and fittings, except piping subject to condensation.

b. Exposed structural steel.

c. Steel stairs and railings.

d. Interior cranes and hoists.

e. Steel doors and frames.

f. Interior equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

2. System No. 3 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning.

3. System No. 3 shop primer shall be one coat of one of the following, or equal:

a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT

b. Tnemec Series 1 Omni-Thane @ 2.5-3.5 mils DFT

c. Porter U-Prime Universal Primer at 2.0 mils DFT.

d. Glidden 5210 Glid-Guard Tank & Structural Primer 5205/5206/5207 at 2.0 mil DFT.

4. System No. 3 field touch-up shall be the same material as the shop primer.

5. System No. 3 finish shall be two (2) coats of one of the following, or equal:

a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat

b. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

c. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.

d. Glidden Ultra Hide Alkyd Semi-Gloss Enamel No. UH8000 at 1.5 mils DFT per coat.

D. System No. 4

1. System No. 4 shall be used for interior, galvanized, ferrous metals not subject to immersion, frequent splashing or condensation, including but not limited to the following:

a. Interior galvanized piping, except piping subject to condensation.

b. Interior galvanized conduit, mechanical equipment, control panels, miscellaneous metal, etc. without a factory-applied final finish.

c. Metal decking

2. System No. 4 surface preparation shall be SSPC-SP:1

3. System No. 4 primer shall be one coat of one of the following, or equal:

a. Induron Vinyl Wash Primer at 0.5 to 1.0 mils DFT

b. Tnemec Series 115 Uni-Bond DF @ 2.0-4.0 mils DFT

c. Porter 1799 V.C.-17 Wash Prime at 0.5 mil DFT.

d. Glidden Glid-Guard Tank and Structural Primer no. 5205/5206/5207 at 2.0 mils DFT.

4. System No. 4 finish coat shall be two (2) coats of one of the following, or equal:

a. Induron Indurethane 5500 Gloss Enamel at 1.5 to 2.5 mils DFT per coat.

b. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

c. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.

d. Glidden Ultra Hyde Alkyd Semi-Gloss Enamel UH8000 at 1.5 mils DFT per coat.

E. System No. 5

1. System No. 5 shall be used for interior, non-galvanized ferrous metals subject to condensation, including but not limited to the following:

a. Interior liquid process and water piping.

b. Chemical piping.

c. Air intake piping.

2. System No. 5 surface preparation shall be SSPC-SP6 Commercial Blast Cleaning

3. System No. 5 shop primer shall be one coat of one of the following, or equal:

a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT

b. Tnemec 37-77 Chem-Prime Universal Primer at 2.0 mils DFT.Series 1 Omnithane @ 2.5-3.5 mils DFT.

c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.

d. Glidden 5251/5252 Glid-Guard Epoxy Chromate Metal Primer at 1.5 mils DFT.

4. System No. 5 field touch-up shall be the same material as the shop primer.

5. System No. 5 finish shall be two (2) coats of one of the following, or equal:

a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.

b. Tnemec Series N69 Epoxoline II @ 3.0-5.0 mils DFT per coat.

c. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 3.0 mils DFT per coat.

d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish at 3.0 mils DFT per coat.

F. System No. 6

1. System No. 6 shall be used for interior, galvanized, ferrous metals subject to condensation, including but not limited to interior galvanized liquid process and water piping.

2. System No. 6 surface preparation shall be SP M1 or SP 7.

3. System No. 6 primer shall be one coat of one of the following, or equal:

   a. Induron Vinyl Wash Primer 0.5 to 1.0 mils DFT

   b. Tnemec: Series N69 @ 2.5-3.5 mils DFT

   c. Porter 45 Galvaprep at 1000 square feet per gallon.

   d. Glidden 5251/5252 Glid-Guard Epoxy Chromate Metal Primer at 1.5 mils DFT.

4. System No. 6 finish shall be two (1) coat of one of the following, or equal:

   a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.

   b. Tnemec Series N69 @ 2.5-3.5 mils DFT (Maximum DFT for galvanized steel *should be 7.0 mils.*

   c. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 3.0 mils DFT per coat.

   d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish at 3.0 mils DFT per coat.

G. System No. 7

1. System No. 7 shall be used for non-galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:

   a. Submerged piping and piping subject to splashing.

   b. Submersible pumps.

   c. Submerged miscellaneous metal, equipment, etc. without a factory-applied final finish.

2. System No. 7 surface preparation shall be SSPC-SP10.

3. System No. 7 shop primer shall be one coat of one of the following, or equal:

   a. Induron P-14 Armorguard Primer at 3.0 to 5.0 mils DFT.

   b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.

d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.

4. Field touch-up shall be the same material as shop primer.

5. Finish shall be two (2) coats of one of the following, or equal:

a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.

b. Tnemec Series 446 Perma-Thane @ 5.0-7.0

c. Porter 24770/24771 Tank Lining at 3.0 mils DFT per coat.

d. Glidden Glid-Guard Chemical Resistant Epoxy No. 5250/5242 at 5.0 mils DFT per coat.

H. System No. 8

1. System No. 8 shall be used for galvanized, ferrous metals subject to immersion or frequent splashing, including but not limited to the following:

a. Submerged galvanized piping and piping subject to splashing.

b. Submerged galvanized conduit, miscellaneous metal, equipment, etc. without a factory-applied final finish.

2. System No. 8 surface preparation shall be SP M1 and SP 7.

3. System No. 8 primer shall be one coat of one of the following, or equal:

a. Tnemec: Series N69 @ 2.5-3.5 mils DFT

b. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.

c. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy Resistant No. 5465 Series at 5.0 mils DFT.

4. System No. 8 finish shall be two (2) coats of one of the following, or equal:

a. Induron Armorguard Epoxy at 3.0 to 5.0 mils DFT per coat.

b. Tnemec Series N69 @ 2.5-3.5 mils DFT

c. Porter 24770/24771 Tank Lining System at 3.0 mils DFT per coat.

d. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish (Double Build) at 5.0 mils DFT per coat.

I. System No. 9

1. System No. 9 shall be used for interior, exterior, except concrete requiring a tile-like epoxy finish, including but not limited to the following:

   a. Interior cast-in-place concrete walls, except washroom walls.

   b. Pipe gallery walls and ceiling.

2. System No. 9 surface preparation shall be SP C2 or SP C3 (horizontal surfaces only).

3. System No. 9 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish. Delete filler for all submerged concrete):

   a. Tnemec 54-561 Modified Epoxy Masonry Filler at 80 square feet per gallon.

   b. Porter 895 Unifill at 100 square feet per gallon.

   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

   d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.

4. System No. 9 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 66 Epoxoline at 5.0 mils DFT per coat.

   b. Porter 24770/24771 Tank Lining System at 3.0 mils DFT per coat.

   c. Glidden 5250/5242 Glid-Guard Epoxy Chemical Resistant Finish (Double Build) at 5.0 mils DFT per coat.

   d. Induron Armorguard SG Epoxy at 3.0 to 5.0 mils DFT per coat.

   System 9A: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**moderate environment**).

   System 9A Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete

   System 9A Finish System:

   1st Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

2nd Coat: Tnemec Series 446 @ 5.0-7.0 mils DFT

System 9B: Submerged Concrete in Wastewater or Concrete Exposed to Wastewater Splash or Wastewater Fumes (**severe environment** such as headworks, digesters, influent structures, grit chambers, lift stations, etc).

System 9B Surface Preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 at an average of 1/16". Fill deep voids (greater than 3/8" and up to 4") with Tnemec Series 217 MortarCrete.

System 9B Finish System:

1st Coat: Tnemec Series 434 Perma-Shield @ 1/8"

2nd Coat: Tnemec Series 435 Perma-Glaze @ 18.0-20.0 mils DFT

J. System No. 10

1. System No. 10 shall be used for interior concrete and CMU requiring a tile-like epoxy finish, including but not limited to interior washroom walls.

2. System No. 10 surface preparation: Allow new Concrete to cure for 28 days. All surfaces must be clean and dry.

3. System No. 10 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):

   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL (CMU Only)

   b. Porter 895 Unifill at 100 square feet per gallon.

   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

   d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.

4. System No. 10 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 84 Ceramlon ENV at 4.0-6.0 mils DFT per coat.

   b. Porter: First coat, Porter M.C.R.-43 High Build Epoxy at 5.0 mils DFT. Second coat, Porter M.C.R.-43 Gloss Epoxy at 2.0 mils DFT.

   c. Glidden 5550 Series Glid-Guard Glid-Tile Epoxide Coating at 6.0 mils DFT per coat.

   d. Induron Perma-Clean II at 4.0 to 6.0 mils DFT per coat.

K. System No. 11

1. System No. 11 shall be used for interior concrete and Concrete Masonry requiring a matte finish, including but not limited to precast concrete ceilings, CMU walls, beams and columns.

2. System No. 11 surface preparation shall be SP C2.

3. System No. 11 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock WB @ 100-125 SF / GL square feet per gallon.

   b. Porter 895 Unifill at 100 square feet per gallon.

   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

   d. Induron AC 202 Acrylic Block Filler at 75 sq. ft. per gallon.

4. System No. 11 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

   b. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

   c. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.

   d. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

L. System No. 12

1. System No. 12 shall be used for exterior concrete and CMU requiring a matte finish.

2. System No. 12 surface preparation shall be SP C2.

3. System No. 12 filler shall be one coat of one of the following, or equal (May be deleted if concrete has rubbed finish):

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon.

   b. Porter 895 Unifill at 100 square feet per gallon.

   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

   d. Induron primer not needed

4. System No. 12 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.

c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

M. System No. 13

1. System No. 13 shall be used for interior masonry, including but not limited to masonry walls, except washroom walls.

2. System No. 13 surface preparation shall be SP C1.

3. System No. 13 filler shall be one coat of one of the following, or equal:

a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon, CMU only

b. Porter 895 Unifill at 100 square feet per gallon.

c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.

4. System No. 13 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 66 Epoxoline at 4.0-6.0 mils DFT per coat.

b. Porter M.C.R.-43 High Build Semi-Gloss Epoxy at 5.0 mils DFT per coat.

c. Glidden Epoxy Chemical Resistant No. 5240-50/5242 5.0 mils DFT.

d. Induron Armorguard Epoxy at 4.0 mils DFT per coat.

N. System No. 14

1. System No. 14 shall be used for masonry walls requiring a tile-like epoxy finish, including but not limited to interior washroom walls.

2. System No. 14 surface preparation shall be SP C1.

3. System No. 14 filler shall be one coat of one of the following, or equal:

a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

b. Porter 895 Unifill at 100 square feet per gallon.

c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

d. Induron Polyfill Epoxy Block Filler at 100 sq. ft. per gallon.

4. System No. 14 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 84 Ceramlon at 4.0-6.0 mils DFT per coat.

b. Porter: First coat, Porter M.C.R.-43 High Build Epoxy at 5.0 mils DFT. Second coat, Porter M.C.R.-43 Gloss Epoxy at 2.0 mils DFT.

c. Glidden 5550 Series Glid-Guard Glid-Tile Epoxide Coating at 6.0 mils DFT per coat.

d. Induron Perma-Clean II at 4.0 mils DFT per coat.

O. System No. 15

1. System No. 15 shall be used for exterior masonry requiring a matte finish.

2. System No. 15 surface preparation shall be SP C2.

3. System No. 15 filler shall be one coat of one of the following, or equal:

a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

b. Porter 895 Unifill at 100 square feet per gallon.

c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

d. Induron primer not needed.

4. System No. 15 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.

c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

P. System No. 16

1. System No. 16 shall be used for interior masonry requiring a matte finish.

2. System No. 16 surface preparation shall be SP C2.

3. System No. 16 filler shall be one coat of one of the following, or equal:

   a. Tnemec Series 1254 Epoxoblock @ 100-125 square feet per gallon

   b. Porter 895 Unifill at 100 square feet per gallon.

   c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

   d. Induron AC 202 Acrylic Block Filler at 75 sq. ft. per gallon.

4. System No. 16 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

   b. Porter 16 Series Acrylic Industrial Coating at 1.1 mils DFT per coat.

   c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

   d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

Q. System No. 17

1. System No. 17 shall be used for the following interior surfaces:

   a. Drywall

   b. Plaster

   c. Stucco

2. System No. 17 surface preparation shall be SP P1 (Drywall) or SP P2 (Plaster and Stucco).

3. System No. 17 primer shall be one coat of one of the following, or equal:

   a. Tnemec 51PVA Sealer at 1.5 mils DFT.

   b. Porter 767 Latex Primer Sealer at 3.0 mils DFT.

   c. Glidden 5019 Ultra-Hide PVA Primer-Sealer at 1.0 mils DFT.

   d. Induron AC 402 Acrylic Masonry Sealer at 1.0 mils DFT.

4. System No. 17 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

   b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.

   c. Glidden 3400 Series Spred Satin Latex Wall Paint at 1.4 mils DFT per coat.

d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

R. System No. 18

1. System No. 18 shall be used for the following exterior surfaces:

a. Concrete columns and beams

b. Stucco

2. System No. 18 surface preparation shall be SP C2.

3. System No. 18 filler shall be one coat of one of the following, or equal:

a. Tnemec 54-561 Modified Epoxy Masonry Surfacer at 80 square feet per gallon.

b. Porter 895 Unifill at 100 square feet per gallon.

c. Glidden Ultra Hide Latex Block Filler No. 5317 at 75 square feet per gallon, or until pin hole free.

d. Induron primer not needed.

4. System No. 18 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 6 Tneme-Cryl at 2.5 mils DFT per coat.

b. Porter 16 Series Acrylic Industrial Coating at 2.0 mils DFT per coat.

c. Glidden 3525 Series Spred Glide-On Masonry Paint at 1.5 mils DFT per coat.

d. Induron AC 403 Acrylic Elastomeric at 6.0 mils DFT per coat.

S. System No. 20

1. System No. 20 shall be used for exterior wood surfaces requiring a semi-gloss finish.

2. System No. 20 surface preparation shall be SP W1.

3. System No. 20 primer shall be one coat of one of the following, or equal:

a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

b. Porter 515 Acrylic Bonding Primer at 1.5 mils DFT.

c. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 20 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.

b. Porter 1660 Series Acrylic Enamel at 2.5 mils DFT per coat.

c. Glidden Spred Ultra Gloss House Paint No. 6600 Series at 1.4 mils DFT per coat.

d. Induron Armorlux 2500 at 1.5 mils DFT per coat.

T. System No. 21

1. System No. 21 shall be used for interior wood surfaces requiring a gloss finish.

2. System No. 21 surface preparation shall be SP W1.

3. System No. 21 primer shall be one coat of one of the following, or equal:

a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

b. Porter 2429 I.A.-24 Undercoat at 2.0 mils DFT.

c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater No. UH400 at 1.5 mils DFT.

d. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 21 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 1028 Endruatone Gloss @ 2.0-3.0 mils DFT per coat.

b. Porter I.A.-24 Gloss Finish at 1.5 mils DFT per coat.

c. Glidden 4550 Series Glid-Guard Alkyd Industrial Enamel at 2.0 mils DFT per coat.

d. Induron Armorlux 2500 at 1.5 mils DFT per coat.

U. System No. 22

1. System No. 22 shall be used for interior wood surfaces requiring a semi-gloss finish.

2. System No. 22 surface preparation shall be SP W1.

3. System No. 22 primer shall be one coat of one of the following, or equal:

a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

b. Porter 2429 I.A.-24 Undercoat at 2.0 mils DFT.

c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater UH400 at 1.5 mils DFT.

d. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 22 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 1029 Enduratone at 2.0-3.0 mils DFT per coat.

   b. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.

   c. Glidden Ultra Hide Alkyd Semi-Gloss Enamel UH-8000 at 1.5 mils DFT per coat.

   d. Induron AC 240 Acrylic Semi-Gloss at 2.0 mils DFT per coat.

V. System No. 23

1. System No. 23 shall be used for interior wood surfaces requiring a low-sheen finish.

2. System No. 23 surface preparation shall be SP W1.

3. System No. 23 primer shall be one coat of one of the following, or equal:

   a. Tnemec 10-1009 Tnemec Primer at 2.0-3.0 mils DFT.

   b. Porter 515 Acrylic Bonding Primer at 1.5 mils DFT.

   c. Glidden Ultra Hide Alkyd Interior Enamel Undercoater UH-400 at 1.5 mils DFT.

   d. Induron AC 301 Wood Primer at 1.5 mils DFT.

4. System No. 23 finish shall be two (2) coats of one of the following, or equal:

   a. Tnemec Series 6 Tneme-Cryl at 2.0-3.0 mils DFT per coat.

   b. Porter 16 Series Industrial Coating at 2.0 mils DFT per coat.

   c. Glidden Ultra Hide Alkyd Eggshell Enamel No. 5000 Series.

   d. Induron AC 230 Acrylic Eggshell at 2.0 mils DFT per coat.

W. System No. 24 - ***Not Used***

1. System No. 24 shall be used for insulated and canvas-wrapped piping.

2. System No. 24 surface preparation shall be general cleaning.

3. System No. 24 primer shall be one coat of one of the following, or equal:

   a. Tnemec 51-792 PVA Sealer at 1.5 mils DFT.

   b. Porter 767 Latex Primer Sealer at 3.0 mils DFT.

   c. Glidden 5116 Insul-Aid Vapor Barrier Primer-Sealer at 1.7 mils

DFT.

d. Induron AC 210 Acrylic Primer at 1.5 mils DFT.

4. System No. 24 finish shall be two (2) coats of one of the following, or equal:

a. Tnemec Series 23 Enduratone at 2.0 mils DFT per coat.

b. Porter I.A.-24 Semi-Gloss at 1.5 mils DFT per coat.

c. Glidden Ultra Hide Alkyd Semi-Gloss Enamel UH-8000 at 1.5 mils DFT per coat.

d. Induron AC 230 Acrylic Eggshell at 1.5 mils DFT per coat.

X. System No. 25

1. System No. 25 shall be used for metal surfaces.

2. System No. 25 surface preparation shall be SP 10.

3. System No. 25 shop primer shall be one coat of one of the following, or equal:

a. Induron PE-54 Primer at 3.0 to 5.0 mils DFT.

b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

c. Porter 4300 M.C.R.-43 Epoxy Primer at 2.0 mils DFT.

d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.

4. System No. 25 field touch-up shall be one of the following, or equal:

a. Induron Ruff Stuff 2100 Coal Tar Epoxy

b. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

c. Porter 4300 M.C.R.-43 Epoxy Primer.

d. Glidden Glid-Guard Corrosion Resistant H.S. Epoxy No. 5465 Series at 3.0 mils DFT.

5. System No. 25 finish shall be two (2) coats of one of the following, or equal:

a. Induron Ruff Stuff 2100 Coal Tar Epoxy at 8.0 mils DFT per coat; apply second coat within 90 days of first coat.

b. Tnemec Series 446 Perma-Thane @ 5.0-7.0 mils DFT per coat; apply second coat within 96 hours of first coat.

c. Porter 7013 Tarset C-200 Black at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

d. Glidden 5270-1 Glid-Guard Coal Tar Epoxy Finish at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

Y. System No. 26

1. System No. 26 shall be used for concrete surfaces.

2. System No. 26 surface preparation shall be SP C1.

3. System No. 26 finish shall be two (2) coats of one of the following, or equal:

a. Induron Ruff Stuff 2100 Coal Tar Epoxy at 8.0 mils DFT per coat; apply second coat within 90 days of first coat.

b. Tnemec 46H-413 Tneme-Tar at 8.0-10.0 mils DFT per coat; apply second coat within 96 hours of first coat.

c. Porter 7013 Tarset C-200 Black at 8.0 mils DFT per coat; apply

second coat within 24 hours of first coat.

d. Glidden 5270-1 Glid-Guard Coal Tar Epoxy Finish at 8.0 mils DFT per coat; apply second coat within 24 hours of first coat.

Z. System No. 27

1. System No. 27 shall be used for steel surfaces in potable water immersion.

2. System No. 27 surface preparation shall be SSPC-SP 10 Near White Metal Blast.

3. System No. 27 shop primer shall be one coat of the following system or equal:

a. Induron PE-54 Primer at 3.0 - 5.0 mils DFT.

b. Induron PE-54 Int./Finish at 3.0 - 5.0 mils DFT per coat

c. Tnemec Series 1 Omnithane @ 2.5-3.5 mils DFT

d. Stripe coat welds and seams using Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0 mils DFT

e. .Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT

f. Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

AA. System No. 28

1. System No. 28 shall be used for concrete surfaces in potable water immersion.

2. System No. 28 surface preparation: Abrasive Blast to remove laitance, fines, curing compounds, form release oils, and establish a surface profile equal to ICRI CSP 5 (minimum). Fill all voids and bugholes, and resurface all concrete using Tnemec Series 218 MortarClad at an average of 1/16".

3. System No. 28 shop primer shall be one coat of the following system or equal: Coating System:

   a. Primer: Tnemec Series N140-1255 Beige Pota-Pox Plus @ 3.0-5.0 mils DFT
   Intermediate Coat: Tnemec Series N140-15BL Tank White Pota-Pox Plus @ 4.0-6.0 mils DFT
   Finish Coat: Tnemec Series N140-00WH White @ 4.0-6.0 mils DFT.

   b. Induron PE-54 Primer at 3.0 to 5.0 mils DFT.

4. System No. 28 field touch-up shall be one coat of the following system or equal:

   a. Induron PE-54 Primer at 3.0 to 5.0 mils DFT.

5. Finish: Two full coats of the following system or equal:

   a. Induron PE-54 Int./Finish at 3.0 to 5.0 mils DFT per coat.

BB. System No. 29

1. System No. 29 shall be used for all non-painted, exposed concrete flooring surfaces.

2. System No. 29 surface preparation shall be SP C1

3. System No. 29 shall be three coats of Sonneborn "Kure-N-Seal", Euclid Chemical Co. "Surfhard", or Lambert Corp. "Solidus" applied per the manufacturer's installation instructions, or an approved equal.

PART 3 EXECUTION

3.01 GENERAL

All painting shall be done in strict accordance with the recommendations of the manufacturer and shall be performed in a manner satisfactory to the Owner/Engineer.

A. All recommendations of the paint manufacture in regard to mixing, applying, thinning and curing as well as the health and safety of the workers shall be followed.

B. Dry film thickness for masonry is approximate for application to a smooth surface.

C. Sequence painting to ensure work area is dust free.

3.02 MIXING

A. Exercise care to keep fire hazards to a minimum. Provide an approved hand fire extinguisher near each paint storage and mixing area. No oily waste, rags, or painting equipment shall be left scattered throughout the premises.

B. Mix coatings in accordance with manufacturer's instructions. Colors shall be thoroughly mixed with no streaks or separation of color. Do not add thinners, driers or other additives except as recommended by the coating manufacturer. Do not incorporate in the coating any thinners or solvents used for cleaning brushes or equipment.

C. Protect all adjacent areas against damage and leave storage and mixing areas clean at the completion of painting.

3.03 ACCEPTANCE OF SURFACES

A. Inspect all surfaces and adjoining work and report to the E/A in writing any existing unsatisfactory conditions. No painting work shall be started until the unsatisfactory conditions are remedied.

B. Commencement of surface preparation and painting shall constitute the acceptance of existing conditions and any defects appearing in the painting work thereafter shall be by the Contractor at no additional cost.

3.04 PROTECTION OF ADJACENT SURFACES

A. Provide necessary protection for completed work and all adjoining surfaces. Provide temporary closures as required to prevent circulation of dust from adjacent areas where other work is in progress. Where it is necessary to remove existing protection of work of others, such protection shall be fully replaced.

B. Locate and protect all existing utilities, structures, or appurtenances.

3.05 VENTILATION

A. Provide adequate ventilation for safe application and for proper drying of coatings on interior surfaces. Ensure solvent vapors are released during and after application of coatings. Remove vapors by exhausting air from the lowest portions of tanks or enclosed spaces and keep tops open and clear. During coating application in enclosed areas the capacity of ventilating fans shall be at least 300 cfm per gallon of coating applied per hour. Provide continuous forced ventilation at a rate of at least one complete air change per 4 hours for at least 7 days after coating application is completed.

3.06 GENERAL SURFACE PREPARATION REQUIREMENTS

A. Prepare all surfaces in accordance with the coating manufacturer's instructions and as specified. Surfaces shall be uniform texture, dry, and free from dust, grit, oil, grease, or any material which will adversely affect adhesion or appearance of the coating. Rough edges of metal, weld seams and sharp edges from scaffold lugs shall be ground to a curve.

B. Surfaces that have been cleaned, pretreated, and/or otherwise prepared for painting shall be given a coat of the first-coat material as soon as practicable prior to any deterioration of the prepared surface.

C. Hardware, accessories, plates, fixtures, and similar items in contact with coated surfaces shall be removed, masked, or otherwise protected prior to surface preparation and painting operations.

D. Exposed nails and other ferrous metals on surfaces to be coated shall be spot-primed with a metal primer compatible with the finish.

3.07 SURFACE PREPARATION

A. Surface Preparation SP 3 - Power Tool Cleaning

1. Remove all oil and grease from surface. Power tool clean the surface removing all loose mill scale, loose rust, loose paint and other detrimental foreign matter by the methods outlined in the SSPC SP 3. Feather out edges of chipped or abraded areas to prevent flaws from showing through finish coats.

2. The cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

B. Surface Preparation SP 6 - Commercial Blast Cleaning

1. Remove all oil and grease from the surface. Blast clean surface to a Commercial Finish, removing mill scale, dirt, rust, and foreign matter by the methods outlined in SSPC SP 6. Two thirds of each square inch of surface area shall be free of all visible residues.

2. Blasting shall be done with centrifugal wheel or compressed air blast using either steel grit or flint silica sand. Abrasive should provide a profile depth of 1.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.

3. The blast cleaned surface shall be primed as soon as possible and before any rusting of the surface occurs.

C. Surface Preparation SP 7 - Brush-Off Blast : Prepare metal as outlined in SSPC SP 7 to provide for proper adhesion of coating.

D. Surface Preparation SP l0 - White Blast Cleaning

1. Steel surfaces shall be dry and clean. Remove all grease, oils and contaminants with rags soaked in toluol or xylol. Solvent Clean all surfaces per SSPC-SP 1 Solvent Cleaning.

2. Remove all weld spatter. Grind all rough welds and sharp edges to a smooth rounded contour. Blast clean the surface to a Near White Metal finish, removing nearly all mill scale, rust, rust-scale, paint or foreign matter by the recommended methods outlined in SSPC SP l0. At least 95 percent of each square inch shall be free of all visible residues and staining.

3. Blasting shall be done with centrifugal wheel or compressed air blast nozzles using either steel grit or flint silica sand. Abrasive should provide profile depth of l.0 to 2.0 mils. Steel Grit #G-80 or flint silica sand 20-50 mesh is recommended to obtain proper profile depth. Remove all dust and sand by vacuuming.

4. The blast cleaned surface should be primed as soon as possible and before any rusting of the surface occurs.

E. Surface Preparation SP C1 - General Cleaning: Allow concrete and masonry to cure in place for 28 days. Remove all dirt, dust, form oil, curing compounds, grease stains, or efflorescence from surfaces and roughen as required to provide good adhesion of coatings. If washing of the surface is required, use tri-sodium phosphate solution followed by a clean water rinse. Fill all minor holes to produce uniform surface textures.

F. Surface Preparation SP C2 - Sweep Sand Blasting

1. Concrete surfaces must be clean, dry and free of existing coatings. Cure new concrete a minimum of 28 days. Fill and seal structural cracks and defects.

2. Concrete shall be cleaned and etched by sweep sandblasting (brush-off blast) so the surface is grainy to the touch. All dust or foreign matter shall be removed by vacuuming.

G. Surface Preparation SP C3 - Acid Etching (Horizontal Surfaces Only)

1. Concrete surfaces must be clean and dry. Cure new concrete a minimum of 28 days. Remove all dirt, dust, grease, oil and other contaminants from surface.

2. Etch concrete surface with l5 to 20 percent muriatic acid. Thoroughly coat the concrete with solution applied with a mop or brush. When foaming stops, thoroughly neutralize with clear water to remove soluble salts. Test the rinse water with litmus paper to verify the neutralization.

3. After etching, the surface shall be "grainy" to the touch; if not, repeat the treatment.

4. Permit surface to thoroughly dry a minimum of 72 hours before coating, while maintaining the cleanliness of the surface.

H. Surface Preparation SP M1 - Solvent Cleaning: Non-ferrous and galvanized ferrous surfaces scheduled to receive paint shall be solvent cleaned to remove all oils, salts, and contaminants prior to application of pretreatments or primers.

I. Surface Preparation SP P1 – Drywall: Fill all surface irregularities with spackling compound and sand to a smooth level surface prior to applying finish. Care shall be exercised to avoid raising nap on the paper.

J. Surface Preparation SP P2 - Plaster and Stucco: Rake cracks, scratches and abrasions deeply. Soak with water and fill with patching plaster or spackling compound. Treat with aqueous solution of zinc sulphate, 4 lbs. to l gallon of water. Add to solution enough phenophthalein to act as a color warning of alkali. Allow to dry for 3 days. Remove loose crystals before coating.

K. Surface Preparation SP W1 – Wood: Sandpaper to a smooth even surface and vacuum or dust off. Treat all knots and sap spots with mineral spirits and, when dry, touch up with an approved sealer. Subsequent to priming and staining, thoroughly fill holes and cracks with plastic wood filler for transparent finishes and putty for painted wood. Unless otherwise approved, paint only when the moisture content of the wood is below l2 percent. Do not apply primer or sealer to wood in areas where cement, mortar, or plaster is not thoroughly dry.

3.08 APPLICATION

A. All work shall be performed by skilled painters. Surfaces shall be free of drops, ridges, waves, laps and brush marks. Edges of paint adjoining other colors or materials shall be sharp and true.

B. Do not apply coatings in temperatures below 50 degrees F except where the manufacturer specifically allows for lower temperatures. No exterior painting shall be done during inclement weather when relative humidity exceeds 85%, the ambient temperature is within 5 degrees F of the Dew Point or under conditions identified by the manufacturer as unsuitable.

C. The average rate of application shall not exceed the theoretical rate of coverage recommended by the coating manufacturer for the type of surface involved, less an allowance for losses. Average DFT shall not be less than thickness set forth under Painting Systems. Not more than l0-20% of points inspected may be less than 90% of the specified thickness. Deficiencies shall be corrected by application of additional coating.

D. Each coat shall be uniform in coverage and color. Successive coats shall perceptibly vary in color. Each coat shall be carefully examined and faulty material, poor workmanship, holidays, damaged areas and other imperfections shall be touched up prior to applying succeeding coats. Comply with coating manufacturer's recommendations for drying time between coats.

E. Bottoms, sides and edges of doors shall receive same finish as faces of doors. If refitting of wood doors is done prior to final acceptance, refinish at no extra cost.

F. Incidental niches, recesses, passages, closets, etc., shall be finished to match similar or adjacent spaces. Access doors, panels, convectors, grilles and similar items shall be coated the same color as adjacent work, except for non-ferrous metal or where otherwise directed by the E/A. Primed hardware shall be coated to match adjacent work to which they are attached.

G. In the event that the finished surfaces are not acceptable, completely refinish entire unit areas or sections as necessary in order to eliminate visible laps or other indications of repairs.

H. Mixing, thinning, pot life, application procedure, equipment, coverage, curing, re-coating, storage and number of coats shall be in accordance with coating manufacturer's instructions.

I. Avoid degradation and contamination of blasted surfaces, and avoid between coat contamination. Surfaces contaminated shall be cleaned before applying next coat. Method of cleaning contaminated surface shall be approved by the Engineer or owner□s representative.

J. Each application of material shall be worked into corners, crevices, joints, etc., and distributed evenly over flat surfaces. Spraying techniques that result in a uniform wet pattern shall be used and dry spraying should be avoided. Dry spray shall be removed prior to coating being applied.

K. All bolts, welds, sharp edges, and difficult access areas shall receive a primer brush coat or spray coat prior to primer spray application.

3.09 PIPE COLOR CODING

A. Coat all exposed piping, conduit and appurtenances to conform to a color code as approved by the E/A.

B. Submit for the E/A to approve a coating schedule for the color coding of exposed piping, conduit and appurtenances.

3.10 CLEAN-UP

At completion of the painting work, clean off all paint spots and other paint materials from surfaces where they are not intended to be. Remove from the premises all rubbish and accumulated material and leave the work in clean orderly condition, acceptable to the E/A. All cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site and/or destroyed in an approved and legal manner.

3.11 EXTRA STOCK

Upon completion of painting work, the Owner shall be furnished at no additional cost, one gallon of each type and color of finish paint for touching up. Paint container labels shall be complete with the manufacturer's name, generic type, number, color and location in which the paint is applied.

3.12 DAMAGED COATINGS

A. Damaged coatings, pinholes, and holidays shall have edges feathered and repaired in accordance with the recommendations of the manufacturer, as approved by the Engineer.

B. All finish coats, including touch up and damage-repair coats shall be applied in a manner which will present a uniform texture and color-match appearance.

3.13 UNSATISFACTORY APPLICATION

A. If the item has an improper finish, color, or insufficient dry film thickness, the surface shall be cleaned and top coated with the specified material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coatings manufacturer and the Engineer.

B. All visible areas of chipped, peeled, or abraded paint shall be hand or power-sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications.

C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.

D. Any defects in the coating system shall be repaired by the Contractor per written recommendations of the coating manufacturer.

E. Any repairs made on steel surfaces for immersion service shall be holiday detected in accordance with ASTM G 62 low voltage holiday detection. Areas found to have holidays shall be marked and repaired in accordance with the paint manufacturer's instructions. The Engineer shall be notified of time of testing so that he might be present to witness testing.

3.14 GUARANTEE AND ANNIVERSARY INSPECTION

A. All work shall be warranted for a period of one year from date of acceptance of the project.

B. The Owner will notify the Contractor at least 30 days prior to the anniversary date and shall establish a date for the inspection. Any defects in the coating system shall be repaired by the Contractor at no additional cost to the Owner. Should a failure occur to 25% of the painted surface, either interior or exterior, the entire surface shall be cleaned and painted in accordance with these specifications.

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SECTION 15012
COMMISSIONING OF HVAC

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.

B. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.

C. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:

1. Control system.
2. Major and minor equipment items.
3. Piping systems and equipment.
4. Ductwork and accessories.
5. Terminal units.
6. Sound control devices.
7. Vibration control devices.
8. Variable frequency drives.
9. Special Ventilation:
    a. Fume hoods.
    b. Laboratory pressurization.
    c. Specialty fans.
    d. Egress pressurization.
10. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
11. Indoor Air Quality Procedures: The Commissioning Authority will coordinate; Contractor will execute.

D. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

1.02 RELATED REQUIREMENTS

A. Section 15950 - Testing, Adjusting, and Balancing.

1.03 REFERENCE STANDARDS

A. ASHRAE Guideline 1.1 - The HVAC Commissioning Process; 2012

1.04 SUBMITTALS

A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.

B. DRAFT Prefunctional Checklists and Functional Test Procedures for Control System: Detailed written plan indicating the procedures to be followed to test, checkout and adjust the control system prior to full system Functional Testing; include at least the following for each type of equipment controlled:

1. System name.

2. List of devices.

3. Step-by-step procedures for testing each controller after installation, including:

a. Process of verifying proper hardware and wiring installation.

b. Process of downloading programs to local controllers and verifying that they are addressed correctly.

c. Process of performing operational checks of each controlled component.

d. Plan and process for calibrating valve and damper actuators and all sensors.

e. Description of the expected field adjustments for transmitters, controllers and control actuators should control responses fall outside of expected values.

4. Copy of proposed log and field checkout sheets to be used to document the process; include space for initial and final read values during calibration of each point and space to specifically indicate when a sensor or controller has “passed” and is operating within the contract parameters.

5. Description of the instrumentation required for testing.

6. Indicate what tests on what systems should be completed prior to TAB using the control system for TAB work. Coordinate with the Commissioning Authority and TAB contractor for this determination.

C. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.

D. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:

1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.

2. Full as-built set of control drawings.

3. Full as-built sequence of operations for each piece of equipment.

4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:

    a. Floor.

    b. Room number.

    c. Room name.

    d. Air handler unit ID.

    e. Reference drawing number.

    f. Air terminal unit tag ID.

    g. Heating and/or cooling valve tag ID.

    h. Minimum air flow rate.

    i. Maximum air flow rate.

5. Full print out of all schedules and set points after testing and acceptance of the system.

6. Full as-built print out of software program.

7. Electronic copy on disk of the entire program for this facility.

8. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.

9. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.

10. Control equipment component submittals, parts lists, etc.

11. Warranty requirements.

12. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).

13. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:

    a. Sequences of operation.

    b. Control drawings.

    c. Points lists.

    d. Controller and/or module data.

    e. Thermostats and timers.

    f. Sensors and DP switches.

    g. Valves and valve actuators.

    h. Dampers and damper actuators.

    i. Program setups (software program printouts).

E. Project Record Documents: See Section 01780 for additional requirements.

1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.

2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.

F. Draft Training Plan:

1. Follow the recommendations of ASHRAE Guideline 1.

2. Control system manufacturer's recommended training.

3. Demonstration and instruction on function and overrides of any local packaged controls not controlled by the HVAC control system.

G. Training Manuals:

1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.

B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

PART 3 EXECUTION

3.01 PREPARATION

A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.

B. Furnish additional information requested by the Commissioning Authority.

C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.

D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.

E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.

1. Include cost of sheaves and belts that may be required for testing, adjusting, and balancing.

F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

G. Provide temperature and pressure taps in accordance with the contract documents.

1. Provide a pressure/temperature plug at each water sensor that is an input point to the control system.

3.02 INSPECTING AND TESTING - GENERAL

A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.

B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.

C. Provide two-way radios for use during the testing.

D. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.

4. Command valve/damper open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.

6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

7. Closure for Heating Coil Valves - Normally Open:

a. Set heating setpoint 20 degrees F (11 degrees C) above room temperature.

b. Observe valve open.

c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.

d. Restore to normal.

e. Set heating setpoint to 20 degrees F (11 degrees C) below room temperature.

f. Observe the valve close.

g. For pneumatics, by override in the control system, increase pressure to valve by 3 psi (20 kPa) (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change.

h. Restore to normal.

8. Closure for Cooling Coil Valves - Normally Closed:

a. Set cooling setpoint 20 degrees F (11 degrees C) above room temperature.

b. Observe the valve close.

c. Remove control air or power from the valve and verify that the valve stem and actuator position do not change.

d. Restore to normal.

e. Set cooling setpoint to 20 degrees F (11 degrees C) below room temperature.

f. Observe valve open.

g. For pneumatics, by override in the control system, increase pressure to valve by 3 psi (20 kPa) (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change.

h. Restore to normal.

E. Coil Valve Leak Check:

1. Method 1 - Water Temperature With 2-Way Valve:

a. Calibrate water temperature sensors on each side of coil to be within 0.2 degree F (0.1 degree C) of each other.

b. Turn off air handler fans, close outside air dampers. Keep pump running. Make sure appropriate coil dampers are open.

c. Normally closed valves will close.

d. Override normally open valves to the closed position.

e. After 10 minutes observe water delta T across coil. If it is greater than 2 degrees F ((one degree C), leakage is probably occurring.

f. Reset valve stroke to close tighter.

g. Repeat test until compliance is achieved.

2. Method 2 - Air Temperature With 2 or 3-Way Valve: Water leak-by less than 10 percent will likely not be detected with this method.

a. Calibrate air temperature sensors on each side of coil to be within 0.2 degree F (0.1 degree C) of each other.

b. Air handler fans should be on.

c. Change mixed or discharge air setpoint, override values or bleed or squeeze bulb pneumatic controller to cause the valve to close.

d. After 5 minutes observe air delta T across coil. If it is greater than one degree F ((0.5 degree C), leakage is probably occurring.

e. Reset valve stroke to close tighter.

f. Repeat test until compliance is achieved.

3. Method 3 - Coil Drain Down: Not for 3-way valves.

a. Put systems in normal mode.

b. If cooling coil valve, remove all call for cooling; if heating coil valve, put system in full cooling.

c. Close isolation valve on supply side of coil, open air bleed cap, open drain-down cock and drain water from coil.

d. If water does not stop draining, there may be a leak through the control valve.

e. Return all to normal when done.

F. Isolation Valve or System Valve Leak Check: For valves not by coils.

1. With full pressure in the system, command valve closed.

2. Use an ultra-sonic flow meter to detect flow or leakage.

G. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.03 TAB COORDINATION

A. TAB: Testing, adjusting, and balancing of HVAC.

B. Coordinate commissioning schedule with TAB schedule.

C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.

D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.

E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.

F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

3.04 CONTROL SYSTEM FUNCTIONAL TESTING

A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of the Contract Documents and the detailed Sequences of Operation documentation submittal.

B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with the contract documents.

C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.

D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.

1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.

2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.

E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.

F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.

1. Setpoint changing features and functions.

2. Sensor calibrations.

G. Demonstrate to the Commissioning Authority:

1. That all specified functions and features are set up, debugged and fully operable.

2. That scheduling features are fully functional and setup, including holidays.

3. That all graphic screens and value readouts are completed.

4. Correct date and time setting in central computer.

5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.

6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.

7. Power failure and battery backup and power-up restart functions.

8. Global commands features.

9. Security and access codes.

10. Occupant over-rides (manual, telephone, key, keypad, etc.).

11. O&M schedules and alarms.

12. Occupancy sensors and controls.

13. “After hours” use tracking and billing.

14. Communications to remote sites.

15. Fire alarm interlocks and response.

16. Fire protection and suppression systems interfaces.

17. Security system interlocks.

18. That points that are monitored only, having no control function, are reporting properly to the control system.

19. All control strategies and sequences not tested during controlled equipment testing.

20. Trend logging and graphing features that are specified.

21. Other integrated tests specified in the contract documents

22. That control system features that are included but not specified to be setup are actually installed.

H. Perform and submit trend logging on the following using the control system, for minimum period of 5 days including one weekend, if the control points are monitored by the control system:

1. Duty cycling, if specified.

2. Demand limiting, including over-ride of limiting.

3. Sequential staging ON of equipment; optionally demonstrate manually.

4. Optimum start-stop functions.

5. Miscellaneous equipment current or status for duty cycling and demand limiting.

6. Equipment or building kW or current for demand limiting.

7. Equipment optimum start/stop functions.

I. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

3.05 OPERATION AND MAINTENANCE MANUALS

A. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

B. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

C. Commissioning Authority will add commissioning records to manuals after submission to Owner.

3.06 DEMONSTRATION AND TRAINING

A. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.

B. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.

C. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:

1. HVAC Control System: 1 hours.

2. Air Handling Units: 1 hours.

3. Air Terminal Units: 1 hours.

4. Packaged Rooftop Units: 1 hours.

5. Computer Room AC Units: 1 hours.

6. Split System AC or Heat Pumps: 1 hours.

7. Restroom Central Exhaust Fans: 1 hours.

D. TAB Review: Instruct Owner's personnel for minimum 1 hours, after completion of TAB, on the following:

1. Review final TAB report, explaining the layout and meanings of each data type.

2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.

3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.

4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.

5. Other salient information that may be useful for facility operations, relative to TAB.

E. HVAC Control System Training: Perform training in at least three phases:

1. Phase 1 - Basic Control System: Provide minimum of 1 hours of actual training on the control system itself. Upon completion of training, each attendee, using appropriate documentation, should be able to perform elementary operations and describe general hardware architecture and functionality of the system.

    a. This training may be held on-site or at the manufacturer's facility.

    b. If held off-site, the training may occur prior to final completion of the system installation.

    c. For off-site training, Contractor shall pay expenses of up to two attendees.

2. Phase 2 - Integrating with HVAC Systems: Provide minimum of 1 hours of on-site, hands-on training after completion of Functional Testing. Include instruction on:

    a. The specific hardware configuration of installed systems in this facility and specific instruction for operating the installed system, including interfaces with other systems, if any.

    b. Security levels, alarms, system start-up, shut-down, power outage and restart routines, changing setpoints and alarms and other typical changed parameters, overrides, freeze protection, manual operation of equipment, optional control strategies that can be considered, energy savings strategies and set points that if changed will adversely affect energy consumption, energy accounting, procedures for obtaining vendor assistance, etc.

    c. Trend logging and monitoring features (values, change of state, totalization, etc.), including setting up, executing, downloading, viewing both tabular and graphically and printing trends; provide practice in setting up trend logging and monitoring during training session.

    d. Every display screen, allowing time for questions.

    e. Use of keypad or plug-in laptop computer at the zone level.

    f. Use of remote access to the system via phone lines or networks.

    g. Setting up and changing an air terminal unit controller.

    h. Graphics generation.

    i. Point database entry and modifications.

j. Understanding DDC field panel operating programming, when applicable.

F. Provide the services of manufacturer representatives to assist instructors where necessary.

G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

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SECTION 15015
HVAC AIR DUCT CLEANING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cleaning of HVAC duct system, equipment, and related components.

B. Testing and inspection agency employed by Owner.

1.02 RELATED REQUIREMENTS

A. Section 15012 - Commissioning of HVAC.

1.03 DEFINITIONS

A. HVAC System: For purposes of this section, the surfaces to be cleaned include all interior surfaces of the heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system, including the inside of air distribution equipment, coils, and condensate drain pans; see NADCA ACR for more details.

1. Above-ceiling plenum for supply air is required to be cleaned.

2. Above-ceiling plenum for return air is required to be cleaned.

3. Makeup air system is required to be cleaned.

4. Exhaust-only system is required to be cleaned.

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

B. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems; 2014.

C. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current Edition, Including All Revisions.

D. UL 181A - Standard for Closure Systems for Use with Rigid Air Ducts; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used.

B. Qualifications Statement: Submit qualifications of proposed cleaning contractor for approval.

C. Qualifications Statement: Submit qualifications of proposed testing and inspection agency for approval.

D. Project Cleanliness Evaluation and Cleaning Plan, as specified.

E. Material Safety Data Sheets (MSDS): For all chemical products proposed to be used in the cleaning process; submit directly to Owner.

F. Project Closeout Report: Include field quality control reports, evidence of satisfactory cleaning, and documentation of items needing further repair.

1.06 QUALITY ASSURANCE

A. Information Available to Contractor: Upon request, Owner will provide the following:

1. One copy of original construction drawings of HVAC system.

2. One copy of original construction specifications of HVAC system.

3. Cleanliness inspection report performed by separate contractor.

4. Indoor air quality report performed by separate contractor.

5. Hazardous material report performed by separate contractor.

B. Cleaning Contractor Qualifications: Company specializing in the cleaning and restoration of HVAC systems as specified in this section.

1. Certified by one of the following:

a. NADCA, National Air Duct Cleaners Association: www.nadca.com

b. Nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.

2. Having minimum of three years documented experience.

3. Employing for this project a supervisor certified as an Air Systems Cleaning Specialist by NADCA.

4. Employing for this project a supervisor certified by same organization that certified the cleaning contractor.

C. Testing and Inspection Agency Qualifications: Experienced in inspection and testing using methods defined in NADCA ACR.

PART 2 PRODUCTS

2.01 TOOLS AND EQUIPMENT

A. Vacuum Devices and Other Tools: Exceptionally clean, in good working order, and sealed when brought into the facility.

B. Vacuum Devices That Exhaust Air Inside Building, Including Hand-Held and Wet Vacuums: Equipped with HEPA filtration with 99.97 percent collection efficiency for minimum 0.3-micron size particles and DOP test number.

C. Vacuum Devices That Exhaust Air Outside Building, Including Truck- and Trailer-Mounted Types: Equipped with particulate collection including adequate filtration to contain debris removed from the HVAC system; exhausted in manner that prevents contaminant re-entry to building; compliant with applicable regulations as to outdoor environmental contamination.

2.02 REPLACEMENT PRODUCTS

A. Fibrous Glass Insulation: Provide material complying with UL 181 equivalent to existing material in quality and thickness.

2.03 SURFACE TREATMENTS

A. Anti-Microbial Materials: EPA registered specifically for use on non-porous HVAC system surfaces and applied per manufacturer's instructions.

B. Surface Coating for Fibrous Glass Materials: Water-based, zero VOC; flame spread index less that 25, smoke developed index less than 450, when tested in accordance with ASTM E84.

PART 3 EXECUTION

3.01 PROJECT CONDITIONS

A. Comply with applicable federal, state, and local requirements.

B. Perform cleaning, inspection, and remediation in accordance with the recommendations of NADCA "Assessment, Cleaning and Restoration of HVAC Systems" (ACR) and as specified herein.

C. Where NADCA ACR uses the terms "recommended", "highly recommended", or "ideally" in regard to a certain procedure or activity, do that unless it is clearly inapplicable to the project.

D. Take precautions to prevent introduction of additional hazards into occupied spaces.

E. Obtain Owner's approval of proposed temporary locations for large equipment.

F. Designate a decontamination area and obtain Owner's approval.

G. When portions of the facility are to remain occupied or in operation during cleaning activities, provide adequate controls or containment to prevent access to spaces being cleaned by unauthorized persons and provide detailed instructions to Owner as to these controls or containment.

H. If unforeseen mold or other biological contamination is encountered, notify Architect immediately, identifying areas affected and extent and type of contamination.

3.02 EXAMINATION

A. Prior to the commencement of any cleaning work, prepare and submit to Architect a project evaluation and plan for this project, including considerations recommended in NADCA ACR.

B. Inspect the system as required to determine appropriate methods, tools, equipment, and protection.

C. Start of cleaning work constitutes acceptance of existing conditions.

D. When concealed spaces are later made accessible, examine and document interior conditions prior to beginning cleaning.

E. Document all instances of mold growth, rodent droppings, other biological hazards, and damaged system components.

3.03 PREPARATION

A. When cleaning work might adversely affect life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with authorities having jurisdiction.

B. Ensure that electrical components that might be adversely affected by cleaning are de-energized, locked out, and protected prior to beginning work.

C. Air-Volume Control Devices: Mark the original position of dampers and other air-directional mechanical devices inside the HVAC system prior to starting cleaning.

D. Access to Concealed Spaces: Use existing service openings and make additional service openings as required to accomplish cleaning and inspection.

1. Do not cut openings in non-HVAC components without obtaining the prior approval of Owner.

2. Make new openings in HVAC components in accordance with NADCA Standard 05; do not compromise the structural integrity of the system.

3. Do not cut service openings into flexible duct; disconnect at ends for cleaning and inspection.

E. Ceiling Tile: Lay-in ceiling tile may be removed to gain access to HVAC systems during the cleaning process; protect tile from damage and reinstall upon completion; replace damaged tile.

3.04 CLEANING

A. Use any cleaning method recommended by NADCA ACR unless otherwise specified; do not use methods prohibited by NADCA ACR, or that will damage HVAC components or other work, or that will significantly alter the integrity of the system.

B. Obtain Owner's approval before using wet cleaning methods; ensure that drainage is adequate before beginning.

C. Ducts: Mechanically clean all portions of ducts.

D. Hoses, Cables, and Extension Rods: Clean using suitable sanitary damp wipes at the time they are being removed or withdrawn from their normal position.

E. Registers, Diffusers, and Grilles: When removing, take care to prevent containment exposure due to accumulated debris.

F. Coils: Follow NADCA ACR completely including measuring static pressure drop before and after cleaning; do not remove refrigeration coils from system to clean; report coils that are permanently impacted.

G. Fibrous Glass Material: Use HEPA vacuuming equipment, under constant negative pressure, do not permit to get wet, and do not damage surfaces; replace material damaged by cleaning operations.

H. Existing Damaged Fibrous Glass Material: Report to Architect all evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture that cannot be remedied by cleaning or resurfacing with an acceptable insulation repair coating.

1. Material with active fungal growth is considered unremediable.

2. Remove unremediable material and clean underlying surfaces.

3. Where surface damage can be repaired by applying a coating, do so at no extra cost to Owner.

4. Replace unremediable material at no extra cost to Owner.

5. Replace unremediable material.

6. Replacement of unremediable material is not covered by this specification.

I. Collect debris removed during cleaning; ensure that debris is not dispersed outside the HVAC system during the cleaning process.

J. Store contaminated tools and equipment in polyethylene bags until cleaned in the designated decontamination area.

3.05 REPAIR

A. Repair openings cut in the ventilation system so that they do not significantly alter the airflow or adversely impact the facility's indoor air quality.

B. At insulated ducts and components, accomplish repairs in such a manner as to achieve the equivalent thermal value.

C. Reseal new openings in accordance with NADCA Standard 05.

D. Reseal rigid fiber glass duct systems using closure techniques that comply with UL 181 or UL 181A.

E. When new openings are intended to be capable of being re-opened in the future, clearly mark them and report their locations to Owner in project report documents.

3.06 FIELD QUALITY CONTROL

A. Ensure that the following field quality control activities are completed prior to application of any treatments or coatings and prior to returning HVAC system to normal operation.

B. Employ an independent testing and inspection agency to inspect, test, and prepare documentation.

C. Visually inspect all portions of the cleaned components; if not visibly clean as defined in NADCA ACR, re-clean and reinspect.

D. Coils: Cleaning must restore the coil pressure drop to within 10 percent of the coil's original installed pressure drop; if original pressure drop is not known, coil will be considered clean if free of foreign matter and chemical residue based on visual inspection.

E. Notify Architect when cleaned components are ready for inspection.

F. Notify Owner's testing and inspection agency when cleaned components are ready for inspection.

G. Owner reserves the right to verify cleanliness using NADCA ACR Surface Comparison Testing or NADCA Vacuum Test.

H. When directed, re-clean components until they pass.

I. Contractor shall bear the costs of retesting due to inadequate cleaning.

J. Submit evidence that all portions of the system required to be cleaned have been cleaned satisfactorily.

3.07 ANTI-MICROBIAL TREATMENT

A. When directed, apply anti-microbial treatment to internal surfaces.

B. Apply anti-microbial agent after removal of surface deposits and debris.

C. Apply anti-microbial treatments and coatings in strict accordance with the manufacturer's written recommendations and EPA registration listing.

D. Spray coatings directly onto interior ductwork surfaces; do not "fog" into air stream.

3.08 ADJUSTING

A. After satisfactory completion of field quality control activities, restore adjustable devices to original settings, including, but not limited to, dampers, air directional devices, valves, fuses, and circuit breakers.

3.09 WASTE MANAGEMENT

A. Double-bag all waste and debris in 0.24 inch (6 mm) polyethylene bags.

B. Dispose of debris off-site in accordance with applicable federal, state and local requirements.

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SECTION 15076

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Ductwork: Nameplates.

G. Heat Transfer Equipment: Nameplates.

H. Instrumentation: Tags.

I. Major Control Components: Nameplates.

J. Piping: Tags.

K. Pumps: Nameplates.

L. Relays: Tags.

M. Small-sized Equipment: Tags.

N. Tanks: Nameplates.

O. Thermostats: Nameplates.

P. Valves: Tags and ceiling tacks where located above lay-in ceiling.

Q. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.

2. Brimar Industries: www.pipemarker.com.

3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

4. Seton Identification Products: www.seton.com.

B. Letter Color: White.

C. Letter Height: 1/4 inch (6 mm).

D. Background Color: Black.

E. Plastic: Conform to ASTM D709.

2.03 TAGS

A. Manufacturers:

1. Advanced Graphic Engraving: www.advancedgraphicengraving.com.

2. Brady Corporation: www.bradycorp.com.

3. Brimar Industries, Inc.: www.pipemarker.com.

4. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

5. Seton Identification Products: www.seton.com.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch (40 mm) diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch (40 mm) diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:

1. Brimar Industries, Inc.: www.pipemarker.com.

B. Material: High gloss acrylic adhesive-backed vinyl film; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Yellow/Black.

2.05 STENCILS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com.

2. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

3. Seton Identification Products: www.seton.com.

B. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch (20-30 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 1/2 inch (15 mm) high letters.

2. 1-1/2 to 2 inch (40-50 mm) Outside Diameter of Insulation or Pipe: 8 inch (200 mm) long color field, 3/4 inch (20 mm) high letters.

3. 2-1/2 to 6 inch (65-150 mm) Outside Diameter of Insulation or Pipe: 12 inch (300 mm) long color field, 1-1/4 inch (30 mm) high letters.

4. 8 to 10 inch (200-250 mm) Outside Diameter of Insulation or Pipe: 24 inch (600 mm) long color field, 2-1/2 inch (65 mm) high letters.

5. Over 10 inch (250 mm) Outside Diameter of Insulation or Pipe: 32 inch (800 mm) long color field, 3-1/2 inch (90 mm) high letters.

6. Ductwork and Equipment: 2-1/2 inch (65 mm) high letters.

C. Stencil Paint: As specified in Section 09912, semi-gloss enamel, colors conforming to ASME A13.1.

2.06 PIPE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradycorp.com.

2. Brimar Industries, Inc.: www.pipemarker.com.

3. Kolbi Pipe Marker Co.: www.kolbipipemarkers.com.

4. MIFAB, Inc.: www.mifab.com.

5. Seton Identification Products: www.seton.com.

B. Color: Conform to ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

F. Color code as follows:

1. Heating, Cooling, and Boiler Feedwater: Green with white letters.

2. Toxic and Corrosive Fluids: Orange with black letters.

3. Compressed Air: Blue with white letters.

2.07 CEILING TACKS

A. Manufacturers:

1. Craftmark: www.craftmarkid.com.

B. Description: Steel with 3/4 inch (20 mm) diameter color coded head.

C. Color code as follows:

1. HVAC Equipment: Yellow.

2. Fire Dampers and Smoke Dampers: Red.

3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch (20 mm) diameter and smaller.

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

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SECTION 15083
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus; 2013.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

L. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2013.

M. ASTM C585 - Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System); 2010.

N. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2013.

O. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2011.

P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

R. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

T. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Samples: Submit two samples of any representative size illustrating each insulation type.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.06 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com.

2. Johns Manville Corporation: www.jm.com.

3. Knauf Insulation: www.knaufinsulation.com.

4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com.

5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).

2. Maximum service temperature: 850 degrees F (454 degrees C).

3. Maximum moisture absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.

1. 'K' ('Ksi') Value: ASTM C177, 0.23 at 75 degrees F (0.034 at 24 degrees C).

2. Maximum Service Temperature: 220 degrees F (104 degrees C).

3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' ('Ksi') value: ASTM C177, 0.24 at 75 degrees F (0.035 at 24 degrees C).

2. Maximum service temperature: 650 degrees F (343 degrees C).

3. Maximum moisture absorption: 0.2 percent by volume.

E. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches (0.029 ng/Pa s m).

F. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

G. Vapor Barrier Lap Adhesive: Compatible with insulation.

H. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

I. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.

2. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.

3. Weave: 5x5.

J. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.

2. Vinyl emulsion type acrylic, compatible with insulation, black color.

K. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

L. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

M. Insulating Cement: ASTM C449.

2.03 CELLULAR GLASS

A. Manufacturers:

1. Pittsburgh Corning Corporation: www.foamglasinsulation.com.

B. Insulation: ASTM C552, Type II.

1. Apparent Thermal Conductivity; 'K' ('Ksi') value: Grade 6, 0.35 at 100 degrees F (0.050 at 38 degrees C).

2. Service Temperature: Up to 800 degrees F (427 degrees C).

3. Water Absorption: 0.5 percent by volume, maximum.

2.04 EXPANDED POLYSTYRENE

A. Insulation: ASTM C578; rigid closed cell.

1. 'K' ('Ksi') value: 0.23 at 75 degrees F (0.033 at 24 degrees C).

2. Maximum service temperature: 165 degrees F (74 degrees C).

3. Maximum water vapor permeance: 5.0 perms (287 ng/Pa s sq m)

2.05 EXPANDED PERLITE

A. Manufacturers:

1. Schundler Company: www.schundler.com.

B. Insulation: ASTM C610, molded.

1. Maximum service temperature: 1200 degrees F (649 degrees C).

2. Maximum water vapor transmission: 0.1 perm.

2.06 HYDROUS CALCIUM SILICATE

A. Manufacturers:

1. Johns Manville Corporation: www.jm.com.

B. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.

1. 'K' ('Ksi') value: ASTM C177 and C518; 0.40 at 300 degrees F (0.057 at 149 degrees C), when tested in accordance with ASTM C177 or ASTM C518.

2. Maximum service temperature: 1200 degrees F (649 degrees C).

3. Density: 15 lb/cu ft (240 kg/cu m).

C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.

D. Insulating Cement: ASTM C449.

2.07 POLYISOCYANURATE CELLULAR PLASTIC

A. Insulation Material: ASTM C591, rigid molded modified polyisocyanurate cellular plastic.

1. Dimension: Comply with requirements of ASTM C585.

2. 'K' ('Ksi') value: 0.18 at 75 degrees F (0.026 at 24 degrees C), when tested in accordance with ASTM C518.

3. Minimum Service Temperature: Minus 70 degrees F (Minus 57 degrees C).

4. Maximum Service Temperature: 300 degrees F (150 degrees C).

5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D2842..

6. Moisture Vapor Transmission: 4.0 perm inch (5.8 ng/Pa s m).

7. Connection: Waterproof vapor barrier adhesive.

2.08 POLYETHYLENE

A. Manufacturers:

1. Armacell LLC: www.armacell.us.

B. Insulation: Flexible closed-cell polyethylene tubing, slit lengthwise for installation, complying with applicable requirements of ASTM D1056.

1. 'K' ('Ksi') value: ASTM C177; 0.25 at 75 degrees F (0.036 at 24 degrees C).

2. Maximum Service Temperature: 300 degrees F (150 degrees C).

3. Density: 2 lb/cu ft (32 kg/cu m).

4. Maximum Moisture Absorption: 1.0 percent by volume.

5. Moisture Vapor Permeability: 0.05 perm inch (0.073 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

6. Connection: Contact adhesive.

2.09 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc: www.aeroflexusa.com.

2. Armacell LLC: www.armacell.us.

3. K-Flex USA LLC: www.kflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F (Minus 40 degrees C).

2. Maximum Service Temperature: 220 degrees F (104 degrees C).

3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.10 JACKETS

A. PVC Plastic.

1. Manufacturers:

a. Johns Manville Corporation: www.jm.com.

2. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F (minus 18 degrees C).

b. Maximum Service Temperature: 150 degrees F (66 degrees C).

c. Moisture Vapor Permeability: 0.002 perm inch (0.0029 ng/Pa s m), maximum, when tested in accordance with ASTM E96/E96M.

d. Thickness: 10 mil (0.25 mm).

e. Connections: Brush on welding adhesive.

3. Covering Adhesive Mastic: Compatible with insulation.

B. ABS Plastic:

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: minus 40 degrees F (minus 40 degrees C).

b. Maximum Service Temperature of 180 degrees F (82 degrees C).

c. Moisture Vapor Permeability: 0.012 perm inch (0.018 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

d. Thickness: 30 mil (0.76 mm).

e. Connections: Brush on welding adhesive.

C. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive: Compatible with insulation.

D. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch (0.40 mm) sheet.

2. Finish: Smooth.

3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.

4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

E. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.

1. Thickness: 0.010 inch (0.25 mm).

2. Finish: Smooth.

3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F (60 degrees C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. For hot piping conveying fluids over 140 degrees F (60 degrees C), insulate flanges and unions at equipment.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.

2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:

1. Application: Piping 1-1/2 inches (40 mm) diameter or larger.

2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.

3. Insert location: Between support shield and piping and under the finish jacket.

4. Insert configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.

5. Insert material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

M. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil (0.025 mm) thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

N. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

END OF SECTION

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SECTION 15086
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Duct Liner.

C. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 15076 - Identification for HVAC Piping and Equipment.

B. Section 15810 - Ducts: Glass fiber ducts.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

D. ASTM C553 - Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 1985 (Reapproved 2007).

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

H. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2011.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2013.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

M. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Samples: Submit two samples of any representative size illustrating each insulation type.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum Three years of experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation: www.knaufusa.com.

2. Johns Manville: www.jm.com.

3. Owens Corning Corporation: www.ocbuildingspec.com.

4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. 'K' ('Ksi') value: 0.36 at 75 degrees F (0.052 at 24 degrees C), when tested in accordance with ASTM C518.

2. Maximum Service Temperature: 1200 degrees F (649 degrees C).

3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter (1.29 mm diameter).

2.03 GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation: www.knaufusa.com.

2. Johns Manville: www.jm.com.

3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com.

4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.

1. 'K' ('Ksi') value: 0.24 at 75 degrees F (0.036 at 24 degrees C), when tested in accordance with ASTM C518.

2. Maximum service temperature: 450 degrees F (232 degrees C).

3. Maximum Water Vapor Sorption: 5.0 percent.

4. Maximum Density: 8.0 lb/cu ft (128 kg/cu m).

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.02 perm inch (0.029 ng/Pa s m), when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.

2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd (220 g/sq m) plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:

a. Compatible with insulation.

B. Mineral Fiber (Outdoor) Jacket: Asphalt impregnated and coated sheet, 50 lb/square (2.45 kg/sq m).

C. Aluminum Jacket: ASTM B209 (ASTM B209M).

1. Thickness: 0.016 inch (0.40 mm) sheet.

2. Finish: Smooth.

3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.

4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.

5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

6. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

2.05 DUCT LINER

A. Manufacturers:

1. Knauf Insulation: www.knaufusa.com.

2. Johns Manville: www.jm.com.

3. Owens Corning Corporation; QuietR Rotary Duct Insulation: www.ocbuildingspec.com.

4. CertainTeed Corporation: www.certainteed.com.

B. Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board, and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer, or black composite.

1. Fungi Resistance: ASTM G21.

2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F (0.045 at 24 degrees C).

3. Service Temperature: Up to 250 degrees F (121 degrees C).

4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm (25.4 m/s), minimum.

5. Minimum Noise Reduction Coefficients:

a. 1/2 inch (13 mm) Thickness: 0.30.

b. 1 inch (25 mm) Thickness: 0.45.

c. 1-1/2 inches (40 mm) Thickness: 0.60.

d. 2 inch (50 mm) Thickness: 0.70.

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air below ambient temperature:

1. Provide insulation with vapor barrier jackets.

2. Finish with tape and vapor barrier jacket.

3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated ducts conveying air above ambient temperature:

1. Provide with or without standard vapor barrier jacket.

2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet (3 meters) above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket.

G. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.

2. Secure insulation without vapor barrier with staples, tape, or wires.

3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.

4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.

5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 90 percent coverage.

2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.

3. Seal and smooth joints. Seal and coat transverse joints.

4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

END OF SECTION

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SECTION 15671

AIR COOLED CONDENSING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Condensing unit package.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Refrigerant piping connections.

E. Motor starters.

F. Electrical power connections.

1.02 RELATED REQUIREMENTS

A. Section 15720 - Air Handling Units.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. AHRI 365 - Commercial and Industrial Unitary Air-Conditioning Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute; 2009.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013 (ANSI/ASHRAE Std 15).

D. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010.

E. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013 (ANSI/ASHRAE/IESNA Std 90).

F. ASHRAE Std 90.2 - Energy-Efficient Design of New Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

H. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

I. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Refer to Drawings

1.05 SUBMITTALS

A. Product Data: Provide rated capacities, weights specialties and accessories, electrical nameplate data, and wiring diagrams. Include equipment served by condensing units in submittal, or submit at same time, to ensure capacities are complementary.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Lubricating Oil: One complete change.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Include schematic layouts showing condensing units, cooling coils, refrigerant piping, and accessories required for complete system.

D. Design Data: Indicate pipe and equipment sizing.

E. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

F. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

G. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.08 WARRANTY

A. Provide a five year warranty to include coverage for refrigerant compressors.

PART 2 PRODUCTS

2.01 MANUFACTURED UNITS

A. Units: Self-contained, packaged, factory assembled and pre-wired units suitable for outdoor use consisting of cabinet, compressors, condensing coil and fans, integral sub-cooling coil, controls, liquid receiver, wind deflector, and screens.

B. Construction and Ratings: In accordance with AHRI 210/240. Test in accordance with ASHRAE Std 23.

C. Performance Ratings: Energy Efficiency Rating (EER) and Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1.

D. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

E. Manufacturers:

1. Trane Inc: www.trane.com

    a. Models: TTA120F4, 4TTA3060D4, TTA090D4, RAUJ30, TTA150E4

2. Carrier Corperation: www.carrier.com.

3. York International Corporation / Johnson Controls: www.york.com.

2.02 CASING

A. House components in welded steel frame with galvanized steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners and piano hinges.

2.03 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless copper tubing. Provide sub-cooling circuits. Air test under water to 425 psig (2900 kPa), and vacuum dehydrate. Seal with holding charge of nitrogen.

B. Coil Guard: Expanded metal with lint screens.

2.04 FANS AND MOTORS

A. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge. Equip with roller or ball bearings with grease fittings extended to outside of casing.

B. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or 3 phase, with permanent lubricated ball bearings and built in current and thermal overload protection. Refer to Section 23 0513.

C. Horizontal discharge, double width, double inlet forward curved centrifugal type condenser fans, equipped with roller or ball bearings with grease fittings extended to outside of casing, V-belt drive with belt guard.

2.05 COMPRESSORS

A. Compressor: Semi-hermetic reciprocating type.

B. Mounting: Statically and dynamically balance rotating parts and mount on spring vibration isolators. Internally isolate hermetic units on springs. Refer to Section 22 0548.

C. Lubrication System: Reversible, positive displacement oil pump with oil charging valve, oil level sight glass, and magnetic plug or strainer.

D. Motor: Constant speed 1800 rpm suction gas cooled with electronic sensor and winding over temperature protection, designed for across-the-line starting. Refer to Section 22 0513. Furnish with starter.

E. Capacity Reduction Equipment: Suction valve unloaders, with lifting mechanism operated by electrically actuated solenoid valve, with unloaded compressor start; controlled from suction pressure.

F. Sump Oil Heater: Evaporates refrigerant returning to sump during shut down. Energize heater continuously when compressor is not operating.

2.06 REFRIGERANT CIRCUIT

A. Provide each unit with one refrigerant circuit, factory supplied and piped.

B. For each refrigerant circuit, provide:

1. Filter dryer replaceable core type.

2. Liquid line sight glass and moisture indicator.

3. Thermal expansion valve for maximum operating pressure.

4. Insulated suction line.

5. Suction and liquid line service valves and gage ports.

6. Liquid line solenoid valve.

7. Charging valve.

8. Discharge line check valve.

9. Compressor discharge service valve.

10. Condenser pressure relief valve.

C. For heat pump units, provide reversing valve, suction line accumulator, discharge muffler, flow control check valve, and solid-state defrost control utilizing thermistors.

2.07 CONTROLS

A. On unit, mount weatherproof steel control panel, NEMA 250, containing power and control wiring, molded case disconnect switch, factory wired with single point power connection.

B. For each compressor, provide across-the-line starter, non-recycling compressor overload, starter relay, and control power transformer or terminal for controls power. Provide manual reset current overload protection. For each condenser fan, provide across-the-line starter with starter relay.

C. Provide safety controls arranged so any one will shut down machine:

1. High discharge pressure switch (manual reset) for each compressor.

2. Low suction pressure switch (automatic reset) for each compressor.

3. Oil Pressure switch (manual reset).

D. Provide the following operating controls:

1. Thermostat located in room cycles compressors activates cylinder unloaders.

2. One minute off timer prevents compressor from short cycling.

3. Periodic pump-out timer to pump down on high evaporator refrigerant pressure.

4. Low ambient temperature controls.

5. Hot gas bypass sized for minimum compressor loading on one compressor only, bypasses hot refrigerant gas to evaporator.

6. Lead-lag switch to alternate compressor operation.

7. Low ambient thermostat to lock out compressor at low ambient temperatures.

E. Provide controls to permit operation down to 0 degrees F (-18 degrees C) ambient temperature.

1. Thermostat to cycle fan motors in response to outdoor ambient temperature.

2. Head pressure switch to cycle fan motors in response to refrigerant condensing pressure.

3. Solid state control to vary speed of one condenser fan motor in response to refrigerant condensing pressure.

4. Electronic control consisting of mixing damper assembly, controlled to maintain constant refrigerant condensing pressure.

F. Gages: Prepiped for suction and discharge refrigerant pressures and oil pressure for each compressor.

G. For multiple units, provide remote mounted sequence panel to allow operation with lead-lag switching and time delay timer.

H. Provide electric solid state microcomputer based room thermostat, located as indicated.

1. Incorporate:

a. Automatic switching from heating to cooling.

b. Preferential rate control to minimize overshoot and deviation from set point.

c. Set-up for four separate temperatures per day.

d. Instant override of setpoint for continuous or timed period from one hour to 31 days.

e. Short cycle protection.

f. Programming based on weekdays, Saturday and Sunday.

g. Switch selection features including imperial or metric display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

2. Display shall include:

a. Time of Day.

b. Actual room temperature.

c. Programmed temperature.

d. Programmed time.

e. Duration of timed override.

f. Day of week.

g. System mode indication: Heating, cooling, auto, off, fan auto, fan on.

h. Stage (heating or cooling) operation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Complete structural, mechanical, and electrical connections in accordance with manufacturer's installation instructions.

C. Provide for connection to electrical service. Refer to Section 16155.

D. Provide connection to refrigeration piping system and evaporators. Comply with ASHRAE Std 15.

3.02 SYSTEM STARTUP

A. Supply initial charge of refrigerant and oil for each refrigeration system. Replace losses of oil or refrigerant prior to end of correction period.

B. Charge system with refrigerant and test entire system for leaks after completion of installation. Repair leaks, put system into operation, and test equipment performance.

C. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

D. Provide cooling season start-up, and winter season shut-down for first year of operation.

E. Inspect and test for refrigerant leaks during first year of operation.

END OF SECTION

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SECTION 15720
AIR HANDLING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Casing construction.

B. Fan section.

C. Coil section.

D. Integral face and bypass coil section.

E. Filter and air cleaner section.

F. Damper section.

G. Airflow measurement.

H. Silencer section.

I. Access section.

J. Air blender section.

K. Diffuser section.

L. Turning and discharge plenum section.

M. Controls.

N. Roof mounting curb.

1.02 RELATED REQUIREMENTS

A. Section 15950 - Testing, Adjusting, and Balancing.

B. Section 15083 - HVAC Piping Insulation.

C. Section 15820 - Duct Accessories: Flexible duct connections.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; American Bearing Manufacturers Association, Inc.; 2015.

B. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings; American Bearing Manufacturers Association, Inc.; 2014.

C. ACGIH - Ultraviolet Radiation, TLV Physical Agents; 2010, 7th edition.

D. AHRI 260 - Sound Rating of Ducted Air Moving and Conditioning Equipment; 2011.

E. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; Air-Conditioning, Heating, and Refrigeration Institute; 2001 (R2011).

F. AHRI 430 (I-P) - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2014.

G. AHRI 610 - Performance Rating of Central System Humidifiers for Residential Applications; Air-Conditioning, Heating, and Refrigeration Institute; 2004.

H. AHRI 1060 I-P - Performance Rating of Air-to-Air Heat Exchangers for Energy Recovery Ventilation Equipment; 2011.

I. AMCA 99 - Standards Handbook; Air Movement and Control Association International, Inc.; 2010.

J. AMCA 210 - Laboratory Methods of Testing Fans for Aerodynamic Performance Rating; Air Movement and Control Association International, Inc.; 2007 (ANSI/AMCA 210, same as ANSI/ASHRAE 51).

K. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; Air Movement and Control Association International, Inc.; 2008.

L. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; Air Movement and Control Association International, Inc; 2007.

M. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2012.

N. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

O. AMCA 611 - Certified Ratings Program for Airflow Measurement Stations; 2010.

P. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.

Q. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2013.

R. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).

S. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.

T. ASTM E477 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers; 2013.

U. CGA 3.2 - Industrial and Commercial Gas-Fired Package Furnaces; Current Edition, Including All Amendments.

V. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

W. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

X. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2012.

Y. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

Z. UL (EAUED) - Electrical Appliance and Utilization Equipment Directory; current edition.

AA. UL 153 - Portable Electric Luminaries; Current Edition, Including All Revisions.

AB. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Current edition, including all revisions.

AC. UL 508 - Industrial Control Equipment; Current Edition, Including All Revisions.

AD. UL 795 - Commercial-Industrial Gas Heating Equipment; Current Edition, Including All Revisions.

AE. UL 1598 - Luminaires; Current Edition, Including All Revisions.

AF. UL 1812 - Ducted Heat Recovery Ventilators; Current Edition, Including All Revisions.

AG. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of HVAC with size, location and installation of service utilities.

B. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.

C. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

D. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. Product Data:

1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.

2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.

4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.

5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

B. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Samples: Submit two of each type of replacement filter media with frame.

E. Specimen Warranty: Submit sample of manufacturer's warranty.

F. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

G. Manufacturer's Instructions: Include installation instructions.

H. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fan Belts: One set for each unit.

2. Extra Filters: One set for each unit.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.09 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Trane Inc: www.trane.com.

1. Models: MCCA08, TWE061D4, MCAA10, CSAA-1

B. Daikin Applied: www.daikinapplied.com.

C. Carrier Corporation: www.carrier.com.

D. York International Corporation / Johnson Controls Inc: www.york.com.

2.02 CASING CONSTRUCTION

A. Full Perimeter Base Rail:

1. Construct of galvanized steel.

2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:

1. Construct of one piece, insulated, double wall panels.

2. Provide mid-span, no through metal, internal thermal break.

3. Construct outer panels of galvanized steel and inner panels of galvanized steel.

4. Casing Air Pressure Performance Requirements:

a. Able to withstand up to 8 inches w.g. (2 kPa) positive or negative static pressure.

b. Not to exceed 0.0042 inches per inch (0.0042 mm/mm) deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. (2 kPa) in all positive pressure sections and minus 8 inches w.g. (2 kPa) in all negative pressure sections.

C. Access Doors:

1. Construction, thermal and air pressure performance same as casing.

2. Provide surface mounted handles on hinged, swing doors.

3. Provide shatterproof viewing window designed to withstand operating pressures.

D. Outdoor Unit Roof:

1. Factory install single layer outer roof above inner roof.

2. Slope at a minimum of 0.125 inches per foot (10.41 mm/m) from one side of unit to the other side, or from center to sides of unit.

3. Roof assembly to overhang all unit walls or base rail to overhang curb to facilitate water runoff and prevent water intrusion into roof curb to base connection.

E. Outside Air and Exhaust Air Weather Hood:

1. Fabricate from same material as casing outer panel.

2. Extend hood past perimeter of unit casing opening so as not to instruct airflow path.

3. Paint hoods with same finish as external surface of outdoor units.

4. Provide inlet hood for each fresh air damper with a sine wave moisture eliminator to prevent entrainment of water into the unit from outside air.

5. Provide exhaust hoods for all exhaust air openings.

6. Size all hoods for 100 percent of nominal fresh air damper capacities.

7. Protect all hoods with bird screens to prevent nesting into entering or leaving air flow paths.

F. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities.

G. Casing Leakage: Seal all joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

H. Insulation:

1. Provide minimum thermal thickness of 12 R (2.29 RSI) throughout.

2. Completely fill all panel cavities in all directions preventing voids and settling.

3. Comply with NFPA 90A.

I. Drain Pan Construction:

1. Provide cooling coil sections with an insulated, double wall, galvanized steel drain pan complying with ASHRAE 62.1 for indoor air quality and sufficiently sized to collect all condensate.

2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.

3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.

4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

J. Bottom Inlet Units: Provide steel or aluminum walking grate on structural supports.

K. Louvers: Stationary, of galvanized steel, 4 inch (100 mm) deep with plenum, nylon bearings, 1/2 inch (13 mm) mesh, 0.04 inch (1.0 mm) galvanized wire bird screen in aluminum frame, and bearing AMCA Certified Ratings Seal in accordance with AMCA 500-L. Furnish adjustable louvers with hollow vinyl bulb edging on blades and foam side stops to limit leakage to maximum 2 percent at 4 inch wg (1 kPa) differential pressure when sized for 2000 fpm (10 m/s) face velocity.

L. Marine Lights:

1. Provide factory installed service module including GFCI receptacle independent from load side; designed to receive power from field supplied 120 volt source.

M. Finish:

1. Outdoor Units:

a. Coat external surface of unit casing with primer and minimum 1.5 mil, enamel paint finish.

b. Comply with salt spray test in accordance with ASTM B177/B177M.

c. Color: Manufacturer's standard color.

2. Indoor Units:

a. Provide exterior, galvanized steel panels without paint.

b. Provide exterior, galvanized steel panels with painted surface complying with ASTM B177/B177M.

c. Color: Manufacturer's standard color.

2.03 FAN SECTION

A. Type: Forward curved, single width, single inlet, centrifugal plug type fan, conforming to AMCA 99.

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting:

1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.

2. Factory mount motor on slide rails.

3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.

4. Provide built-in inertia base of welded steel with bottom sheet and reinforcing grid for concrete ballast.

5. Mount base on vibration isolators.

F. Mounting:

1. Locate motor, drive, and belt guard on integral casing framework on exterior of casing.

2. Provide ventilated weather cover of galvanized steel completely enclosing motor and drive with tachometer opening.

3. Mount casing on vibration isolators.

G. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

H. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect, variable frequency drive, external motor junction box.

I. Fan Accessories:

1. Variable inlet vanes.

2. Discharge dampers.

3. Damper operator.

J. Flexible Duct Connections:

1. For separating fan, coil, and adjacent sections.

2. Refer to Section 15820.

K. Supply Fan Performance Conforming to AHRI 430:

L. Return Fan Performance Conforming to AHRI 430:

M. Drives:

1. Conform to AMCA 99.

2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.

3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

4. V-Belt Drive: Cast iron or steel sheaves, dynamically balanced, bored to fit shafts, and keyed. Variable and adjustable pitch sheaves for motors 15 hp and under selected so required rpm is obtained with sheaves set at mid-position; fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

5. Belt Guard: Fabricate to SMACNA (DCS); 0.106 inch (2.6 mm) thick, 3/4 inch (20 mm) diamond mesh wire screen welded to steel angle frame or equivalent, prime coated. Secure to fan or fan supports without short circuiting vibration isolation, with provision for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

2.04 COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends exposed outside casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch (600 mm) downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Three break of galvanized steel, mounted over drain pan.

D. Refrigerant Coils:

1. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

2. Headers: Seamless copper tubes with silver brazed joints.

3. Liquid Distributors: Brass or copper venturi distributor with seamless copper distributor tubes.

4. Configuration: Down feed with bottom suction.

E. Electric Coils:

1. Assembly: Listed in UL (EAUED) and labeled, with terminal control box and hinged cover, splice box, coil, casing, and controls.

2. Coil: Enclosed copper tube, aluminum finned element.

3. Casing: Die formed channel frame of galvanized steel.

4. Controls: Automatic reset thermal cut-out, built-in magnetic contactors control circuit transformer and fuse.

2.05 FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Permanent Filters:

1. Media: 2 inch (50 mm), all-metal, viscous-impingement type, consisting of layers of cleanable wire mesh capable of operating up to a maximum of 625 fpm (3.17 m/s) without loss of efficiency and holding capacity.

2. Frame: Construct of galvanized steel.

3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE 52.2.

C. Throwaway Filters:

1. Media: 2 inch (50 mm) fiberglass with rigid supporting mesh across the leaving face, capable of operating up to a maximum of 500 fpm (2.54 m/s) without loss of efficiency and holding capacity.

2. Frame: Rigid.

3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE 52.2.

D. Pleated Media Filters:

1. Media: 2 inch (50 mm), 100 percent synthetic fibers, continuously laminated to a grid with water repellent adhesive, and capable of operating up to a maximum of 625 fpm (3.17 m/s) without loss of efficiency and holding capacity.

2. Frame: Steel wire grid.

3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE 52.2.

E. Bag Filters:

1. Media: 2 inch (50 mm), pleated, 8 MERV prefilter with fine-fiber, fiberglass bag filter, sealed into gasketed, metal headers, and capable of operating up to a maximum of 625 fpm (3.17 m/s) for without loss of efficiency and holding capacity.

2. Filter Rack: Side-access rack designed to hold the metal headers.

3. Minimum Efficiency Reporting Value: 12 MERV when tested in accordance with ASHRAE 52.2.

F. Cartridge Filters:

1. Media: 2 inch (50 mm), pleated, 8 MERV prefilter and 12 inch (305 mm) closely spaced, pleated, fine-fiber, cartridge filter, sealed into gasketed, metal headers, and capable of operating up to a maximum of 625 fpm (3.17 mps) for without loss of efficiency and holding capacity.

2. Filter Rack: Side-access rack designed to hold the metal headers.

3. Minimum Efficiency Reporting Value: 11 MERV when tested in accordance with ASHRAE 52.2.

G. Hi-Efficiency Filters:

1. Media: 2 inch (50 mm) prefilter and 4 inch (305 mm) closely spaced, pleated, fine fiber, hi-efficiency filter, sealed into a rigid frame, and capable of operating up to a maximum of 625 fpm (3.17 mps) without loss of efficiency and holding capacity.

2. Filter Rack: Side-access designed to hold rigid frames.

3. Minimum Efficiency Reporting Value: 11 MERV when tested in accordance with ASHRAE 52.2.

H. HEPA Filters:

1. Media: Continuously pleated, waterproof, micro-fiberglass; enclosed in a galvanized, steel frame with neoprene rubber seal applied to leaving air side, and capable of operating up to a maximum of 625 fpm (2.54 mps) without loss of efficiency and holding capacity.

2. Frame: Continuously welded, gasketed, front loaded filter frames, mounted inside section casing along with filter holding clips, requiring tooling to tighten and hold filter cells.

3. Minimum Efficiency: Not less than: 99.97 percent when tested in accordance with ASHRAE 52.2.

I. Differential Pressure Gage:

1. Provide factory installed dial type differential pressure gage, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.

2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F (minus 6.7 degrees C) to 120 degrees F (48.9 degrees C).

2.06 DAMPER SECTION

A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor, return, and exhaust air.

B. Internal Face and Bypass Section: Provide dampers to divert airflow around the heating, and cooling coils.

C. Internal Face Damper Section: Provide as scheduled within the air handling unit.

D. Damper Blades:

1. Double-skin airfoil design with metal, compressible jamb seals and extruded-vinyl blade-edge seals on all blades.

2. Self-lubricating stainless steel or synthetic sleeve bearings.

3. Comply with ASHRAE 90.1 for rated maximum leakage rate.

4. Base all leakage testing and pressure ratings on AMCA 500-D.

5. Arrange in parallel or opposed-blade configuration.

E. Barometric Relief Dampers:

1. Frame: Roll formed galvanized steel.

2. Blades: Roll formed galvanized steel.

3. Blade Seals: Extruded vinyl, mechanically attached to the blade edge.

4. Material:

a. Galvanized steel, single tie bar linkage for damper sections up to 24 inches (610 mm) wide.

b. Stainless steel, single tie bar linkage for damper sections larger than 24 inches (610 mm) wide.

c. Synthetic axle assembly mechanically locked onto blade edge for damper sections up to 42 inches (1067 mm).

d. Stainless steel axle and blade bracket assembly for damper sections larger than 42 inches (1067 mm) wide.

2.07 AIRFLOW MEASUREMENT

A. Flow Meter:

1. Provide airflow measurement system to directly measure fan airflow or measure differential pressure that can be used to calculate airflow without interfering with submitted airflow performance and noise levels.

2. Accuracy: Plus/minus 5 percent (device and transmitter) when operating within the stable operating region of the fan curve.

B. Air Flow Measurement Station:

1. Provide factory installed, airflow measurement station tested in accordance with AMCA 611 and bearing the AMCA Ratings Seal for Airflow Measurement Performance.

2. Station Location: Install in outdoor, return opening to measure airflow.

3. Damper Blades:

a. Galvanized steel or extruded aluminum construction.

b. Housed in galvanized steel or extruded aluminum frame and mechanically fastened to a rotating axle rod.

c. Comply with ASHRAE 90.1 for rated maximum leakage rate.

4. Measurement Range: Minimum of 15 percent to 100 percent of unit nominal flow.

5. Operation: Provide low voltage signal corresponding to actual airflow for controlling and documenting airflow.

6. Accuracy: Plus/minus 5 percent.

2.08 SILENCER SECTION

A. Provide rectangular silencer(s) to reduce airborne sound transmitted through the air handling unit.

1. Comply with ASTM E477 for forward or reverse flow of air and noise in same or opposite directions in accordance with project requirements.

2. Factory test silencer(s) as an appurtenance with sufficient number of test points to validate performance over the full operating range in accordance with AHRI 260.

2.09 ACCESS SECTION

A. Provide where indicated on the Drawings to allow for inspection, cleaning, and maintenance of field installed components.

B. Construct access doors same as previously specified within this Section.

2.10 AIR BLENDER SECTION

A. Provide factory engineered air mixers incorporating fixed blades with no moving parts.

B. Construction:

1. Material: 0.80 inches (20.32 mm) aluminum, carbon steel, galvanized steel, aluminized steel, stainless steel

2. Welded and mechanically fastened.

3. Finish: Galvanized.

C. Factory install with adequate distances upstream and downstream, based on cataloged performance with a minimum, effectiveness of 70 percent outside air or within plus/minus 6 degrees F (2.73 degrees C) of theoretical mixed air temperature, at a minimum distance of one mixer diameter downstream of the mixer.

D. Include pressure loss due to mixer design and mixer-to-plenum ratio in the pressure drop rating for the static air mixer.

2.11 DIFFUSER SECTION

A. Provide diffuser section immediately after fan section.

B. Diffuser provides equal air distribution to blow-thru components immediately downstream of the diffuser.

2.12 TURNING AND DISCHARGE PLENUM SECTION

A. Provide plenum to efficiently turn and discharge air.

1. Scale plenum vertical height to accommodate discharge duct height.

2. Scale plenum horizontal length to accommodate required dimensional constraints.

B. Acoustical Liner:

1. Fabricate from corrosion-proof, perforated stainless steel with completely encapsulated fiberglass insulation.

2. Prevent breakaway, flake off, or delamination when tested at 9000 fpm (45.7 m/sec) in accordance with UL 181.

2.13 CONTROLS

A. Combination Starter-Disconnects:

1. Provide combination starter-disconnect for each fan motor.

2. Factory mount in full metal enclosure and wire to fan motor.

3. Mount starter-disconnect on fan section externally in a NEMA 1 enclosure within a dedicated controls section or housed fan section.

    a. Internal Enclosure Construction Characteristics:

        1) Integral part of unit casing to allow for thermal venting to casing interior.

        2) Accessible from unit exterior via access door.

        3) Construction of access doors same throughout unit.

4. Include circuit breaker disconnect with through-the-door interlocking handle for externally mounted starters, spring loaded, and designed to rest only in the full and lockable ON or OFF state.

5. Allow enclosure entry via a concealed defeater mechanism when the handle is in the ON position.

6. Include the following items:

    a. Hand-Off-Auto (H-O-A) switch.

    b. Two normally open auxiliary contacts.

    c. Overload heaters.

    d. Manual reset overloads.

    e. 120V control transformer with fusing and secondary grounding.

7. Include power wiring from the starter control transformer to the secondary control system transformers, and start-stop wiring from the direct digital controller start-stop relay to the starter H-O-A switch.

B. Combination VFD - Disconnects:

1. Provide factory mounted, combination VFD - disconnect for each fan motor.

    a. Provide in accordance with Section 16425.

2. Factory mount in full metal enclosure and wire to fan motor.

3. Mount VFD-disconnect on fan section externally in a NEMA 1 enclosure within a dedicated controls section or housed fan section.

    a. Internal Enclosure Construction Characteristics:

        1) Integral part of unit casing to allow for thermal venting to casing interior.

        2) Accessible from unit exterior via access door.

        3) Construction of access doors same throughout unit.

4. Include circuit breaker disconnect with through-the-door interlocking handle for externally mounted starters, spring loaded, and designed to rest only in the full and lockable ON or OFF state.

5. Allow enclosure entry via a concealed defeater mechanism when the handle is in the ON position.

6. Include control transformer with sufficient capacity to support the following items:

    a. VFD and controls.

    b. Binary output on-off wiring.

    c. Analog output speed-signal wiring.

    d. All interfacing wiring between the VFD and the direct digital controller.

7. Mount starter on fan section externally in a NEMA 1 enclosure within a dedicated controls section or housed fan section.

    a. Internal Enclosure Construction Characteristics:

        1) Integral part of unit casing to allow for thermal venting to casing interior.

        2) Accessible from unit exterior via access door.

        3) Construction of access doors same throughout unit.

8. Provide bypass relays and bypass circuitry with VFD-OFF-BYPASS selector switch.

C. Factory Installed Direct Digital Control (DDC) System:

1. Factory engineer and test all components.

2. Provide fully functional control system to operate in either stand-alone mode or as part of the building automation system (BAS) via single pair of twisted wires tie-in.

3. DDC Controller:

    a. Dedicated, field programmable DDC controller with appropriate point capabilities.

    b. Portable Screen and Keypad Capabilities:

        1) Local monitoring.

        2) Troubleshooting.

        3) Setpoint adjustments.

4) Physical plugging compatibility into other factory-configured controllers by same manufacturer.

4. Control Options:

a. Electronic End Devices:

1) Accommodate integration into existing building systems.

2) Wire to standard point locations of unit mounted DDC controller or terminal block for remote controller.

b. Mixing Section Spring Return Damper Actuators:

1) Outdoor Air Damper: Normally closed.

2) Return Air Damper: Normally open.

c. Air Flow Measurement Stations: 2 to 10 VDC signal corresponding to CFM for controlling and documenting airflow.

d. Fan Discharge Temperature and Temperature Averaging Sensors: Suitable for integration into the BAS system.

e. Low Limit Switches:

1) Factory wire to momentary push-button reset circuit.

2) Provide separate low limit for each coil in a coil stack.

f. Airflow Switches: Pipe to both filter sides to indicate fan status.

g. Dirty Filter Switches: Pipe to both filter sides to indicate filter status.

h. Condensate Overflow Switches:

1) Comply with UL 508.

2) Factory install float switch in drain pan to detect high water condensate level.

3) Shut down air handling unit in the event of primary drain blockage.

4) Locate float switch above primary drain line connection and below drain pan rim.

i. Provide Relays for each Binary Output of Controller for User Interface of the following:

1) Motor starters for supply, return, and exhaust fans.

2) Relief dampers.

3) Pumps.

4) Condensing units.

D. Factory Provided Controls for Field Installation:

1. Control Valves.

2. Space and Outdoor Air Temperature Sensors.

2.14 ROOF MOUNTING CURB

A. Roof Vibration Isolation Mounting Curb: 14 inches (350 mm) high galvanized steel, channel frame with gaskets and nailer strips.

B. Include roof curb accessories for each roof mounted unit.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Isolate fan section with flexible duct connections.

D. Install flexible duct connections between fan inlet and discharge ductwork and air handling unit sections. Ensure that metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.

E. Install assembled unit on vibration isolators. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as indicated. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

F. Provide fixed sheaves required for final air balance.

G. Make connections to coils with unions or flanges.

H. Refrigerant Coils: Provide sight glass in liquid line within 12 inches (300 mm) of coil.

I. Insulate Coil Headers Located Outside Air Flow as Specified for Piping

J. Insulate Coil Headers Located Outside Air Flow as Specified for Piping: Refer to Section 15083.

K. Electric Duct Coils:

1. Wire in accordance with NFPA 70.

L. Cooling Coils:

1. Pipe drain and overflow to nearest floor drain.

M. Field-wire all factory provided controls for field installation.

3.02 FIELD QUALITY CONTROL

A. Vibration Analysis:

1. Measure vibration levels with an FFT (Fast Fourier Transformation) analyzer.

2. Characteristics:

a. Frequency Response Range: 5 Hz thru 10 KHz (300 thru 600,000 cpm).

b. Capability to use a Hanning window.

c. Capacity to perform ensemble averaging.

d. Auto-ranging frequency amplitude.

e. Minimum amplitude accuracy over the selected frequency range of plus/minus 20 percent or plus/minus 1.5 dB.

3. Use accelerometer, stud-mounted to collect data.

4. Ensure the mass of the accelerometer and its mounting have minimal influence on the frequency response of the system over the selected measurement range.

B. Final Acceptance Requirements:

1. Use dial indicator gauges to demonstrate fan and motor are aligned.

2. Verify conformance to specifications using vibration analysis.

3. Maximum Vibration Levels:

a. 0.075 inch (1.905 mm) per second at 1 times run speed and at fan/blade frequency.

b. 0.04 inch (1.016 mm) per second at other multiples of run speed.

C. Coordination of Other Tests and Inspections:

1. Owner will employ independent Testing, Adjusting, and Balancing agency to test and/or inspect modular central-station air handling-unit.

2. Provide access as required to accommodate timely performance.

3. Refer to Section 15950.

3.03 SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.04 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.

2. Conduct walking tour of project.

3. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours of training.

3. Instructor: Manufacturer's training personnel.

4. Location: At project site.

5. Location: Owner's offsite classroom facilities may be used.

6. Location: Provide local classroom facilities.

7. Location: At manufacturer's training facility; include travel expenses for one member of Owner's staff.

END OF SECTION

SECTION 15731
SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Forced air furnaces.

C. Air cooled condensing units.

D. Indoor air handler (fan & coil) units for duct connection.

E. Indoor ductless fan & coil units.

F. Controls.

1.02 RELATED REQUIREMENTS

A. Section 15810 - Ducts.

1.03 REFERENCE STANDARDS

A. AHRI 210/240 - Standard for Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning, Heating, and Refrigeration Institute; 2008.

C. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; Air-Conditioning, Heating, and Refrigeration Institute; 2004.

D. AHRI 610 - Performance Rating of Central System Humidifiers for Residential Applications; Air Conditioning, Heating, and Refrigeration Institute; 2004.

E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013 (ANSI/ASHRAE Std 15).

F. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2010.

G. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2012.

H. ASHRAE Std 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2013, Including All Addenda (ANSI/ASHRAE/IES Std 90.1).

I. ASHRAE Std 90.2 - Energy-Efficient Design of New Low-Rise Residential Buildings; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

J. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

K. NEMA MG 1 - Motors and Generators; National Electrical Manufacturers Association; 2014.

L. NFPA 31 - Standard for the Installation of Oil Burning Equipment; National Fire Protection Association; 2011.

M. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

N. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

O. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

P. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; National Fire Protection Association; 2013.

Q. UL 207 - Refrigerant-Containing Components and Accessories, Nonelectrical; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

B. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Filters: One for each unit.

2. Extra Pilot Thermocouples: One for each unit.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience and approved by manufacturer.

1.06 WARRANTY

A. Provide three year manufacturers warranty for solid state ignition modules.

B. Provide five year manufacturers warranty for heat exchangers.

C. Provide five year manufacturers warranty for electronic air cleaners.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi Inc: www.mitsubishipro.com

1. PKA-A12HA4, PUY-A12NHA4

B. Carrier Corporation: www.carrier.com.

C. Trane Inc: www.trane.com.

D. York International Corporation / Johnson Controls: www.york.com.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.

1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator; auxiliary electric heat.

2. Heating: Electric resistance heating.

3. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.

4. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

C. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch on equipment

2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

1. Location: Ceiling.

2. Sound Rating:

3. Cabinet: Galvanized steel.

a. Finish: White.

4. Fan: Line-flow fan direct driven by a single motor.

5. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.

6. Wall-Mounted Units:

a. Cooling Output: 9000 Btuh (2.64 kW).

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.

1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.

2. Manufacturer: System manufacturer.

C. Remote Actuators:

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.

1. Comply with AHRI 210/240.

2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

3. Refrigerant: R-410A.

4. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

5. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

6. Sound Rating: 69 dBA, when measured in accordance with AHRI 270.

B. Compressor: Hermetic, two speed 1800 and 3600 rpm, AHRI 520 resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

1. Condenser Fans: Direct-drive propeller type.

2. Condenser Fan Motor: Enclosed, 1-phase type, permanently lubricated.

D. Coil: Air-cooled, aluminum fins bonded to copper tubes.

E. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).

1. Provide thermostatic expansion valves.

2. Provide heat pump reversing valves.

F. Operating Controls:

1. Control by room thermostat to maintain room temperature setting.

2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig (1965 kPa) and off when pressure drops below 140 psig (965 kPa) for operation to 0 degrees F (-18 degrees C).

G. Mounting Pad: Precast concrete parking bumpers, minimum 4 inches (100 mm) square; minimum of two located under cabinet feet.

2.05 ELECTRIC FURNACE COMPONENTS

A. Electric Heater: Helix wound bare nichrome wire heating elements arranged in incremental stages of 5 kW each, with porcelain insulators.

B. Operating Controls:

1. Heater stages energized in sequence with pre-determined delay between heating stages.

2. High limit temperature control to de-energize heating elements, with automatic reset.

3. Supply fan started before electric elements are energized and continues operating after thermostat is satisfied until bonnet temperature reaches minimum setting. Include manual switch for continuous fan operation.

4. Outdoor thermostat lock-out of some heating elements until outdoor temperature drops.

2.06 ACCESSORY EQUIPMENT

A. Economizer Damper Units: Steel cabinet with baked enamel finish, easily removed and secured access doors, glass fiber insulation.

1. Dampers: Formed steel with nylon bearings and gaskets.

2. Damper Operator: 24 volt, three position spring return motor with adjustable minimum position switch.

3. Control Wiring: Provide wiring harness consisting of control board with relays, wiring harness, transformer, and hardware.

4. Controls: Discharge air thermostat, adjustable outdoor air "enthalpy" control, return air "enthalpy" sensor position dampers, and interface to room thermostat.

B. Room Humidistat: Electric, adjustable, to energize humidifier when fan operating, to maintain setting.

C. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:

1. System selector switch (heat-off-cool) and fan control switch (auto-on).

2. Automatic switching from heating to cooling.

3. Preferential rate control to minimize overshoot and deviation from setpoint.

4. Set-up for four separate temperatures per day.

5. Instant override of setpoint for continuous or timed period from one hour to 31 days.

6. Short cycle protection.

7. Programming based on weekdays, Saturday and Sunday.

8. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.

9. Battery replacement without program loss.

10. Thermostat display:

    a. Time of day.

    b. Actual room temperature.

    c. Programmed temperature.

    d. Programmed time.

    e. Duration of timed override.

    f. Day of week.

    g. System mode indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

11. Manufacturers:

    a. Carrier Corporation: www.carrier.com.

    b. Trane Inc: www.trane.com.

    c. York International Corporation / Johnson Controls: www.york.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

D. Verify that water supply is available for humidifier.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Provide vent connections in accordance with NFPA 211.

D. Install refrigeration systems in accordance with ASHRAE Std 15.

E. Mount counterflow furnaces installed on combustible floors on additive base.

F. Pipe drain from cooling coils to nearest floor drain.

END OF SECTION

SECTION 15810
DUCTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Nonmetal ductwork.

C. Casing and plenums.

D. Duct cleaning.

1.02 RELATED REQUIREMENTS

A. Section 15086 - Duct Insulation: External insulation and duct liner.

B. Section 15820 - Duct Accessories.

C. Section 15840 - Air Terminal Units.

D. Section 15850 - Air Outlets and Inlets.

E. Section 15950 - Testing, Adjusting, and Balancing.

F. Section 15015 - HVAC Air Duct Cleaning: Cleaning ducts after completion of installation.

1.03 REFERENCE STANDARDS

A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications; 2015.

D. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2013a.

E. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2014a.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength, Low Alloy, and High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2013.

I. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy, High-Strength Low-Alloy With Improved Formability, and Ultra-High Strength; 2014.

J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

L. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015.

M. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]; 2015.

N. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

O. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

Q. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2012.

R. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2012.

S. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2013.

T. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2013.

U. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

V. NFPA 90B - Standard for the Installation of Warm Air Heating and Air Conditioning Systems; National Fire Protection Association; 2012.

W. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; National Fire Protection Association; 2014.

X. SMACNA (DCS) - HVAC Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2005.

Y. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

Z. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication & Installation Guidelines; 2001.

AA. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

AB. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

AC. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

AD. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data for duct materials.

B. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work forpressure class and higher systems.

C. Samples: Submit two samples of typical shop fabricated duct fittings.

D. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.

E. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

F. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

G. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum 3 years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

D. Medium and High Pressure Supply: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

E. Return and Relief: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

F. General Exhaust: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

G. Outside Air Intake: 1/2 inch w.g. (125 Pa) pressure class, galvanized steel.

H. Transfer Air and Sound Boots: 1/2 inch w.g. (125 Pa) pressure class, fibrous glass.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread of zero, smoke developed of zero, when tested in accordance with ASTM E84.

4. For Use With Flexible Ducts: UL labeled.

5. Products:

a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: www.carlislehvac.com.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.

2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.

4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.

5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

6. Other Types: As required.

7. Manufacturers:

    a. Powers Fasteners, Inc: www.powers.com.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE Handbook - Fundamentals.

C. Duct systems have been designed for metal duct. At the Contractor's option, fibrous glass duct may be substituted for metal duct.

D. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

E. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

F. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

G. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

H. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Slab Duct Ventilation System: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS, with G90/Z275 coating designed for installation in cast-in-place concrete floor assemblies.

1. Fittings: Elbows, End caps, Connecting couplings, Spin-in-collar, Sofit-discharge head, Support Brackets, Wall discharge head

B. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA (DCS).

2. Insulation:

a. Thickness: 1 inch (25 mm).

b. Material: Air.

C. Fiber Glass Reinforced Plastic (FRP) Ducts: Glass fiber reinforced plastic, minimum 3/16 inch (5 mm) wall thickness.

D. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.

1. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.

2. Maximum Velocity: 4000 fpm (20.3 m/sec).

3. Temperature Range: Minus 10 degrees F to 160 degrees F (Minus 23 degrees C to 71 degrees C).

4. Manufacturers:

a. Hart & Cooley, Inc: www.hartandcooley.com.

E. Flexible Ducts: Black polymer film supported by helically wound spring steel wire.

1. UL labeled.

2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

3. Pressure Rating: 4 inches WG (1000 Pa) positive and 0.5 inches WG (175 Pa) negative.

4. Maximum Velocity: 4000 fpm (20.3 m/sec).

5. Temperature Range: Minus 20 degrees F to 175 degrees F (Minus 28 degrees C to 79 degrees C).

6. Manufacturers:

a. Hart & Cooley, Inc: www.hartandcooley.com.

F. Flexible Ducts: Multiple layers of aluminum laminate supported by helically wound spring steel wire.

1. UL labeled.

2. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

3. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.

4. Maximum Velocity: 4000 fpm (20.3 m/sec).

5. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

6. Manufacturers:

    a. Hart & Cooley, Inc: www.hartandcooley.com.

G. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

2. Pressure Rating: 10 inches WG (2.50 kPa) positive and 1.0 inches WG (250 Pa) negative.

3. Maximum Velocity: 4000 fpm (20.3 m/sec).

4. Temperature Range: Minus 20 degrees F to 210 degrees F (Minus 28 degrees C to 99 degrees C).

5. Manufacturers:

    a. Hart & Cooley, Inc: www.hartandcooley.com.

H. Flexible Ducts: UL 181, Class 0, interlocking spiral of aluminum foil.

1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

2. Pressure Rating: 8 inches WG (2.0 kPa) positive or negative.

3. Maximum Velocity: 5000 fpm (25.4 m/sec).

4. Temperature Range: Minus 20 degrees F to 250 degrees F (Minus 28 degrees C to 99 degrees C).

5. Manufacturers:

    a. Hart & Cooley, Inc; _____: www.hartandcooley.com.

I. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

1. Manufacturers:

a. Carlisle HVAC Products; Nexus Flange Connectors with Sealant Pocket: www.carlislehvac.com.

b. Elgen Manufacturing: www.elgenmfg.com.

2.05 CASINGS

A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of galvanized 18 gage, 0.0478 inch (1.21 mm) expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

1. Provide clear wire glass observation ports, minimum 6 X 6 inch (150 X 150 mm) size.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gage, 0.0598 inch (1.52 mm) sheet steel back facing and 22 gage, 0.0299 inch (0.76 mm) perforated sheet steel front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber insulation media, on inverted channels of 16 gage, 0.0598 inch (1.52 mm) sheet steel.

2.06 FIBROUS GLASS DUCTS

A. Fibrous Glass Ducts: 1 inch (25 mm) thick rigid glass fiber with aluminum foil, glass scrim and Kraft or plastic jacket vapor barrier; maximum 0.23 K value at 75 degrees F (0.034 KSI at 24 degrees C).

1. UL labeled to UL 181.

2. Manufacturers:

B. Fabricate in accordance with SMACNA (FGD), except as indicated.

C. Machine fabricate fibrous glass ducts and fittings. Make only minor on site manual adjustments.

D. Staple duct joints and tape with 3 inch (75 mm) wide 2 mil (0.05 mm) thick or 2 inch (50 mm) wide 3 mil (0.75 mm) thick aluminum pressure sensitive tape, UL approved.

E. Staple duct joints and tape with 2-1/2 inch (63 mm) wide pressure sensitive tape, UL approved.

F. Staple duct joints and tape with 3 inch (75 mm) wide heat activated chemical bonding tape.

G. Do not use fibrous glass ducts within 12 inches (300 mm) of electric or fuel fired heaters.

H. Maximum stress exerted on structural steel members: 22000 psi (152 MPa).

I. Maximum temperature: 250 degrees Fahrenheit (121 degrees Celsius).

J. Conform to safety standards NFPA 90A and 90B.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Fibrous Glass Ducts: Install in accordance with SMACNA (FGD). Obtain manufacturer's inspection and acceptance of fabrication and installation at beginning of installation.

E. Flexible Ducts: Connect to metal ducts with adhesive.

F. PVC Coated Metal Ductwork: Tape with PVC tape.

G. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

H. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.

K. Use double nuts and lock washers on threaded rod supports.

L. Connect terminal units to supply ducts directly or with one foot (300 mm) maximum length of flexible duct. Do not use flexible duct to change direction.

M. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.

N. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.

O. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment that could be harmed by excessive dirt with temporary filters, or bypass during cleaning.

B. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

SECTION 15820
DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Backdraft dampers - fabric.

D. Combination fire and smoke dampers.

E. Duct access doors.

F. Duct test holes.

G. Fire dampers.

H. Flexible duct connections.

I. Smoke dampers.

J. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 15810 - Ducts.

B. Section 15840 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; National Fire Protection Association; 2012.

B. NFPA 92 - Standard for Smoke-Control Systems; 2012.

C. NFPA 96 - Standard Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

D. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

E. UL 33 - Heat Responsive Links for Fire-Protection Service; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

F. UL 555 - Standard for Fire Dampers; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

G. UL 555S - Standard for Leakage Rated Dampers for Use in Smoke Control Systems; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.

C. Manufacturer's Installation Instructions: Provide instructions for fire dampers.

D. Project Record Drawings: Record actual locations of access doors and test holes.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Hollow Vane and Rail (Double Wall Vane): www.carlislehvac.com.

2. Elgen Manufacturing: www.elgenmfg.com.

3. Krueger: www.krueger-hvac.com.

4. Ruskin Company: www.ruskin.com.

5. Titus: www.titus-hvac.com.

6. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.

C. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

2.02 BACKDRAFT DAMPERS - METAL

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Gravity Backdraft Dampers, Size 18 x 18 inches (450 x 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 BACKDRAFT DAMPERS - FABRIC

A. Manufacturers:

1. Metal Form Manufacturing, Inc: www.mfmca.com.

2. American Warming and Ventilating: www.awv.com.

3. Vent Products Company: www.ventproducts.com.

B. Fabric Backdraft Dampers: Factory-fabricated.

1. Frame: Galvanized steel, 18 gage, 0.0478 inch (1.21 mm) minimum base sheet thickness.

2. Frame: Extruded aluminum alloy.

3. Blades: Neoprene coated fabric material.

4. Birdscreen: 1/2 inch (12 mm) nominal mesh of galvanized steel or aluminum.

5. Maximum Velocity: 1000 fpm (5 m/sec) face velocity.

2.04 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch (12.7 mm) actuator shaft.

E. Operators: UL listed and labelled spring return pneumatic type suitable for operation on 0-20 psig (0-140 kPa) instrument air. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

F. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.

G. Normally Closed Smoke Responsive Fire Dampers: Curtain type, opening by gravity upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure.

H. Normally Open Smoke Responsive Fire Dampers: Curtain type, closing upon actuation of electro thermal link, flexible stainless steel blade edge seals to provide constant sealing pressure, stainless steel springs with locking devices to ensure positive closure for units mounted horizontally.

I. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.05 DUCT ACCESS DOORS

A. Manufacturers:

1. Acudor Products Inc: www.acudor.com.

2. Elgen Manufacturing: www.elgenmfg.com.

3. Nailor Industries Inc: www.nailor.com.

4. Ruskin Company: www.ruskin.com.

5. SEMCO Incorporated: www.semcohvac.com.

6. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch (25 mm) thick insulation with sheet metal cover.

1. Less Than 12 inches (300 mm) Square: Secure with sash locks.

2. Up to 18 inches (450 mm) Square: Provide two hinges and two sash locks.

3. Up to 24 x 48 inches (600 x 1200 mm): Three hinges and two compression latches with outside and inside handles.

4. Larger Sizes: Provide an additional hinge.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.06 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

1. Products:

2. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com.

2.07 FIRE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

4. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling Dampers: Galvanized steel, 22 gage, 0.0299 inch (0.76 mm) frame and 16 gage, 0.0598 inch (1.52 mm) flap, two layers 0.125 inch (3.2 mm) ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

D. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch (0.76 mm) frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch (250 Pa) pressure class ducts up to 12 inches (300 mm) in height.

F. Multiple Blade Dampers: 16 gage, 0.0598 inch (1.52 mm) galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch (3.2 x 12.7 mm) plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

G. Fusible Links: UL 33, separate at 160 degrees F (71 degrees C) with adjustable link straps for combination fire/balancing dampers.

2.08 FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

1. Carlisle HVAC Products; Dynair Connector Plus G90 Steel Offset Seam Neoprene Fabric: www.carlislehvac.com.

2. Elgen Manufacturing: www.elgenmfg.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).

a. Net Fabric Width: Approximately 2 inches (50 mm) wide.

2. Metal: 3 inches (75 mm) wide, 24 gage, 0.0239 inch (0.61 mm) thick galvanized steel.

D. Leaded Vinyl Sheet: Minimum 0.55 inch (14 mm) thick, 0.87 lbs per sq ft (4.2 kg/sq m), 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch (356 mm).

2.09 SMOKE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Dampers: UL Class 1 airfoil blade type smoke damper, normally open automatically operated by pneumatic actuator.

D. Electro Thermal Link: Fusible link melting at 165 degrees F (74 degrees C); 120 volts, single phase, 60 Hz; UL listed and labeled.

2.10 VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:

1. Material: Same gage as duct to 24 inches (600 mm) size in either direction, and two gages heavier for sizes over 24 inches (600 mm).

2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Operator: Minimum 1/4 inch (6 mm) diameter rod in self aligning, universal joint action, flanged bushing with set screw.

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch (150 x 760 mm).

1. Fabricate for duct sizes up to 6 x 30 inch (150 x 760 mm).

2. Blade: 24 gage, 0.0239 inch (0.61 mm), minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, 0.0478 inch (1.21 mm), minimum.

F. End Bearings: Except in round ducts 12 inches (300 mm) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

1. Products:

    a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com.

    b. Elgen Manufacturing Company; Snap-in Bushing: www.elgenmfg.com.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

4. Products:

    a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com.

2.11 MISCELLANEOUS PRODUCTS

A. Internal Strut End Plugs: Combination end-mounting and sealing plugs for metal conduit used as internal reinforcement struts for metal ducts; plug crimped inside conduit with outside gasketed washer seal.

1. Products:

    a. Carlisle HVAC Products; Dynair Internal Duct Reinforcement - Conduplugs: www.carlislehvac.com.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils (0.6 mm).

2. High tack water based adhesive.

3. UV stable light blue color.

4. Elongation Before Break: 325 percent, minimum.

5. Products:

    a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com.

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 15810 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch (100 x 100 m) for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

G. Demonstrate re-setting of fire dampers to Owner's representative.

H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

I. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

J. For fans developing static pressures of 5.0 inches (1250 Pa) and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

K. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

L. Use splitter dampers only where indicated.

M. Provide balancing dampers on high velocity systems where indicated. Refer to Section 15840 - Air Terminal Units.

N. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 15840
AIR TERMINAL UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct variable volume units.

1.02 RELATED REQUIREMENTS

A. Section 15810 - Ducts.

B. Section 15820 - Duct Accessories.

C. Section 15850 - Air Outlets and Inlets.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).

B. AHRI 880 - Performance Rating of Air Terminals; 2011.

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012.

D. ASHRAE Std 62.1 - Ventilation For Acceptable Indoor Air Quality; 2013.

E. ASHRAE Std 130 - Methods of Testing for Rating Ducted Air Terminal Units; 2008 (R2014).

F. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995.

G. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope; 1998 (Reapproved 2009).

H. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2014.

J. ASTM E488/E488M - Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements; 2010.

K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilation Systems; National Fire Protection Association; 2012.

N. SMACNA 1981 - Seismic Duct Restraint Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

O. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

B. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg (250 to 1000 Pa).

C. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

D. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

E. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Motors: One of each type and size.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 WARRANTY

A. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE DUCT VARIABLE VOLUME UNITS

A. Manufacturers:

1. Carrier Corporation: www.carrier.com.

2. Johnson Controls, Inc: www.johnsoncontrols.com.

3. Trane Inc: www.trane.com.

1. VCEF05, VCEF06, VCEF08, VCEF12

B. General:

1. Factory assembled, AHRI 880 rated, variable air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.

2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:

1. Minimum 22 gage, 0.0299 inch (0.76 mm) galvanized steel.

2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.

3. Unit Discharge: Rectangular, with slip and drive connections.

4. Acceptable Liners:

a. 1/2 inch (13 mm) thick, coated, fibrous-glass complying with ASTM C1071.

1) Secure with adhesive.

2) Coat edges exposed to airstream with NFPA 90A approved sealant.

3) Cover liner with non-porous foil.

b. 3/4 inch (19 mm) thick adhesive of polyurethane foam complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E84.

D. Sound Attenuator:

1. Provide if required to meet scheduled acoustical performance requirements.

2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.

E. Damper Assembly:

1. Heavy gage, galvanized steel or extruded aluminum construction with solid shaft rotating in bearings.

2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.

3. Incorporate low leak damper blades for tight airflow shutoff.

F. Electric Heating Coil:

1. Listed and provided by the terminal unit manufacturer.

2. Coil Casing: 20 gage, 0.0359 inch (0.912 mm) galvanized steel.

3. Heating Elements: Nickel chrome, supported by ceramic insulators.

4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.

5. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.

6. Provide the following additional components, mounted and/or wired within the control enclosure:

a. Fused or non-fused door interlocking disconnect switch.

b. Mercury contactors.

c. Fuse block.

7. Factory wired, including all limit switches and steps of control as shown on the equipment schedule, with the SSR (solid-state relay) proportional heat control.

G. Electrical Requirements:

1. Single point power connection.

2. Equipment wiring to comply with requirements of NFPA 70.

H. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

I. Controls:

1. Electric:

a. Damper Actuator: 24 volt, powered closed, spring return open.

b. Wall mounted thermostat with Celsius and Fahrenheit display including clock display and set-point of occupied space.

2. Electronic:

a. Damper Actuator: 24 volt, power closed, spring return open.

b. Velocity Controller:

1) Settings for minimum/maximum air volumes, factory calibrated, and field adjustable at thermostat.

2) Maintain constant airflow dictated by thermostat to within 5 percent of set point while compensating for inlet static-pressure variations up to 4 inch wg (1 kPa), when tested in accordance with ASHRAE Std 130.

3) Provide controller with multi-point with velocity sensors located in air inlet and outlet.

c. Thermostat: Wall mounted, time-proportional with reheat-coil control including a temperature set-point display in Celsius and Fahrenheit.

3. DDC:

a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.

b. Microprocessor-based Controller: Air volume controller, pressure independent with electronic airflow transducers, factory calibrated maximum and minimum CFM's.

1) Occupied and unoccupied operating mode.

2) Remote reset of temperature or CFM set points.

3) Proportional, plus integral control of room temperature.

4) Monitoring and adjusting with portable terminal.

5) Time-proportional reheat coil control.

c. Room Sensor:

1) Compatible with temperature controls specified.

2) Wall mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.

4. Control Sequence:

a. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg (60 and 750 Pa) inlet static pressure.

b. Include factory mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.

B. Verify that field measurements are as shown on the drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide ceiling access doors or locate units above easily removable ceiling components.

C. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA 1981.

D. Embed anchors in concrete in accordance with ASTM E488/E488M.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 15810.

G. Provide minimum of 5 ft (1.5 m) of 1 inch (25 mm) thick lined ductwork downstream of units.

H. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

3.04 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to test, inspect, instruct, observe, and field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

1. Leak Test:

a. After installation, fill water coils and test for leaks.

b. Repair leaks and retest until no leaks exist.

2. Operational Test:

a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. Test and adjust controls and safeties.

c. Replace damaged and malfunctioning controls and other equipment.

d. Remove and replace malfunctioning units and retest as specified above.

3.05 CLEANING

A. Vacuum clean coils and inside of units.

B. Install new filters.

END OF SECTION

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SECTION 15850
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers.

B. Light troffer diffusers.

C. Registers/grilles.

D. Door grilles.

E. Louvers.

F. Louvered penthouses.

G. Roof hoods.

H. Goosenecks.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; Air Movement and Control Association International, Inc.; 2012.

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.; 2006 (R2011).

C. SMACNA (DCS) - HVAC Duct Construction Standards; 2005.

1.03 SUBMITTALS

A. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

B. Samples: Submit two of each required air outlet and inlet type.

C. Project Record Documents: Record actual locations of air outlets and inlets.

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 MOCK-UP

A. Provide mock-up of typical exterior ceiling module with supply and return air outlets.

B. Locate where directed.

C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. American Louver Company; ALC Grilles and Registers: www.americanlouver.com.

B. Carnes Company HVAC: www.carnes.com.

C. Hart & Cooley, Inc: www.hartandcooley.com.

D. Krueger: www.krueger-hvac.com.

E. Price Industries: www.price-hvac.com.

F. Titus: www.titus-hvac.com.

1. 300FL, 350FL, TDC, 45F

2.02 RECTANGULAR CEILING DIFFUSERS

A. Type: Provide square, stamped, multi-core, square, adjustable pattern,stamped, multi-core, square and rectangular, multi-louvered, square and rectangular, adjustable pattern, multi-louvered diffuser to discharge air in 360 degree, one way, two way, three way, four way pattern with sectorizing baffles where indicated.

B. Connections: Round.

C. Frame: Provide surface mount, snap-in, inverted T-bar, spline type. In plaster ceilings, provide plaster frame and ceiling frame.

D. Fabrication: Steel with baked enamel finish.

E. Color: As shown on drawings.

F. Color: As selected by Architect from manufacturer's standard range.

G. Accessories: Provide radial opposed blade, removable core, sectorizing baffle, safety chain, wire guard, equalizing grid, operating rod extension, gaskets for surface mounted diffusers, and with damper adjustable from diffuser face.

2.03 PERFORATED FACE CEILING DIFFUSERS

A. Type: Perforated face with fully adjustable pattern and removable face.

B. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

C. Fabrication: Steel with steel frame and baked enamel finish.

D. Color: As shown on drawings.

E. Color: As selected by Architect from manufacturer's standard range.

F. Accessories: Radial opposed blade damper and multi-louvered equalizing grid with damper adjustable from diffuser face.

2.04 CEILING SLOT DIFFUSERS

A. Type: Continuous 1/2 inch (13 mm) wide slot, 1 slots wide, with adjustable vanes for left, right, or vertical discharge; integral ceiling fire damper.

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: As shown on the drawings.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket, mitered end border.

F. Plenum: Integral, galvanized steel, insulated.

2.05 LIGHT TROFFER DIFFUSERS

A. Type: Single plenum constructed independent of light troffers with volume and pattern controllers, 4 inch (round or oval top air inlet. Match diffusers to light troffers for air tight connection without tools.

B. Fabrication: Galvanized steel with welded or soldered joints and finish matte black inside.

2.06 CEILING SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Construction: Made of aluminum extrusions with factory enamel finish.

D. Color: As shown on drawings.

E. Color: As selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.07 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

G. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.08 CEILING LINEAR EXHAUST AND RETURN GRILLES

A. Type: Streamlined blades with 90 degree one-way deflection, 1/8 x 3/4 inch (3.2 x 19 mm) on 1/4 inch (6 mm) centers.

B. Frame: 1-1/4 inch (32 mm) margin, extra heavy for floor mounting, with countersunk screw mounting.

C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As shown on the drawings

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.09 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

A. Type: Egg crate style face consisting of 1/2 x 1/2 x 1/2 inch (13 x 13 x 13 mm), 1/2 x 1/2 x 1 inch (13 x 13 x 25 mm), 1 x 1 x 1 inch (25 x 25 x 25 mm), and _____ grid core.

B. Fabrication: Grid core consists of aluminum with mill aluminum finish.

C. Color: As shown on the drawings

D. Color: To be selected by Architect from manufacturer's standard range.

E. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

F. Frame: Channel lay-in frame for suspended grid ceilings.

2.10 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, vertical face, single deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Steel with 20 gage, 0.0359 inch (0.91 mm) minimum frames and 22 gage, 0.0299 inch (0.76 mm) minimum blades, steel and aluminum with 20 gage, 0.0359 inch (0.91 mm) minimum frame, or aluminum extrusions, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

G. Gymnasiums: Provide front pivoted or welded in place blades, securely fastened to be immobile.

2.11 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille with one-way deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions with factory clear lacquer finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.12 WALL EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with spring or other device to set blades, vertical face.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

C. Fabrication: Steel frames and blades, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.13 WALL GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch (13 x 13 x 13) louvers.

B. Fabrication: Aluminum with factory clear lacquer finish.

C. Color: As shown on the drawings.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.

F. Frame: Channel lay-in frame for suspended grid ceilings.

G. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.14 LINEAR WALL REGISTERS/GRILLES

A. Type: Streamlined blades with 0 degree deflection, 1/8 x 3/4 inch (3.2 x 19 mm) on 1/4 inch (6 mm) centers.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions, with factory baked enamel finish.

D. Color: As shown on the drawings.

E. Color: To be selected by Architect from manufacturer's standard range.

F. Damper: Integral gang-operated opposed blade damper with removable key operator, operable from face.

2.15 FLOOR SUPPLY REGISTERS/GRILLES

A. Fixed blades, wide stamped border, single or double blade damper with set screw adjustment.

B. Fabricate of steel, welded construction, with factory baked enamel finish.

2.16 DOOR GRILLES

A. Type: V-shaped louvers of 20 gage, 0.0359 inch (0.91 mm) thick steel, 1 inch (25 mm) deep on 1/2 inch (13 mm) centers.

B. Frame: 20 gage, 0.0359 inch (0.91 mm) steel with auxiliary frame to give finished appearance on both sides of door, with factory prime coat finish.

2.17 LOUVERS

A. Type: 4 inch (100 mm) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch (13 mm) square mesh screen over exhaust and 1/2 inch (13 mm) square mesh screen over intake.

B. Fabrication: 16 gage, 0.0598 inch (1.52 mm) thick galvanized steel welded assembly, with factory prime coat finish.

C. Color: As shown on the drawings.

D. Color: To be selected by Architect from manufacturer's standard range.

E. Fabrication: 12 gage, 0.1046 inch (2.66 mm) thick extruded aluminum, welded assembly, with factory prime coat finish.

F. Color: As shown on the drawings.

G. Color: To be selected by Architect from manufacturer's standard range.

H. Mounting: Furnish with interior flat flange for installation.

2.18 ROOF HOODS

A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).

B. Fabricate of galvanized steel, minimum 16 gage, 0.0598 inch (1.52 mm) base and 20 gage, 0.0359 inch (0.91 mm) hood, or aluminum, minimum 16 gage, 0.0598 inch (1.52 mm) base and 18 gage, 0.0598 inch (1.21 mm) hood; suitably reinforced; with removable hood; birdscreen with 1/2 inch (13 mm) square mesh for exhaust and 3/4 inch (19 mm) for intake, and factory prime coat finish.

C. Fabricate louver penthouses with mitered corners and reinforce with structural angles.

D. Mount unit on minimum 12 inch (300 mm) high curb base with insulation between duct and curb.

E. Make hood outlet area minimum of twice throat area.

2.20 GOOSENECKS

A. Fabricate in accordance with SMACNA (DCS) of minimum 18 gage, 0.0598 inch (1.21 mm) galvanized steel.

B. Mount on minimum 12 inch (300 mm) high curb base where size exceeds 9 x 9 inch (230 x 230 mm).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black.

END OF SECTION

SECTION 15926
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

G. HVAC control programs.

1.02 REFERENCE STANDARDS

A. ANSI/CEA 709.1.D - Control Network Protocol Specification; 2014.

B. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.

C. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G, 2014.

D. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants From Refrigerating and Air-Conditioning Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.

2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.

3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

4. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

H. Maintenance Materials:

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Designer Qualifications: Perform design of system software under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Honeywell International, Inc; Alerton BMS: www.honeywell.com. Without exceptions.

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 OPERATOR INTERFACE

A. PC Based Work Station:

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

D. Hardware:

1. Desktop:

a. Computer(s) and display(s) to be provided by DDC controls manufacturer.

b. Quantity: As indicated on the Drawings.

c. Minimum RAM: 4 GB.

d. Minimum Processing Speed: 2.66 GHz.

e. Minimum Hard Drive Memory: 86 GB.

f. Drives: CD/DVD.

g. Ports: 4 USB 2.0 compatible.

h. Monitor: 17” x 19” flat screen

i. Location(s): As indicated on the Drawings.

j. Network Connection:

1) Ethernet interface card.

2) Minimum Speed: 10/100 Mbps.

2.04 CONTROLLERS

A. BUILDING CONTROLLERS

1. General:

a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.

b. Provide sufficient memory to support controller's operating system, database, and programming requirements.

c. Share data between networked controllers.

d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.

e. Utilize real-time clock for scheduling.

f. Continuously check processor status and memory circuits for abnormal operation.

g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.

h. Communication with other network devices to be based on assigned protocol.

2. Communication:

a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.

b. Perform routing when connected to a network of custom application and application specific controllers.

c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

a. Outdoors and/or in Wet Ambient Conditions:

1) Mount within waterproof enclosures.

2) Rated for operation at 40 to 150 degrees F (4 to 65 degrees C).

b. Conditioned Space:

1) Mount within dustproof enclosures.

2) Rated for operation at 32 to 120 degrees F (0 to 50 degrees C).

4. Provisions for Serviceability:

a. Diagnostic LEDs for power, communication, and processor.

b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:

a. Maintain operation at 90 to 110 percent of nominal voltage rating.

b. Perform orderly shutdown below 80 percent of nominal voltage.

c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet (1 m).

B. APPLICATION SPECIFIC CONTROLLERS

1. General:

a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.

b. Customized for operation within the confines of equipment served.

c. Communication with other network devices to be based on assigned protocol.

2. Communication:

    a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.

    b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.

3. Anticipated Environmental Ambient Conditions:

    a. Outdoors and/or in Wet Ambient Conditions:

        1) Mount within waterproof enclosures.

        2) Rated for operation at 40 to 150 degrees F (4 to 65 degrees C).

    b. Conditioned Space:

        1) Mount within dustproof enclosures.

        2) Rated for operation at 32 to 120 degrees F (0 to 50 degrees C).

4. Provisions for Serviceability:

    a. Diagnostic LEDs for power, communication, and processor.

    b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.

5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

6. Power and Noise Immunity:

    a. Maintain operation at 90 to 110 percent of nominal voltage rating.

    b. Perform orderly shutdown below 80 percent of nominal voltage.

    c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet (1 m).

C. INPUT/OUTPUT INTERFACE

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.

2. All Input/Output Points:

    a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.

b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.

3. Binary Inputs:

   a. Allow monitoring of On/Off signals from remote devices.

   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.

   c. Sense dry contact closure with power provided only by the controller.

4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.

5. Analog Inputs:

   a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).

   b. Compatible with and field configurable to commonly available sensing devices.

6. Binary Outputs:

   a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.

   b. Outputs provided with three position (On/Off/Auto) override switches.

   c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.

7. Analog Outputs:

   a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.

   b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.

   c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:

   a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.

b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:

c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.

9. System Object Capacity:

a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.

b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.05 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.06 SYSTEM SOFTWARE

A. Operating System:

1. Concurrent, multi-tasking capability.

a. Common Software Applications Supported: Microsoft Excel.

b. Acceptable Operating Systems: Windows 10

2. System Graphics:

a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.

b. Animation displayed by shifting image files based on object status.

c. Provide method for operator with password to perform the following:

1) Move between, change size, and change location of graphic displays.

2) Modify on-line.

3) Add, delete, or change dynamic objects consisting of:

(a) Analog and binary values.

(b) Dynamic text.

(c) Static text.

(d) Animation files.

3. Custom Graphics Generation Package:

a. Create, modify, and save graphic files and visio format graphics in PCX formats.

b. HTML graphics to support web browser compatible formats.

c. Capture or convert graphics from AutoCAD.

4. Standard HVAC Graphics Library:

a. HVAC Equipment:

1) Air Handlers.

2) Terminal HVAC Units.

3) Condensers.

b. Ancillary Equipment:

1) Fans.

2) Dampers.

3) Ductwork.

B. Workstation System Applications:

1. Automatic System Database Save and Restore Functions:

a. Current database copy of each Building Controller is automatically stored on hard disk.

b. Automatic update occurs upon change in any system panel.

c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.

2. Manual System Database Save and Restore Functions by Operator with Password Clearance:

   a. Save database from any system panel.

   b. Clear a panel database.

   c. Initiate a download of a specified database to any system panel.

3. Software provided allows system configuration and future changes or additions by operators under proper password protection.

4. On-line Help:

   a. Context-sensitive system assists operator in operation and editing.

   b. Available for all applications.

   c. Relevant screen data provided for particular screen display.

   d. Additional help available via hypertext.

5. Security:

   a. Operator log-on requires user name and password to view, edit, add, or delete data.

   b. System security selectable for each operator.

   c. System supervisor sets passwords and security levels for all other operators.

   d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.

   e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.

   f. All system security data stored in encrypted format.

6. System Diagnostics:

   a. Operations Automatically Monitored:

      1) Workstations.

      2) Printers.

      3) Modems.

4) Network connections.

5) Building management panels.

6) Controllers.

b. Device failure is annunciated to the operator.

7. Alarm Processing:

a. All system objects are configurable to "alarm in" and "alarm out" of normal state.

b. Configurable Objects:

1) Alarm limits.

2) Alarm limit differentials.

3) States.

4) Reactions for each object.

8. Alarm Messages:

a. Descriptor: English language.

b. Recognizable Features:

1) Source.

2) Location.

3) Nature.

9. Configurable Alarm Reactions by Workstation and Time of Day:

a. Logging.

b. Printing.

c. Starting programs.

d. Displaying messages.

e. Dialing out to remote locations.

f. Paging.

g. Providing audible annunciation.

h. Displaying specific system graphics.

10. Custom Trend Logs:

    a. Definable for any data object in the system including interval, start time, and stop time.

    b. Trend Data:

        1) Sampled and stored on the building controller panel.

        2) Archivable on hard disk.

        3) Retrievable for use in reports, spreadsheets and standard database programs.

        4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.

        5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.

11. Alarm and Event Log:

    a. View all system alarms and change of states from any system location.

    b. Events listed chronologically.

    c. Operator with proper security acknowledges and clears alarms.

    d. Alarms not cleared by operator are archived to the workstation hard disk.

12. Object, Property Status and Control:

    a. Provide a method to view, edit if applicable, the status of any object and property in the system.

    b. Status Available by the Following Methods:

        1) Menu.

        2) Graphics.

        3) Custom Programs.

13. Reports and Logs:

    a. Reporting Package:

        1) Allows operator to select, modify, or create reports.

        2) Definable as to data content, format, interval, and date.

        3) Archivable to hard disk.

b. Real-time logs available by type or status such as alarm, lockout, normal, etc.

c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.

d. Set to be printed on operator command or specific time(s).

14. Reports:

a. Standard:

1) Objects with current values.

2) Current alarms not locked out.

3) Disabled and overridden objects, points and SNVTs.

4) Objects in manual or automatic alarm lockout.

5) Objects in alarm lockout currently in alarm.

6) Logs:

(a) Alarm History.

(b) System messages.

(c) System events.

(d) Trends.

b. Custom:

1) Daily.

2) Weekly.

3) Monthly.

4) Annual.

5) Time and date stamped.

6) Title.

7) Facility name.

c. Tenant Override:

1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.

2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:

1) Electrical Meter(s):

(a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.

(b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.

2) Fuel Meter(s):

(a) Monthly showing daily natural gas consumption for each meter.

(b) Annual summary showing monthly consumption for each meter.

3) Weather:

(a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

C. Workstation Applications Editors:

1. Provide editing software for each system application at PC workstation.

2. Downloaded application is executed at controller panel.

3. Full screen editor for each application allows operator to view and change:

a. Configuration.

b. Name.

c. Control parameters.

d. Set-points.

4. Scheduling:

a. Monthly calendar indicates schedules, holidays, and exceptions.

b. Allows several related objects to be scheduled and copied to other objects or dates.

c. Start and stop times adjustable from master schedule.

5. Custom Application Programming:

a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.

b. Programming Features:

1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.

2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.

3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.

4) Allows the development of independently, executing, program modules designed to enable and disable other modules.

5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.

6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.

8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.

9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.07 HVAC CONTROL PROGRAMS

A. General:

1. Identify each HVAC Control system.

B. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.

2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.

3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.

4. Use outside air temperature to determine early shut down with ventilation override.

5. Operator commands:

    a. Define term schedule

    b. Define heating/cooling parameters.

    c. Lock/unlock program.

6. Control Summary:

    a. HVAC Control system begin/end status.

    b. Heating/cooling mode status.

    c. Optimal run time schedule.

    d. Start/Stop times.

    e. Optimal run time system normal start times.

    f. Occupancy and vacancy times.

7. Mass temperature summary:

    a. Mass temperature point type and ID.

    b. Desired and current mass temperature values.

    c. Calculated warm-up/cool-down time for each mass temperature.

    d. Heating/cooling season limits.

8. HVAC point summary:

    a. Control system identifier and status.

    b. Point ID and status.

    c. Outside air temperature point ID and status.

    d. Mass temperature point ID and point.

    e. Period start.

C. Supply Air Reset:

1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.

2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:

    a. Raising cooling temperatures to highest possible value.

    b. Reducing heating temperatures to lowest possible level.

3. Operator commands:

    a. Lock/unlock program.

    b. Request HVAC point summary.

    c. Request space load summary.

4. Control summary:

    a. HVAC control system status (begin/end).

    b. Supply air reset system status.

    c. Optimal run time system status.

    d. Heating and cooling loop.

    e. High/low limits.

    f. Deadband.

    g. Response timer.

    h. Reset times.

5. Space load summary:

    a. HVAC system status.

    b. Optimal run time status.

    c. Heating/cooling loop status.

    d. Space load point ID.

    e. Current space load point value.

    f. Fan status point ID and status.

    g. Control discharge temperature point ID and status.

    h. Space load point ID and status.

D. Enthalpy Switchover:

1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

2. Operator commands:

    a. Lock/unlock program.

    b. Request control summary.

    c. Request HVAC point summary.

3. Control summary:

    a. HVAC control system begin/end status.

    b. Enthalpy switchover optimal system status.

    c. Optimal return time system status.

    d. Status of damper mode switch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Provide conduit and electrical wiring in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C. Provide basic operator training for 2 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.04 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.05 MAINTENANCE

A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

B. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

C. Provide complete service of systems, including call backs. Make minimum of 2 complete normal inspections of approximately 8 hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

END OF SECTION

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SECTION 15950
TESTING, ADJUSTING, AND BALANCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic, steam, and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Vibration measurement of equipment operating conditions.

F. Commissioning activities.

1.02 RELATED REQUIREMENTS

A. Section 15012 - Commissioning of HVAC.

1.03 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; National Environmental Balancing Bureau; 2005, Seventh Edition.

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting, and Balancing; Sheet Metal and Air Conditioning Contractors' National Association; 2002.

1.04 SUBMITTALS

A. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

B. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.

2. Submit to the Commissioning Authority.

3. Submit six weeks prior to starting the testing, adjusting, and balancing work.

4. Include at least the following in the plan:

    a. Preface: An explanation of the intended use of the control system.

    b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

    c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

    d. Identification and types of measurement instruments to be used and their most recent calibration date.

    e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

    f. Final test report forms to be used.

    g. Detailed step-by-step procedures for TAB work for each system and issue, including:

        1) Terminal flow calibration (for each terminal type).

        2) Diffuser proportioning.

        3) Branch/submain proportioning.

        4) Total flow calculations.

        5) Rechecking.

        6) Diversity issues.

    h. Expected problems and solutions, etc.

    i. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.

    j. Details of how TOTAL flow will be determined; for example:

        1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.

        2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.

    k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.

l. Confirmation of understanding of the outside air ventilation criteria under all conditions.

m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).

n. Method of checking building static and exhaust fan and/or relief damper capacity.

o. Proposed selection points for sound measurements and sound measurement methods.

p. Methods for making coil or other system plant capacity measurements, if specified.

q. Time schedule for TAB work to be done in phases (by floor, etc.).

r. Description of TAB work for areas to be built out later, if any.

s. Time schedule for deferred or seasonal TAB work, if specified.

t. False loading of systems to complete TAB work, if specified.

u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.

v. Interstitial cavity differential pressure measurements and calculations, if specified.

w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).

x. Procedures for formal progress reports, including scope and frequency.

y. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. Field Logs: Submit at least twice a week to Commissioning Authority.

D. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

E. Progress Reports.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.

2. Revise TAB plan to reflect actual procedures and submit as part of final report.

3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.

4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.

5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

7. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

8. Include the following on the title page of each report:

    a. Name of Testing, Adjusting, and Balancing Agency.

    b. Address of Testing, Adjusting, and Balancing Agency.

    c. Telephone number of Testing, Adjusting, and Balancing Agency.

    d. Project name.

    e. Project location.

    f. Project Architect.

    g. Project Engineer.

    h. Project Contractor.

    i. Project altitude.

    j. Report date.

G. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC MN-1, AABC National Standards for Total System Balance.

2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

3. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

4. SMACNA (TAB).

5. Maintain at least one copy of the standard to be used at project site at all times.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Having minimum of three years documented experience.

3. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org.

c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org.

E. TAB Supervisor Qualifications: Professional Engineer licensed in the State in which the Project is located.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Final filters are clean and in place. If required, install temporary media in addition to final filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place and open.

8. Air coil fins are cleaned and combed.

9. Access doors are closed and duct end caps are in place.

10. Air outlets are installed and connected.

11. Duct system leakage is minimized.

12. Hydronic systems are flushed, filled, and vented.

13. Pumps are rotating correctly.

14. Proper strainer baskets are clean and in place.

15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.

2. Discrepancies, deficient or uncompleted work by others.

3. Contract interpretation requests.

4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on the drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches (12.5 Pa) positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

O. On fan powered VAV boxes, adjust air flow switches for proper operation.

3.07 COMMISSIONING

A. See Sections 15012 for additional requirements.

B. Perform prerequisites prior to starting commissioning activities.

C. Fill out Prefunctional Checklists for:

1. Air side systems.

2. Water side systems.

D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

E. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 10 percent of the air handlers plus a random sample equivalent to 10 percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.

2. Use the same test instruments as used in the original TAB work.

3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.

4. For purposes of re-check, failure is defined as follows:

    a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.

    b. Minimum Outside Air Flow: Deviation of more than 20 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 30 percent at intermediate supply flow.

    c. Temperatures: Deviation of more than one degree F (0.5 degree C).

    d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.

    e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

F. In the presence of the Commissioning Authority, verify that:

1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.

2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

G. No seasonal tests are required.

H. No further monitoring is required.

I. No deferred testing is required.

3.08 SCOPE

A. Test, adjust, and balance the following:

1. Air Cooled Refrigerant Condensers
2. Packaged Roof Top Heating/Cooling Units
3. Computer Room Air Conditioning Units
4. Air Coils
5. Terminal Heat Transfer Units
6. Air Handling Units
7. Fans
8. Air Filters
9. Air Terminal Units
10. Air Inlets and Outlets
11. Controls Compressor

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. Sheave Make/Size/Bore

B. V-Belt Drives:

1. Identification/location

2. Required driven RPM
3. Driven sheave, diameter and RPM
4. Belt, size and quantity
5. Motor sheave diameter and RPM
6. Center to center distance, maximum, minimum, and actual

C. Air Cooled Condensers:

1. Identification/number
2. Location
3. Manufacturer
4. Model number
5. Serial number
6. Entering DB air temperature, design and actual
7. Leaving DB air temperature, design and actual
8. Number of compressors

D. Cooling Coils:

1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air DB temperature, design and actual
7. Entering air WB temperature, design and actual
8. Leaving air DB temperature, design and actual
9. Leaving air WB temperature, design and actual
10. Air pressure drop, design and actual

E. Heating Coils:

1. Identification/number

2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air temperature, design and actual
7. Leaving air temperature, design and actual
8. Air pressure drop, design and actual

F. Electric Duct Heaters:

1. Manufacturer
2. Identification/number
3. Location
4. Model number
5. Design kW
6. Number of stages
7. Phase, voltage, amperage
8. Test voltage (each phase)
9. Test amperage (each phase)
10. Air flow, specified and actual
11. Temperature rise, specified and actual

G. Air Moving Equipment:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Arrangement/Class/Discharge
6. Air flow, specified and actual
7. Return air flow, specified and actual

8. Outside air flow, specified and actual
9. Total static pressure (total external), specified and actual
10. Inlet pressure
11. Discharge pressure
12. Sheave Make/Size/Bore
13. Number of Belts/Make/Size
14. Fan RPM

H. Return Air/Outside Air:

1. Identification/location
2. Design air flow
3. Actual air flow
4. Design return air flow
5. Actual return air flow
6. Design outside air flow
7. Actual outside air flow
8. Return air temperature
9. Outside air temperature
10. Required mixed air temperature
11. Actual mixed air temperature
12. Design outside/return air ratio
13. Actual outside/return air ratio

I. Exhaust Fans:

1. Location
2. Manufacturer
3. Model number
4. Serial number
5. Air flow, specified and actual

6. Total static pressure (total external), specified and actual
7. Inlet pressure
8. Discharge pressure
9. Sheave Make/Size/Bore
10. Number of Belts/Make/Size
11. Fan RPM

J. Duct Traverses:

1. System zone/branch
2. Duct size
3. Area
4. Design velocity
5. Design air flow
6. Test velocity
7. Test air flow
8. Duct static pressure
9. Air temperature
10. Air correction factor

K. Duct Leak Tests:

1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
    a. Blower
    b. Orifice, tube size
    c. Orifice size

d. Calibrated

7. Test static pressure
8. Test orifice differential pressure
9. Leakage

L. Air Monitoring Stations:

1. Identification/location
2. System
3. Size
4. Area
5. Design velocity
6. Design air flow
7. Test velocity
8. Test air flow

M. Flow Measuring Stations:

1. Identification/number
2. Location
3. Size
4. Manufacturer
5. Model number
6. Serial number
7. Design Flow rate
8. Design pressure drop
9. Actual/final pressure drop
10. Actual/final flow rate
11. Station calibrated setting

N. Terminal Unit Data:

1. Manufacturer

2. Type, constant, variable, single, dual duct
3. Identification/number
4. Location
5. Model number
6. Size
7. Minimum static pressure
8. Minimum design air flow
9. Maximum design air flow
10. Maximum actual air flow
11. Inlet static pressure

O. Air Distribution Tests:

1. Air terminal number
2. Room number/location
3. Terminal type
4. Terminal size
5. Area factor
6. Design velocity
7. Design air flow
8. Test (final) velocity
9. Test (final) air flow
10. Percent of design air flow

P. Sound Level Reports:

1. Location
2. Octave bands - equipment off
3. Octave bands - equipment on

Q. Vibration Tests:

1. Location of points:

a. Fan bearing, drive end

b. Fan bearing, opposite end

c. Motor bearing, center (if applicable)

d. Motor bearing, drive end

e. Motor bearing, opposite end

f. Casing (bottom or top)

g. Casing (side)

h. Duct after flexible connection (discharge)

i. Duct after flexible connection (suction)

2. Test readings:

   a. Horizontal, velocity and displacement

   b. Vertical, velocity and displacement

   c. Axial, velocity and displacement

3. Normally acceptable readings, velocity and acceleration

4. Unusual conditions at time of test

5. Vibration source (if non-complying)

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SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Electrical Requirements specifically applicable to Division 16 sections in addition to Division 1 - General Requirements.

1.02 GENERAL CONDITIONS FOR ALL WORK

A. All Work must closely be coordinated among the electric utility, the construction manager, and the Owner.

1.03 SCOPE OF WORK

A. Provide complete electrical system for the facility including but not limited to:

1. Circuit Breaker
2. Disconnect Switches
3. Wire and Cable
4. Conduit Drawings

B. Provide conduits to serve the electrical system as shown on the drawings:

C. Provide surge suppressors where indicated on the drawings.

D. Provide site grounding.

E. Provide all testing and startup services.

F. Each bidder or his authorized representatives shall, before preparing a bid, visit all areas of the proposed site in which work will take place and be performed to inspect carefully the present conditions. The submission of the bid by this bidder shall be considered evidence that the bidder has visited the project and noted the locations and conditions under which the work will be performed and that the bidder takes full responsibility for a complete knowledge of all factors governing his work.

G. All necessary temporary power, control and instrumentation requirements are the responsibility of the Contractor and shall be furnished at no extra cost to the Owner. Power and controls shall be furnished to all existing equipment at all times.

H. Pay all fees required for permits, inspections, and connections.

1.04 REFERENCES

A. ANSI/NFPA70-National Electrical Code.

1.05 SUBMITTALS

A. Include products specified in the following sections:

1. Section 16100 – Raceways, Boxes and Cabinets
2. Section 16108 – Miscellaneous Equipment
3. Section 16120 – Wires and Cables
4. Section 16160 – Panelboards
5. Section 16195 – Electrical Identification
6. Section 16450 – Grounding System
7. Section 16476 – Miscellaneous Equipment

B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.

C. Mark dimensions and values in units to match those specified.

D. Indicate applicable specification section on each submitted document.

1.06 REGULATORY REQUIREMENTS

A. Conform to applicable Building Codes for project location.

B. Electrical: Conform to NFPA 70 - 2014 Edition.

C. Occupational Safety and Health Administration (O.S.H.A.).

D. Obtain permits and request inspections from authority having jurisdiction.

1.08 CONDUIT DRAWINGS

A. In addition to the manufacturer's equipment shop drawings, the CONTRACTOR shall submit for approval, electrical installation working drawings for the site electrical containing the following:

1. Concealed and buried conduit layouts shown on floor plans drawn at not less than 1/4-inch = 1-foot-0-inch scale. The layouts shall include locations of process equipment, panelboards, antennas, RTUs, switches, large junction or pull boxes, instruments, and any other electrical devices connected to concealed or buried conduits.

2. Plans shall be drawn on high quality reproducible bond paper, size 36-inch x 24-inch, and shall be presented in a neat, professional manner.

3. Concrete floors and/or walls containing concealed conduits shall not be poured until conduit layouts are approved.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit complete operations and maintenance data for all equipment furnished under this Division in accordance with Section 01340 manuals shall be prepared specifically for this installation and shall include all required cuts, Drawings, equipment lists, descriptions, complete part lists, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

1.10 WARRANTY

A. Provide a warranty for all the electrical equipment in accordance with the requirements of other sections, but in no case less than three (3) years from date of substantial completion.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 INSTALLATION

A. Electrical systems shall be complete and operable for the intended purpose in accordance with applicable codes at the time of acceptance.

B. The Contractor shall coordinate all activities with the construction manager and the Owner.

END OF SECTION

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SECTION 16010FA

GENERAL PROVISIONS

PART 1 GENERAL

1.01 WORK INCLUDED:

A. The work covered under this Division of the Specifications is intended to include the furnishing of all materials, equipment and labor necessary for or reasonably incidental to, the installation of a complete and fully operative electrical system as indicated on the drawings and specified in this section.

1. The work shall consist generally of, but is not limited to, the following major items:

a. Fire Alarm System.
b. Conduit and Wiring.

B. Work Not Included:

The following work is not included in this Section:

1. Temperature controls and related wiring.

C. Fees and Permits:

1. Obtain all permits required for his/her work and include the cost of same in his/her bid.
2. The contractor shall also include in his/her bid the cost for the power company service.

D. Certificate of Inspection:

The Contractor shall, at his/her expense, have a final inspection made of the complete electrical installation and shall deliver a certificate of approval of the complete work to the Owner before receiving his/her final payment.

1.02 SUBMITTALS

A. Submit properly identified manufacturer's literature and technical data to the form defined in Section 01300, before commencing work.

B. Shop Drawings:

1. Submit copies of manufacturer's drawing of conduit, wire, wiring devices, fire alarm and voice evacuation system and any other special electrical equipment to be installed, and shall receive the Project Engineer's acceptance before ordering the same for installation.

2. All shop drawings shall be submitted in 3-ring binders with each specification section indicated with tabs.

3. If shop drawings are submitted intermittingly and not in 3-ring binders, they will not be reviewed and will be returned to contractor for proper submittal.

4. Substitutions – refer to Specification Section 01631 Accepted Equivalent:

1.03 QUALITY ASSURANCE

A. Qualifications of manufacturers, materials and equipment:

1. Material and equipment, except as herein otherwise noted, shall be new and conform to standards specified herein defined to include conduits, cable, wiring materials and devices, panelboards, and the like.

2. Materials and equipment shall be of an approved design.

a. Similar materials shall be of one manufacturer wherever possible.

3. Equipment offered under these Specifications shall be limited to products regularly produced and recommended for service ratings in accordance with manufacturer's catalogs, engineering data, or other comprehensive literature made available to the public and in effect at the time of opening of bids.

4. Install equipment in strict accordance with manufacturer's instruction for type, capacity and suitability of each piece of equipment used.

a. Obtain these instructions which shall be considered a part of these Specifications.

B. Qualifications of supervisor, workmanship and installers:

1. The Contractor shall have a Master Electrician constantly supervising the work covered by these Specifications, and so far as possible shall keep the same foreman on the job from start to finish.

a. The workmanship of the entire job shall be first class in every way and only experienced and competent workers shall be employed for the work.

1.04 CODES AND REGULATIONS

A. Work shall be installed in accordance with the regulations and requirements of the National Electrical Code NFPA No. 70; Life Safety Code NFPA No. 101, Standard Building Code as well as all rules, state and local codes regulations and requirements of the telephone and power companies.

B. Where conduits and/or cables penetrate fire rated walls, ceilings or floors, the penetrations shall be fire stopped in accordance with chapter 10, section 1001 of the standard building code.

1. The above shall be ascertained and fully coordinated before the installation of any material, equipment, and the like, and any discrepancy shall be immediately brought to the attention of the Project Engineer in writing, and the Contractor shall receive a disposition of same before proceeding with the work.

2. Furnish, without additional charge, any additional materials and labor that may be required for compliance with these codes, law, rules, regulations or requirements even though the work is not mentioned in these Specifications or shown on the Drawings.

C. Material and equipment shall bear the label of approval of the National Board of Fire Underwriters Laboratory.

1.05 INSPECTIONS

A. All work and materials covered by these Specifications and shown on the Drawings shall be subject to inspection at any and all times by representatives of the Project Engineer or Owner.

B. If the Project Engineer or Owner's inspectors find that any material does not conform with these Specifications, the Contractor shall within three days after being notified by the Project Engineer or Owner, remove the material from the premises, and if said material has been installed, the entire expense of removing and replacing same, including any cutting and patching that may be necessary, shall be borne by the Contractor.

C. Tests:

The Owner reserves the right to inspect and test any portion of the equipment during the progress of this work.

1. The Contractor shall test the entire system in the presence of the Owner or the Owner's representative when the work is completed to insure that all portions are free from short circuits and grounds.

2. All equipment, material and labor necessary to conduct the above tests shall be furnished at the Electrical Contractor's expense.

1.06 PRODUCT HANDLING

A. Protection of Equipment, Material and Work:The Contractor shall effectively protect, at his/her own expense, much of his/her work, materials or equipment, as is liable to injury during the construction period.

1. Openings into any part of the conduit system as well as associated fixtures, equipment, and the like, both before and after being set in place, shall be securely covered or otherwise protected to prevent obstruction of the conduit, or injury due to carelessness or maliciously dropped tools or materials, grit, dirt, or any foreign matter.

a. The Contractor will be held responsible for all damage done until his/her work is fully and finally accepted.

2. Cover conduit ends with capped bushings.

B. Repair of damage: In the event of damage, repair shall be made immediately, to the Project Engineer's satisfaction and at no additional cost to the Owner.

C. Special Handling: Special care, storage and handling of new and existing lighting fixtures shall be taken to minimize breakage of lenses and lamps shipped with fixtures.

1. Immediately replace any breakage with the exact lens or lamp. Used material is not an acceptable replacement.

1.07 JOB CONDITIONS

A. Accuracy of Data: The data given herein and on the Drawings are as exact as could be secured.

1. The Specifications and Drawings are for the assistance and guidance of the Contractor.

2. Exact locations, distances, levels, and the like, will be governed by the building field conditions and the Contractor shall use the data contained herein with this understanding.

B. Drawings:

1. The electrical drawings are diagrammatic, but shall be followed as closely as actual construction and work of other Contractors will permit.

2. Deviations from drawings required to make the work of the Contractor conform to the building as constructed, and to the work of other contractors, shall be made by the Contractor at his/her expense.

3. The branch circuit wiring and arrangements of home runs have been worked out for maximum economy consistent with adequate sizing for voltage drop, and the like. Maximum number of branch circuits per home-run conduit shall be (3) three.

4. Install the wiring circuits arranged exactly as shown on the drawings.

5. It is not the intention of the drawings or specifications to indicate each piece of conduit, fittings, and the like, required for the satisfactory operation of the installation and whereby one is indicated, but not specified, or specified but not indicated on the drawings, it shall be considered to be both specified and indicated.

C. Measurements:

1. Contractor shall thoroughly review the Contract Drawings and the Specifications to gain a complete understanding of the project requirements. It is highly recommended that the Contractor visit the job site to ascertain all existing building conditions, project access and proposed lay down areas, conduit runs, interfacing, interferences, conflicts, discrepancies, etc., and shall report the same to the Procurement Division for clarification ten days prior to submittal of the bid.

2. The Contractor shall make all measurements necessary for his/her work and shall assume responsibility for their accuracy.

3. Install necessary pull boxes, manholes and junction boxes as may be required to accomplish the distribution system indicated on the riser diagram.

D. Structural difficulties: Should any structural difficulties prevent the setting of cabinets, running conductors, and the like, at points indicated on the drawings, the necessary deviation therefrom, as determined by the Project Engineer will be permitted and shall be made without additional cost.

E. Cooperation with Other Contractors

1. The Contractor shall arrange all parts of his/her work in proper relation to the work of other contractors.

2. Where interferences occur, the Contractor shall, before installing the work involved, consult with the Project Engineer as to exact location and level of his/her work.

3. The Project Engineer's decision will be final.

4. The Contractor shall be responsible for arrangement of his/her work and equipment and maintenance of proper headroom under this work.

5. Should work installed by him/her require any modifications to avoid interference with the other work, such changes shall be made without additional cost.

6. The Engineer's decision as to determination or allocation or responsibility where conditions require changing of work, shall be final.

7. If any work of the Contractor is dependent for its proper execution on contiguous work, examine such work and report in writing any defect thereon or conditions rendering it unsuitable.

8. The beginning of work, without making such report, shall constitute an acceptance of such work, and any defects in his/her own work consequently shall be his/her responsibility.

1.08 CLEANING

A. Keep the premises free of debris and unusable materials resulting from the work, and immediately upon completion of the work remove such debris and material from the site and leave floors broom clean in areas affected by the work.

1.09 GUARANTEE

A. Leave the electrical installation in proper working order and without charge, replace any work or materials which develop defects within one year from date of final inspection and acceptance by the Owner.

1.10 DEFINITIONS

A. In this Division "provide" is used as a term contraction meaning "to furnish, install and connect up completely in the specified or in an approved manner for the item and/or material described".

PART 2 PRODUCTS Not Used

PART 3 EXECUTION Not Used

END OF SECTION

SECTION 16060FA

MINOR ELECTRICAL DEMOLITION FOR REMODELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

B. Materials and equipment for patching and extending work: As specified in individual Sections.

PART 3 EXECUTION

3.01 EXAMINATION

C. Verify field measurements and circuiting arrangements are as shown on Drawings.

D. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Owner or Owner's Representative before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

B. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner Engineer and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

G. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

3.05 INSTALLATION

i. Install relocated materials and equipment under the provisions found in other sections of the specifications.

END OF SECTION

SECTION 16100
RACEWAYS, BOXES, AND CABINETS

PART 1 GENERAL

1.01 SUBMITTALS

A. Provide submittals for all electrical equipment enclosures.

1.02 REFERENCES

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Comply with NECA "Standard of Installation."

1.03 LISTING AND LABELING

A. Provide products specified in this Section that are UL listed and labeled.

PART 2 PRODUCTS

2.01 CONDUIT

A. Electrical Metallic Tubing (EMT): Steel thin wall tubing and fittings with electrically galvanized finish and shall comply with ANSI C80.3 and UL/797.

B. Liquid Tight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

C. PVC Conduit and Tubing Fittings: NEMA TC 3; Schedule 80, match to conduit or conduit/tubing type and material.

D. Aluminum Rigid Conduit

2.02 BOXES

A. Outlet and Device Boxes: Use 1 of the following:

1. Nonmetallic Boxes: NEMA OS2.

B. PWI and Junction Boxes: Use 1 of the following:

1. Small Boxes: NEMA OS 1, stainless steel.

2. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

C. Hinged Cover Enclosures: Stainless steel enclosure with continuous hinge cover and flush latch. The enclosure shall be provided with stainless panel insert for mounting equipment. Outdoor enclosures shall be 316 NEMA 4X Stainless Steel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Seal all outdoor raceways using duct seal.

B. Use the following wiring methods:

1. Exposed outdoors: Rigid Aluminum conduit & fittings.

2. Underground: PVC Schedule 80 with Rigid Aluminum elbows coated in mastic.

3. Instrumentation (shielded cable): Aluminum or PVC (dependent on location)

4. Indoors in office or conditioned spaces, exposed or concealed: EMT conduit and fittings.

5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquid tight flexible metal conduit.

6. Boxes and Enclosures:

a. 316 NEMA 4X stainless steel. All hardware shall be stainless steel.

C. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

D. Install raceways level and square and at proper elevations. Provide adequate headroom.

E. Complete raceway installation before starting conductor installation.

F. Use temporary closures to prevent foreign matter from entering raceway.

G. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

H. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated keep the legs of a bend in the same plane and the straight legs of offsets parallel.

I. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1-inch (25 mm) concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in the concrete.

3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

J. Install underground raceways:

1. At least 18" below grade.
2. At least 24" below driveways and roads.
3. All buried ductbanks to be concrete encased 3000 psi color red concrete.

K. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.

1. Run parallel or banked raceways together, on common supports where practical.

2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

L. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.

2. Use insulating bushings to protect conductors.

M. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

N. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

O. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb (90kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

P. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling, threaded inside for plugs, and set flush with the finished floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

Q. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid tight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

R. Install hinged cover enclosures and cabinets plumb. Support at each corner.

S. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

END OF SECTION

SECTION 16108

MISCELLANEOUS EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all miscellaneous equipment as hereinafter specified and as shown on the Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Disconnect Switches:

1. Fusible and non-fusible disconnect switches shall be heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3 pole with full cover interlock. All current carrying parts shall be copper.

2. Enclosure type outdoors shall be NEMA 4X, 316 stainless steel with copper lugs except as otherwise shown on the Drawings.

3. Enclosure type indoors in office or conditioned spaces shall be NEMA 1.

4. Switches shall be horsepower rated as manufactured by the Eaton, General Electric or Square D Co.

5. Control wiring shall not pass through any disconnect enclosure. A junction box shall be provided, constructed of the same material as the disconnect and utilized to separate power and control wiring prior to the disconnect enclosure.

6. Each disconnect shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served.

B. Manual Transfer Switches:

1. Non-fusible manual transfer switches shall be double-throw, heavy-duty, NEMA type H, quick-make, quick-break, visible blades, 600 volt, 3 pole with full cover interlock. All current carrying parts shall be copper.

2. Enclosure type shall be NEMA 4X, 316 stainless steel with copper lugs except as otherwise shown on the Drawings.

3. Switches shall be horsepower rated as manufactured by the Eaton, General Electric or Square D Co.

4. Control wiring shall not pass through any manual transfer switch enclosure. A junction box shall be provided, constructed of the same material as the disconnect and utilized to separate power and control wiring prior to the disconnect enclosure.

5. Each MTS shall be provided with a plastic nameplate, affixed to the enclosure without screws, identifying the equipment served.

C. Manual Motor Starters:

1. Manual motor starters shall be furnished and installed for single-phase motors. Manual starters shall be non-reversing, reversing or two speed type as shown on the Drawings. Built-in control stations shall be furnished where shown on the Drawings.

2. Enclosure type shall be NEMA 1 except as shown on the Drawings.

3. NEMA Type 4 enclosures shall be 316 stainless steel.

4. Manual motor starters shall be as manufactured by Allen-Bradley, no equal.

D. Magnetic Motor Starters:

1. Motor starters shall be 2 or 3 pole, 1 or 3-phase as required, 60 Hz, 600 volt, magnetically operated, full voltage nonreversing except as shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 volt operating coil, and control power transformer. Three phase starters shall have 3 overload relays. Auxiliary contacts shall be provided as shown on the Drawings or required.

4. Overload relays shall be non-adjustable, ambient compensated and manually reset.

5. Control power transformers shall be sized for additional load where required. Transformer secondaries shall be equipped with time-delay fuses.

6. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

7. Enclosure type shall be NEMA 1 except as shown on the Drawings.

8. NEMA Type 4 enclosures shall be 316 stainless steel.

9. Magnetic motor starter shall be as manufactured by Allen-Bradley, no equal.

E. Combination Magnetic Motor Starters:

1. Motor starters shall be a combination motor circuit protector and 3-pole, 60 Hz, 600 volt, magnetically operated, full voltage non-reversing contactor except as otherwise shown on the Drawings. NEMA sizes shall be as required for the horsepowers shown on the Drawings.

2. Two speed starters shall be for single or two winding motors as shown on the Drawings.

3. Each motor starter shall have a 120 volt operating coil and control power transformer. Three phase starters shall have 3 overload relays. Auxiliary contacts shall be provided as shown on the Drawings or required.

4. Overload relays shall be non-adjustable, ambient compensated and manually reset.

5. Built-in control stations and indicating lights shall be furnished where shown on the Drawings.

6. Enclosure type shall be NEMA 1 except as shown on the Drawings.

7. NEMA Type 4 enclosures shall be 316 stainless steel.

8. Motor circuit protectors shall be molded case with adjustable magnetic trip only. They shall be specifically designed for use with magnetic motor starters. Motor circuit protectors shall be furnished with bolt-on current limiting fuses.

9. Combination magnetic motor starters shall be as manufactured by Allen-Bradley, no equal.

F. Dry Type Step Down Transformers:

1. Transformers shall be dry type, two-winding with KVA and voltage ratings as shown on the Drawings.

2. Four full capacity taps shall be furnished, two 2-1/2% above and two 2-1/2% below rated primary voltage.

3. Transformers shall be built in accordance with ANSI C89 and NEMA ST1-4 with a maximum insulation temperature rise of 115° C.

4. Transformers shall be as manufactured by the Eaton, General Electric or Square D Co.

G. Control Relays:

1. Control relays shall be socket type, with 10 ampere, 600 volt, convertible contacts. Time delay relays shall be solid state, adjustable 1/5 to 180 seconds.

H. Unless otherwise noted, all NEMA 4 enclosures shall be stainless steel. NEMA 4X push buttons and pilot lights shall be provided in all weatherproof control panels.

I. All Enclosures installed in “Corrosive” areas shall be 316 stainless steel.

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 16110FA

RACEWAYS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to electrical raceways specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of raceway work is indicated by drawings and schedules.

B. Types of raceway specified in this section include the following:

1. Rigid metal conduit.
2. Intermediate metal conduit.
3. PVC coated metal conduit.
4. Flexible metal conduit.
5. Liquid tight flexible metal conduit.
6. Electrical metallic tubing (EMT).
7. Rigid nonmetallic conduit (PVC).
8. Surface Metal Raceway

C. Electrical nonmetallic tubing (ENT) is <u>not</u> acceptable.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Installer shall have at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.

1.04 CODES AND STANDARDS:

A. NEMA Compliance: Comply with applicable requirements of NEMA Standards Publications pertaining to raceways.

B. UL Compliance and Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

C. NEC Compliance: Comply with applicable requirements of NFPA-70 pertaining to construction and installation of raceway systems.

1.05 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions for each type of raceway system required. Include data substantiating that materials comply with requirements.

PART 2 PRODUCTS

2.01 GENERAL:

A. Provide raceways and fittings, of types, sizes, and weights (wall thickness) for each installation indicated. Where types are not indicated, provide proper selection determined by installer to fulfill installation requirements and comply with applicable portions of NFPA-70 for raceways.

B. All conduits and fittings shall bear the U.L. label or seal.

C. Minimum trade size raceway shall be 1/2".

D. Where conduit size is not indicated on plan, size conduit in accordance with NFPA-70, except no conduit smaller than 3/4" shall be embedded in concrete or masonry or installed below grade.

2.02 RIGID METAL CONDUIT

A. Provide zinc coated or hot-dipped galvanized type rigid steel conduit conforming to Federal Specification WW-C-581, ANSI C80 and U.L.6.

B. Provide threaded type zinc plated or hot-dipped galvanized malleable iron or steel fittings conforming to Federal Specification W-F-408.

1. Use Type 1 fittings for rain tight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for other miscellaneous conditions.

C. Provide insulated bushings on all rigid steel conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.03 INTERMEDIATE METAL CONDUIT:

A. Provide zinc coated or hot-dipped galvanized type intermediate steel conduit conforming to Federal Specification WW-C-581 and U.L. 1242.

B. Provide threaded type zinc plated or hot-dipped galvanized, malleable iron or steel fittings.

C. Provide insulated bushings on all intermediate steel conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.04 PVC COATED METAL CONDUIT

A. Provide hot-dipped galvanized type rigid steel conduit with external PVC coating (20 mil. thick) conforming to Federal Specification WW-C-581, ANSI C80.1, U.L. 6, and NEMA RN1.

B. Provide threaded type zinc plated or hot-dipped galvanized, malleable iron or steel fittings with external PVC coating (20 mil. thick).

C. Provide insulated bushings on all PVC coated metal conduits terminating in panels, boxes, wire gutters, or cabinets.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.05 FLEXIBLE METAL CONDUIT

A. Provide flexible steel conduit formed from continuous length of spirally wound, interlocked zinc coated strip steel and conforming to Federal Specification WW-C-56 and U.L. 1.

B. Provide threadless hinged clamp type fittings for use with flexible steel conduit.

1. Straight Terminal Connectors: One piece body, female end with clamp and deep slotted machine screw for securing conduit, male threaded end provided with locknut, and insulated throat connections for terminations.
2. 45 deg. Or 90 deg. Angle Terminal Connectors: Two piece body construction with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, male threaded end provided with locknut, and insulated throat connections for terminations.

2.06 LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Provide liquid tight flexible metal conduit constructed from a continuous, flexible, interlocked, single strip and double wrapped steel, galvanized inside and outside, coated with liquid tight jacket of flexible polyvinyl chloride (PVC), and conforming to U.L. 360.

B. Provide compression type cadmium plated, malleable iron fittings with neoprene gasket sealing rings, and complying with ANSI/NEMA FB1 and U.L. 5148.

C. Provide insulated throat connectors for terminations.

2.07 ELECTRICAL METALLIC TUBING

A. Provide galvanized steel tubing conforming to Federal Specification WW-C-563, ANSI C80.3, and U.L. 797.

B. Provide set screw or compression type zinc plated or hot-dipped galvanized, malleable iron or steel fittings conforming to Federal Specification W-F-408.

1. Use Type 1 fittings for rain tight connections.
2. Use Type 2 fittings for concrete tight connections.
3. Use Type 3 fittings for miscellaneous connections.

C. Provide insulated throat connectors for terminations.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.08 RIGID NONMETALLIC CONDUIT:

A. Provide rigid nonmetallic conduit conforming to Federal Specification WC1094A, NEMA TC-2 and U.L. 651.

1. Heavy Wall Conduit: Schedule 40, 90C, U.L. rated, constructed of polyvinyl chloride, for direct burial or normal above ground use.
2. Extra Heavy Wall Conduit: Schedule 80, U.L. rated, constructed of polyvinyl chloride, for direct burial or above ground use.

B. Provide fittings which mate and match to conduit type and material and comply with NEMA TC-3 and U.L. 514.

C. Provide threaded terminal adapters on all rigid nonmetallic conduits terminating in panels, boxes, wire gutters, or cabinets. Adapters to have male threads on one end, socket end on other.

D. Provide zinc plated or hot-dipped galvanized, malleable iron conduit bodies with removable cover, corrosion resistant screws, threaded hubs and complying with ANSI/NEMA FB1.

2.09 EXPANSION FITTINGS:

A. Expansion fittings shall be:

1. U.L. Listed, hot-dipped galvanized inside and outside, providing a 4" expansion chamber, external braided grounding and bonding jumper with approved clamps and U.L. listed for the application.
2. U.L. Listed, polyvinyl chloride, providing a 6" expansion chamber, and meet requirements for rigid nonmetallic conduit.

2.10 Available Conduit Bodies Manufacturers: Subject to compliance with requirements, manufacturers offering conduit bodies which may be incorporated in the work include, but are not limited to the following:

A. Appleton Electric; Div. of Emerson Electric Co.
B. Arrow Hart Div.; Crouse Hinds Co.
C. Bell Electric Div.; Square D Co.
D. Killark Electric Mfg. Co.
E. O-Z/Gedney Div.; General Signal Co.
F. Spring City Electrical Mfg. Co.

2.11 SURFACE METAL RACEWAY

A. Provide one-piece steel surface raceway which bears U.L. label or seal, size as required for each application, and finish as indicated on drawings or as directed by Engineer.

B. Manufacturers:

1. Wiremold System 500 or 700 as required.
2. Thomas & Betts Corporation.
3. Walker Systems, Inc.

C. Provide insulating bushings on all surface metal raceways terminating in panels, boxes, wire gutters, or cabinets.

D. Provide fittings and boxes from manufacturers standard accessories which mate and match for a complete system installation. Minimum box depth shall be 1-3/4".

PART 3 EXECUTION

3.01 INSTALLATION:

A. General: Install raceways as indicated; in accordance with manufacturer's written installation instructions, and in compliance with NFPA-70, and NECA's "Standards of Installation".

B. Coordinate with other work including wires/cables, boxes and panel work, as necessary to interface installation of electrical raceways and components with other work.

C. Install conduits concealed in either wall, slabs, or above hung ceilings. Where conduits cannot be concealed, route conduits exposed on wall or ceiling.

D. Mechanically fasten together metal conduits, enclosures and raceways for conductors to form continuous electrical conductor. Connect to electrical boxes, fittings and cabinets to provide electrical continuity and firm mechanical assembly.

E. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.

F. Install miscellaneous fittings such as reducers, chase nipples, 3 piece unions, split couplings, and plugs that have been specifically designed and manufactured for their particular application. Install expansion fittings in raceways every 200' linear run or wherever structural expansion joints are crossed.

G. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.

H. Provide nylon pull cord in all empty conduits. Test conduits required to be installed, but left empty, test with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.

3.02 CONDUIT INSTALLATION:

A. Use electrical metal tubing conduit in mechanical equipment rooms, electrical equipment rooms and for main feeder circuits.

B. Use EMT in offices, corridors and toilets for branch circuits.

C. Use flexible metal conduit in movable partitions and from outlet boxes to recessed lighting fixtures, and final 24" of connections to motors, or control items subject to movement or vibration and in cells of precast concrete panels.

D. Use liquid tight flexible metal conduit where subject to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray or dripping oil, water or grease.

E. Cut conduits straight, properly ream, and cut threads for heavy wall conduit deep and clean.

F. Field bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.

G. Size conduits to meet NFPA-70, except no conduit smaller than 3/4" shall be embedded in concrete or masonry or install below grade.

H. Where penetrating grade or floor in an exposed location from underground or in slab, a black mastic coated or PVC coated galvanized rigid steel conduit shall be used.

I. Provide rigid 90 degree elbows when turning conduit up in slab or turning conduit up above grade.

J. Fasten conduit terminations in sheet metal enclosures by 2 metal locknuts, and terminate with bushing. Install locknuts inside and outside enclosure.

K. Conduits are not to cross pipe shafts, or ventilating duct openings.

L. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes, or other sources of heat. Wherever possible, install horizontal raceway runs above water and steam piping.

M Support riser conduit at each floor level with clamp hangers.

N. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3 piece union or split coupling.

O. Complete installation of electrical raceways before starting installation of cables/wires within raceway.

3.03 CONCEALED CONDUITS:

A. Raceways installed underground or in floors, or outside shall be PVC Schedule 40.

B. For floors-on-grade, install conduits under concrete slabs.

C. Install underground conduits minimum of 24" below finished grade.

D. Where penetrating a floor in a location concealed in a block wall and acceptable by applicable codes, PVC Schedule 40 rigid non-metallic raceways may be used up to the first outlet box, provided outlet height above finished floor does not exceed 48".

3.04 CONDUITS IN CONCRETE SLAB:

A. Place conduits between bottom reinforcing steel and top reinforcing steel.

B. Place conduits either parallel, or at 90 deg. to main reinforcing steel.

C. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.

D. Conduits crossing in slab must be reviewed for proper cover by Engineer.

E. Embedded conduit diameter is not to exceed 1/3 of slab thickness.

F. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.

3.05 EXPOSED CONDUITS:

A. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with, or at right angles to walls of building.

B. Install exposed conduit work as not to interfere with ceiling insets, lights, or ventilation ducts or outlets.

C. Support exposed conduits by use of hangers or clamps. Support conduits on each side of bends and on spacing not to exceed following: up to 1": 6'-0"; 1-1/4" and over: 8'-0".

D. Exposed conduits shall be painted to match the color of walls, ceilings, canopies, etc., as indicated on drawings, or as directed by the Engineer.

3.06 NON-METALLIC CONDUITS:

A. Make solvent cemented joints in accordance with recommendations of manufacturer.

B. Install PVC conduits in accordance with NFPA-70 and in compliance with local utility practices.

3.07 CONDUIT FITTINGS:

A. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal, and ridged outside circumference for proper fastening.

B. Insulated bushing for terminating conduits smaller than 1-1/4" are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.

C. Insulated bushings for terminating conduits 1-1/4" and larger are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.

D. Bushing of insulated type to have screw type grounding terminal.

E. Miscellaneous fittings such as reducers, chase nipples, 3 piece unions, split couplings, and plugs to be specifically designed for their particular application.

END OF SECTION

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SECTION 16120
WIRES AND CABLES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish, install and test all wire, cable, and appurtenances as shown on the Drawings and as hereinafter specified.

1.02 SUBMITTALS

A. Samples of proposed wire and cable shall be submitted for approval. Each sample shall have the size, type of insulation, UL listing and voltage stenciled on the jacket.

B. Approved samples will be sent to the project location for comparison by the Resident Engineer with the wire actually installed.

C. Installed, unapproved wire shall be removed and replaced at no additional cost to the Owner.

1.03 APPLICATIONS

A. Wire for lighting and receptacle circuits above grade shall be type THWN.

B. Wire for all power motor circuits and below grade lighting and receptacle circuits shall be type RHW or XHHW, stranded.

C. Wire for all service conductors shall be type RHW or XHHW, stranded.

D. Single conductor wire for control, indication and metering shall be type MTW No. 14 AWG, 19 strand or type THHN No. 14 AWG stranded.

E. Multi-conductor control cable shall be No. 14 AWG, 19 strand.

F. Wire for process instrumentation or shielded control cable shall be No. 16 AWG, shielded and stranded.

1.04 MINIMUM SIZES

A. Except for control and signal leads, no conductor smaller than No. 12 AWG shall be used.

PART 2 PRODUCTS

2.01 MATERIALS

A. All wires and cables shall be of annealed, 98 percent conductivity, soft drawn stranded copper conductors.

2.02 600 VOLT WIRE AND CABLE

A. Type RHW and XHHW shall be cross-linked polyethylene (XLP); as manufactured by the Southwire Co., Anixter, General Cable or Rome Cable.

B. Type THWN shall be as manufactured by the Southwire Co., Anixter, General Cable or Rome Cable.

2.03 INSTRUMENTATION AND CONTROL CABLE

A. Process instrumentation wire shall be twisted pair, 600V, cross-linked polyethylene insulated, aluminum tape shielded, polyvinyl chloride jacketed, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or Allied Wire and Cable type “XLP/PVC”. Multi-conductor cables shall be supplied with individually shielded twisted pairs.

B. Multi-conductor control cable shall be stranded, 600V, cross-linked polyethylene insulated with PVC jacket, type "XLP" as manufactured by the American Insulated Wire Co., Eaton Corp. "Polyset," or Allied Wire and Cable type “XLP/PVC”.

2.04 TERMINATIONS AND SPLICES

A. Power Conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling.

B. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors per termination. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors. Heat shrink boots shall be utilized for all outdoor splices.

C. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): Terminations permitted shall be typical of control conductors. Splices are allowed at instrumentation terminal boxes only.

D. Except where otherwise approved by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.

E. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.

PART 3 EXECUTION

3.01 INSTALLATION

A. All conductors shall be carefully handled to avoid kinks or damage to insulation.

B. Lubrications shall be used to facilitate wire pulling. Lubricants shall be U.L. listed for use with the insulation specified.

C. Shielded instrumentation wire shall be installed from terminal to terminal with no splicing at any intermediate point.

D. Shielded instrumentation wire shall be installed in rigid steel conduit and pull boxes that contain only shielded instrumentation wire. Instrumentation cables shall be separated from control cables in manholes.

E. Shielding on instrumentation wire shall be grounded at one end only, as directed by supplier of the instrumentation equipment.

F. Wire and cable connections to terminals and taps shall be made with compression connectors. Connections of insulated conductors shall be insulated and covered. All connections shall be made using materials and installation methods in accordance with instructions and recommendations of the manufacturer of the particular item of wire and cable. The conductivity of all completed connections shall be not less than that of the uncut conductor. The insulation resistance of all completed connections of insulated conductors shall be not less than that of the uncut conductor.

G. All wire and cable shall be continuous and without splices between points of connection to equipment terminals, except a splice will be permitted by the Engineer if the length required between the points of connection exceeds the greatest standard shipping length available from the manufacturer specified or approved by the Engineer as the manufacturer of the particular item of wire and cable.

H. Steel fish tapes and/or steel pulling cables shall not be used in PVC conduit runs.

I. All control and instrumentation circuits and wiring shall be clearly and permanently numbered and labeled at each end so as to identify the location of the opposite end and the function of the circuit. Individual wires in a multi-wire circuit shall be identified with wire numbers. Labeling shall be in place prior to turnover of any equipment, system or sub-system to Owner.

3.02 TESTS

A. All 600-volt wire insulation shall be tested with a meg-ohmmeter after installation. Tests shall be made at not less than 1,000 VDC.

END OF SECTION

SECTION 16120FA

WIRES AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is a Division 16 Basic Electrical Materials and Methods section and is part of Division 16 section making reference to electrical wires and cables specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of electrical wires and cable work is indicated by drawings and schedules.

B. Types of electrical wire, cable, and connectors specified in this section include the following:

1. Copper conductors.
2. Service entrance cable.
3. Split-bolt connectors.
4. Wirenut connectors.

C. Applications of electrical wire, cable, and connectors required for project are as follows:

1. For power distribution circuits.
2. For appliance and equipment circuits.
3. For motor branch circuits.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in the manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects similar to that required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction, installation and color coding of electrical wires and cables.

D. UL Compliance: Comply with applicable requirements of UL Std. 83, "Thermoplastic Insulated Wires and Cables" and Std. 486A, "Wire Connectors and Soldering for Use With Copper Conductors".

E. UL Compliance: Provide wiring/cabling and connector products which are UL listed and labeled.

F. NEMA/ICEA Compliance: Comply with NEMA/ICEA Std. Pub/No's WC5, Thermoplastic Insulated Wires and Cable for the "Transmission and Distribution of Electrical Energy", and WC30, "Color Coding of Wires and Cables", pertaining to electrical power type wires and cables.

G. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring.

H. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8, and D-573. Provide copper conductors with conductivity of not less than 98% at 20 degrees C. (68 deg.F.).

I. FOIST Compliance: Comply with Federal Specifications J-C-30, "Electrical Cable and Wire (Power, Fixed, Installation)", and W-S-610, "Splice Conductor".

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's data on electrical wires, cables, and conductors.

B. DELIVERY, STORAGE, AND HANDLING:

1. Deliver wire and cable properly packaged in factory fabricated type containers, or wound on NEMA specified type wire and cable reels.
2. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
3. Handle wire and cable carefully to avoid abrasing, puncturing, and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:

1. Wire and Cable:

a. Apex Wire and Cable Corp.
b. American Insulated Wire Corp.
c. American Wire and Cable Co.

d. Anaconda-Ericson Inc., Wire and Cable Div.
e. Beldon Div.; Cooper Industries.
f. Brand-Rex Div.; Pyle National Co.
g. Cerro Wire and Cable Corp.
h. Cleveland Insulated Wire Co.
j. Phelps Dodge Cable and Wire Co.
k. Rome Cable Corp.
l. Southwire Corp.
m. Triangle PWC, Inc.

2. Connectors;

a. AMP, Inc.
b. Appleton Electric Co.; Emerson Electric Co.
c. Burndy Corporation.
d. Brand-Rex Div.; Pyle National Co.
e. Electrical Products Div.; Midland Ross Corp.
f. General Electric Co.
g. Ideal Industries, Inc.
h. Leviton Mfg. Company.
i. 3M Company.
j. O-Z/Gedney Co.
k. Southport Industries Inc.
l. Square D Company.
m. Thomas and Betts Corp.

2.02 WIRES, CABLES, AND CONNECTORS:

A. General: Provide electrical wires, cables, and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, for a complete installation, and for application indicated. Except as otherwise indicated, provide copper conductors with conductivity of not less than 98% at 20 degrees C (68 degrees F.).

B. Building Materials: Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated. Where not indicated, provide proper wire selection as determined by installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following UL types, those wires with construction features which fulfill project requirements.

1. Type THWN: For dry or wet locations; max. operating temperature 75 deg.C. (167 deg.F.). Insulation, flame retardant, moisture and heat resistant, thermoplastic; outer covering, nylon jacket; conductor, annealed copper.
2. Type THHN: For dry and damp locations; max. operating temperature 90 deg.C. (194 deg.F.). Insulation, flame retardant, heat resistant thermoplastic conductor, annealed copper.

2.03 CONNECTORS:

A. General: Provide UL type factory fabricated, metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements, NFPA-70 and NEMA standards. Select from the following, those types, classes, kinds and styles of connectors to fulfill project requirements:

1. Type: Pressure.
2. Type: Crimp.
3. Type: Threaded.
4. Class: Insulated.
5. Kind: Copper (for CU to CU connection).
6. Style: Butt connection.
7. Style: Elbow connection.
8. Style: Combined "T" and straight connection.
9. Style: "T" connection.
10. Style: Split-bolt parallel connection.
11. Style: Tap connection.
12. Style: Pigtail connection.
13. Style: Wirenut connection.

PART 3 EXECUTION

3.01 INSTALLATION OF WIRES AND CABLES:

A. General: Install electrical cables, wire and wiring connectors as indicated, in compliance with applicable requirements of NFPA-70, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.

B. Coordinate wire/cable installation work including electrical raceway and equipment installation work, as necessary to properly interface installation of wires/cables with other work.

C. Install UL type wiring in conduit, for feeders and branch circuits.

D. Pull conductors simultaneously where more than one is being installed in same raceway.

E. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulator.

F. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceways.

G. Keep conductor splices to a minimum.

H. Install splices and tapes which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.

I. Use splice and tap connectors which are compatible with conductor material.

J. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std 486A and B.

3.02 FIELD QUALITY CONTROL:

A. Prior to energization of circuitry, check installed wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled.

B. Prior to energization, test wires and cables for electrical continuity and for short circuits.

C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

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EDSECTION 16135FA

ELECTRICAL BOXES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 making reference to electrical wiring boxes specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of electrical box work is indicated by drawings and schedules.

B. Types of electrical boxes specified in this section include the following:

1. Outlet boxes.
2. Junction boxes.
3. Pull boxes.
4. In-ground hand hole.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of electrical boxes, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects utilizing electrical boxes similar to those required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 as applicable to construction and installation of electrical wiring boxes.

D. UL Compliance: Comply with applicable requirements of UL 50, UL 514 Series, and UL 886 pertaining to electrical boxes which are UL listed and labeled.

E. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub.No.'s OS1, OS2, and Pub.250 pertaining to outlets and device boxes, covers and box supports.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's data on electrical boxes and fittings.

PART 2 PRODUCTS

2.01 FABRICATED MATERIALS:

A. Outlet Boxes: Provide galvanized coated flat rolled sheet steel outlet wiring boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct outlet boxes with mounting holes, and with cable and conduit size knockout openings in bottom and sides. Provide boxes with threaded screw holes, with corrosion resistant cover and grounding screws for fastening surface and device type box covers, and for equipment type grounding.

1. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations. Choice of accessories is Installer's code compliance option.

B. Device Boxes: Provide galvanized coated flat rolled sheet steel gangable or non-gangable device boxes, of shapes, cubic inch capacities, and sizes, including box depths as indicated, suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable size knockout openings in bottom and ends, and with threaded screw holes in end plates for fastening devices. Provide cable clamps, and for equipment type grounding.

1. Device Box Accessories: Provide device box accessories as required for each installation, including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations. Choice of accessories is installer's code compliance option.
2. Manufacturers: Subject to compliance with requirements, provide interior outlet boxes of one of the following:

a. Adalet-PLM Div., Scott Fetzer Co.
b. Appleton Electric; Emerson Electric Co.
c. Bell Electric; Square D Company.
d. Midland-Ross Corp.
e. OZ/Gedney; General Signal Co.
f. Pass and Seymor, Inc.
g. RACO Div; Harvey Hubbell Inc.
h. Thomas and Betts Co.

C. Rain tight Outlet Boxes: Provide corrosion resistant cast metal rain tight outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit holes for fastening electrical conduit, cast metal face plates with spring-hinged watertight caps suitably configurated for each application, including face plate gaskets and corrosion resistant plugs and fasteners.

1. Manufacturers: Subject to compliance with requirements, provide rain tight outlet boxes of one of the following:

a. Appleton Electric; Emerson Electric Co.
b. Arrow Hart Div.; Crouse-Hinds Co.
c. Bell Electric; Square D Co.
d. Harvey Hubbell, Inc.
e. OZ/Gedney; General Signal Co.
f. Pass and Seymor, Inc.

D. Junction and Pull Boxes: Provide galvanized code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes, and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

1. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

a. Adalet-PLM Div.; Scott Fetzer Co.
b. Appleton Electric; Emerson Electric Co.
c. Arrow Hart Div.; Crouse Hinds-Co.
d. Bell Electric; Square D Company.
e. OZ/Gedney Co.; General Signal Co.
f. Spring City Electrical Mfg. Co.

E. Knockout Closures: Provide corrosion resistant box knockout closures of types and sizes, to suit respective installation requirements and applications.

1. Manufacturers: Subject to compliance with requirements, provide knockout closures of one of the following:

a. Adalet-PLM Div.; Scott Fetzer Co.
b. AMP, Inc.
c. Arrow Hart Div.; Crouse-Hinds Co.
d. Appleton Electric Co.; Emerson Electric Co.
e. Bell Electric; Square D Co.
f. Midland Ross Corp.
g. Midwest Electric; Cooper Industries, Inc.
h. OZ/Gedney Co.; General Signal Co.
i. RACO Div.; Harvey Hubbell, Inc.
j. Thomas and Betts Co. Inc.

F. In-ground Hand Hole: Provide concrete hand hole with knockouts, sump, pull eyes, ground rod hole, and cast iron ring with cover. Cover shall read “Electric”. Refer to drawings for size.

1. Manufacturers: Subject to compliance with requirements, provide in-ground hand hole of one of the following:

a. Brooks Products.
b. Armorcast Products Company.
c. Carson Industries LLC.

PART 3 EXECUTION

3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NFPA-70 and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.

C. Provide weather tight outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring.

F. Avoid installing boxes back-to-back in walls. Provide not less than 6" (150mm) separation.

G. Avoid installing aluminum products in concrete.

H. Position recessed outlet boxes accurately to allow for surface finish thickness.

I. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

J. Provide electrical connections for installed boxes.

K. Subsequent to installation of boxes, protect boxes from construction debris and damage.

L. Install in-ground hand hole on 6" gravel base. Provide 3/4" x 10'-0" long ground rod in box and connect to counterpoise. Connect cover to ground rod with 96" long #4 AWG minimum. Install cover flush with finished grade.

3.02 GROUNDING:

A. Upon completion of installation work, properly ground electrical boxes and demonstrate compliance with requirements.

END OF SECTION

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SECTION 16142FA
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.

B. This section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 sections making reference to electrical connections for equipment specified herein.

1.02 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.

B. Applications of electrical power connections specified in this section include the following, but not limited:

1. From electrical source to motor starters.
2. From motor starters to motors.

C. Electrical connections for equipment, not furnished as integral part of equipment, are specified in Division 16 sections, and are work of this section.

D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this section.

E. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this section.

F. Refer to sections of other Divisions for specific individual equipment power requirements, not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and rating required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer's Qualifications: Installer shall have at least 3 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

C. NFPA-70 Compliance: Comply with applicable requirements of NFPA-70 as to type products used and installation of electrical power connections (terminals and splices), for junction boxes, motor starters and disconnect switches.

D. IEEE Compliance: Comply with Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to connections and terminations.

E. ANSI Compliance: Comply with applicable requirement of ANSI/NEMA and ANSI/EIA standards pertaining to products and installation of electrical connections for equipment.

F. UL Compliance: Comply with UL Std.486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of product):

1. Adalet-PLM Div., Scott and Fetzer Co.
2. Allen-Stevens Conduit Fittings Corp.
3. AMP Incorporated.
4. Appleton Electric Co.
5. Arrow Hart Div., Crouse Hinds Co.
6. Burndy Corp.
7. General Electric Co.
8. Harvey Hubbell Inc.
9. Ideal Industries, Inc.
10. Pyle National Co.
11. Reliable Electric Co.
12. Square D Company.
13. Thomas and Betts Corp.

2.02 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cables ties, solderless wire-nuts, and other items and accessories as needed to complete splices and terminations of types indicated.

2.03 METAL CONDUIT, TUBING AND FITTINGS

A. General: Provide metal conduit, tubing, and fittings of types, grades, sizes, and weights (wall thickness) indicated for each type service. Where types and grades are not indicated, provide proper selection to fulfill wiring requirements, and comply with NFPA-70 requirements for raceways. Provide products complying with Division 16 basic electrical materials and methods section "Raceways" and in accordance with the following listing of metal conduit, tubing and fittings.

1. Rigid metal conduit.
2. Rigid metal conduit fittings.
3. Electrical metallic tubing (EMT).
4. EMT fittings.
5. Flexible metal conduit.
6. Flexible metal conduit fittings.
7. Liquid tight flexible metal conduit.
8. Liquid tight flexible metal conduit fittings.
9. PVC coated metal conduit.
10. PVC coated metal conduit fittings.

2.04 WIRES, CABLES AND CONNECTORS

A. General: Provide wires, cables, and connectors complying with Division 16 basic electrical materials and methods section "Wires and Cables".

B. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes and ratings, of wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20 deg. C. (68 deg. F.)

C. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.

D. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, wirenuts and cable ties as recommended for use by accessories manufacturers for type services indicated.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF ELECTRICAL CONNECTIONS

A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NFPA-70, and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Coordinate with other work, including wires/cables, raceways and equipment installation, as necessary to properly interface installment of electrical connections for equipment with other work.

C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.

D. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity ratings, than electrical insulation rating of those conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torquing tools, including torque screwdriver, bean-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torquing requirements are not available, tighten connectors and terminals to comply with torquing values contained in UL's 486A.

H. Provide flexible conduit for motor connections, and other electrical equipment connections, where subject to movement and vibration.

I. Provide liquid tight flexible conduit for connections of motors and other electrical equipment where subject to movement and vibration, and also where connections are subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subject to water spray or dripping oil, grease, or water.

J. Fasten identification markers to each electrical power supply wire/cable conductor which indicates their voltage, phase and feeder number in accordance with Division 16 section "Electrical Identification". Affix markers on each terminal conductor, as close as possible to the point of connection.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION

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SECTION 16160
PANELBOARDS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor materials, equipment and incidentals required and install all panelboards as hereinafter specified and as shown on the Drawings.

PART 2 PRODUCTS

2.01 RATING

A. Panelboard ratings shall be as shown on the Drawings. All panelboards shall be rated for the intended voltage.

B. Panelboards installed indoors shall be NEMA 1 enclosure unless otherwise noted.

2.02 STANDARDS

A. Panelboards shall be in accordance with the Underwriter Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Panelboards shall also comply with NEMA Standard for Panelboards and the National Electrical Code.

2.03 CONSTRUCTION

A. Interiors:

1. All interiors shall be completely factory assembled with circuit breakers, wire connectors, etc. All wire connectors, except screw terminals, shall be of the antiturn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated.

2. Interiors shall be so designed that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

3. Branch circuits shall be arranged using double row construction except when narrow column panels are indicated. Branch circuits shall be numbered by the manufacturer.

4. A nameplate shall be provided listing panel type, number of circuit breakers and ratings.

B. Buses:

1. Bus bars for the mains shall be of copper. Full size neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Phase bussing shall be full height without reduction. Cross connectors shall be copper.

2. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection.

3. Spaces for future circuit breakers shall be bussed for the maximum device that can be fitted into them.

4. Buses for 120/208V lighting panels shall be rated 10,000 amperes RMS symmetrical.

C. Boxes:

1. Recessed boxes shall be made from galvanized code gauge steel without multiple knockouts. Surface mounted boxes shall be painted to match the trim. Boxes shall be of sufficient size to provide a minimum gutter space of 4 inches on all sides.

2. Surface mounted boxes shall have an internal and external finish as hereinafter specified in paragraph D4.

3. At least 4 interior mounting studs shall be provided.

4. All conduit entrances shall be field punched.

D. Trim:

1. Hinged doors covering all circuit breaker handles shall be included in all panel trims.

2. Doors shall have semi flush type cylinder lock and catch, except that doors over 48-in in height shall have a vault handle and 3-point catch, complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. Two keys shall be supplied for each lock. All locks shall be keyed alike; directory frame and card having a transparent cover shall be furnished on each door.

3. The trims shall be fabricated from code gauge sheet steel.

4. All exterior and interior steel surfaces of the panelboard shall be properly cleaned and finished with ANSI Z55.1, No. 61 light gray paint over a rust-inhibiting phosphatized coating. The finish paint shall be of a type to which field applied paint will adhere.

5. Trims for flush panels shall overlap the box by at least 3/4-inch all around. Surface trims shall have the same width and height as the box. Trims shall be fastened with quarter turn clamps.

E. Manufacturer:

1. 120/240V, single phase, 3-wire, and 120/208V 3-phase, 4-wire panelboards shall be as manufactured by Square D, Eaton Cutler-Hammer or Siemens.

2. 480V, 3-phase, 3-wire panelboards shall be as manufactured by Square D, Eaton Cutler-Hammer or Siemens.

2.04 CIRCUIT BREAKERS:

A. Panelboards shall be equipped with circuit breakers as shown on the Drawings.

B. Circuit breakers shall be molded case, bolt-in type.

C. Circuit breakers used in 120/240 and 120/208V panelboards shall have an interrupting capacity of not less than 10,000 - amperes, RMS symmetrical.

D. GFCI (ground fault circuit interrupter) shall be provided for circuits where indicated on the Drawings. GFCI units shall be 1 pole, 120 volt, molded case, bolt-on breakers, incorporating a solid state ground fault interrupter circuit insulated and isolated from the breaker mechanism. The unit shall be U.L. listed Class A Group I device (5 milliamp sensitivity, 25 millisecond trip time), and an interrupting capacity of 10,000 amperes RMS.

PART 3 EXECUTION

3.01 INSTALLATION

A. Boxes for surface mounted panelboards shall be mounted so there is at least 1/2-inch air space between the box and the wall.

B. Unless otherwise noted on the Drawings, top of cabinets shall be mounted 6-feet 0-inch above the floor, properly aligned and adequately supported independently of the connecting raceways.

C. All wiring in panelboards shall be neatly formed, grouped, laced, and identified to provide a neat and orderly appearance. A typewritten directory card identifying all circuits shall be placed in the cardholder inside the front cover.

END OF SECTION

SECTION 16190FA
SUPPORTING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions, and Division 1 Specification sections, apply to work of this section.

B. This section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical supporting devices specified herein.

1.02 DESCRIPTION OF WORK:

A. Extent of supports, anchors, sleeves and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:
1. C-clamps.
2. I-Beam clamps.
3. One-hole conduit straps.
4. Two-hole conduit straps.
5. Round steel rods.
6. Lead expansion anchors.
7. Toggle bolts.
8. Wall and floor seals.
9. Bridle Rings.

3. Conduit supporting devices of the spring or tension type, such as conduit clips manufactured by Caddy Corporation, are <u>not</u> acceptable.

1.03 QUALITY ASSURANCE:

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installers Qualifications: Installer with at least 3 years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to construction and installation of electrical supporting devices.

D. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation" pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

E. UL Compliance: Provide electrical components which are UL listed and labeled.

1.04 SUBMITTALS:

A. Product Data: Submit manufacturer's data on supporting devices including catalog cuts, specifications, and installation instructions, for each type of support, anchor, sleeve and seal.

PART 2 PRODUCTS

2.01 MANUFACTURED SUPPORTING DEVICES:

A. General: Provide supporting devices which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation; and as herein specified. Where more than one type of supporting device meets indicated requirement, selection is Installer's option.

B. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:

1. C-Clamps: Black malleable iron; 1/2" rod size; approximately 70 pounds per 100 units.
2. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
3. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
4. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
5. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
6. Round Steel Rod: Black steel; 1/2" dia.; approximately 67 pounds per 100 feet.
7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel; approximately 200 pounds per 100 units.

C. Anchors: Provide anchors of types, sizes, and materials indicated, with the following construction features:

1. Lead Expansion Anchors: 1/2"; approximately 38 pounds per 100 units.
2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.
3. Manufacturers: Subject to compliance with requirements, provide anchors of one of the following:

a. Ideal Industries, Inc.

b. Joslyn Mfg. and Supply Co.
c. McGraw Edison Co.
d. Star Expansion Co.
e. U.S. Expansion Bolt Co.

D. Sleeves and Seals: Provide sleeves and seals of types, sizes and materials indicated, with the following construction features:

1. Wall and Floor Seals: Provide factory assembled watertight wall and floor seals, of types, and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and wall. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
2. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 12 gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel.

a. Fixture hangers.
b. Channel hangers.
c. End caps.
d. Beam clamps.
e. Wiring studs.
f. Thinwall conduit clamps.
g. Rigid conduit clamps.
h. Conduit hangers.
i. U-bolts.

3. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:

a. Allied Tube and Conduit Corp.
b. B-Line Systems, Inc.
c. Greenfield Mfg. Co., Inc.
d. Midland Ross Corp.
e. OZ/Gedney Div.; General Signal Corp.
f. Power Strut Div.; Van Huffel Tube Corp.
g. Unistrut Div.; GTE Products Corp.

2.02 FABRICATED SUPPORTING DEVICES:

A. Pipe Sleeves: Provide pipe sleeves of one of the following:

1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snap lock joint, welded spiral seam, or welded longitudinal joint. Fabricate sleeves from the following gage metal: 3" and smaller, 20 gage; 4" to 6", 16 gage; over 6", 14 gage.
2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

3. Iron Pipe: Fabricate from cast-iron or ductile iron pipe; remove burrs.

PART 3 EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES:

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NFPA-70 for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacing indicated and in compliance with NFPA-70 requirements.

D Torque sleeve seal nuts, complying with manufacturer's recommended values. Ensure that sealing grommets expand to form watertight seal.

END OF SECTION

SECTION 16195
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Nameplates and tape labels.

B. Wire and cable markers.

C. Color coding.

1.02 SCOPE

A. Provide engraved nameplates for the following equipment as indicated on the drawings:

1. Label all compartments.
2. Label all outdoor junction boxes.
3. Label control system panels.

B. All wires shall be marked and color-coded.

C. All control wiring shall have wire numbers on each end.

D. All exposed conduits to be painted to match color of back wall.

PART 2 PRODUCTS

2.01 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.

B. Wire and Cable Markers: Pre-printed self-sticking type.

C. Color Coding Tape: Vinyl plastic insulating tape, colors as specified in part 3.

PART 3 EXECUTION

3.01 INSTALLATION

A. Degrease and clean surfaces to receive nameplates and tape labels.

B. Install nameplates and tape labels parallel to equipment lines.

C. Secure nameplates to equipment fronts using screws, rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations.

3.02 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. Any color coding schemes used in existing work shall be maintained in new work.

C. Conductor Color Coding: Provide color coding for feeder, and branch circuit conductors throughout the project secondary electrical system as follows:

240/120 Volts	120/208 Volts	Phase	480/277 Volts
Black	Black	A	Brown
Blue	Blue	B	Orange
Red	Red	C	Yellow
White	White	Neutral	White
Green	Green	Ground	Green

3.03 NAMEPLATE ENGRAVING

A. Provide nameplates to identify all electrical distribution and control equipment and loads served. Letter Height: 1/8 inch for individual switches and loads served for distribution and control equipment identification.

B. Panelboards: 1/4 inch; identify equipment designation. 1/8 inch; identify voltage rating and source.

C. Individual Circuit Breakers, Switches, and in Panelboards: 1/8 inch; identify circuit and load served, including location.

END OF SECTION

SECTION 16450
GROUNDING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as hereinafter specified and shown on the Drawings.

1.02 RELATED WORK

A. Conduit shall be as specified under Section 16100.

B. Wire shall be as specified under Section 16120.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ground rods: Ground rods shall be copperclad steel 5/8-inch x 30 foot. Ground rods shall be Copperweld or be an approved equal product.

PART 3 EXECUTION

3.01 GENERAL

A. Tie into existing grounding system.

B. Grounding electrodes shall be driven as required. Where rock is encountered, grounding plates may be used in lieu of grounding rods.

C. All equipment enclosures, motor and transformer frames, conduits systems, cable armor, exposed structural steel and similar items shall be grounded.

D. Exposed connections shall be made by means of approved grounding clamps. Coat and seal exposed connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces. All buried connections shall be made by welding process equal to Cadweld.

E. The grounding grid conductors shall be embedded in backfill material around the structures.

F. All underground conductors shall be laid slack and where exposed to mechanical injury shall be protected by pipes or other substantial guards. If guards are iron pipe or other magnetic material, conductors shall be electrically connected to both ends of the guard.

G. The Contractor shall exercise care to insure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.

3.02 TESTS

A. The Contractor shall test the ground resistance of the system. The Engineer shall be notified forty-eight (48) hours before tests are made to enable the Owner to have designated personnel present. All test equipment shall be provided by the Contractor and approved by the Engineer. Dry season resistance of the system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, the Contractor shall provide additional grounding as directed by the Engineer, without additional payment. The Contractor shall submit all grounding system test results to the Engineer for review.

END OF SECTION

SECTION 16450FA

GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Division 16 Basic Materials and Methods sections apply to work of this section.

1.02 DESCRIPTION OF WORK

A. Extent of grounding work is indicated by drawings and schedules.

B. Types of grounding specified in this section include the following:

1. Solid Grounding.

C. Applications of grounding work in this section include the following:

1. Underground metal water piping.
2. Grounding electrodes.
3. Grounding rods.
4. Service equipment.
5. Enclosures.
6. Equipment.
7. Ground Test Well.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors, terminals and fittings, of types and ratings required, and ancillary grounding materials, including stranded cables, copper brain and bus, ground rods and plate electrodes, whose products have been in satisfactory use in similar service for not less than 3 years.

B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical grounding work similar to that required for project.

C. NFPA-70 Compliance: Comply with NFPA-70 requirements as applicable to materials and installation of electrical grounding systems, associated equipment and wiring. Provide grounding products which are UL listed and labeled.

D. UL Compliance: Comply with applicable requirements of UL Standards Nos.467 and 869 pertaining to electrical grounding and bonding.

E. IEEE Compliance: Comply with applicable requirements of IEEE Standard 142 and 241 pertaining to electrical grounding.

1.04 SUBMITTAL

A. Product Data: Submit manufacturer's data on grounding systems and accessories.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Manufacturers: Subject to compliance with requirements, provide grounding products of one of the following:

1. B-Line Systems, Inc.
2. Burndy Corp.
3. Crouse-Hinds Co.
4. Electrical Components Div.; Grould, Inc.
5. General Electric Supply Co.
6. Ideal Industries, Inc.
7. Thomas and Betts Corp.
8. Western Electric Co.

2.02 GROUNDING SYSTEMS

A. Materials and Components:

1. General: Except as otherwise indicated, provide electrical grounding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes, and plate electrodes, bonding jumper braid, surge arrestors, and additional accessories needed for complete installation. Where more than one type unit meets indicated requirements, selection is Installer's option. Where materials or components are not indicated, provide products complying with NFPA-70, UL, IEEE, and established industry standards for applications indicated.
2. Provide raceways, and electrical boxes and fittings complying with Division 16 Basic Materials and Methods sections "Raceways" and "Electrical Boxes and Fittings", in accordance with the following listing:
   a. Rigid steel conduit.
   b. Electrical metallic tubing.
   c. Flexible metal conduit, Type 2.
   d. Liquid-tight flexible metal conduit.
   e. Rigid metal conduit fittings.
   f. EMT Fittings, Type 1.
   g. Flexible metal conduit fittings.
   h. Liquid-tight flexible metal conduit fittings.

B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NFPA-70.

C. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.

D. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 cm. Protect braid with copper bolthole ends with holes sized for 3/8" dia. bolts.

E. Ground Rods: Steel with copper welded exterior. Each ground rod shall consist of a 40 ft. ground rod, 5/8" driven vertically. Top of ground rod shall be at least one (1) foot deep below grade.

F. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, welding materials, bonding straps, as recommended by accessories manufacturers for type services indicated.

G. Ground Test Well: Plastic 10" diameter x 10" high body with two pipe slots; plastic snap-lock cover with lifting holes and shall read "Ground". Provide test well at each ground rod location. Cover shall be flush with grade.

H. Grounding Bars: Ground bars shall be copper of the size and description as shown on the drawings, or shall be 1/4" x 2" bus grade copper, spaced from wall on insulating 1" high supports, of 6" or greater O.A. length, allowing 2" length per lug connected thereto.

PART 3 EXECUTION

3.01 GENERAL

A. Grounding conductors shall be provided with every circuit.

B. Grounding conductors shall; be so installed as to permit shortest and most direct path from equipment to ground; be installed in metal conduit with both conductor and conduit bonded at each end; have connections accessible for inspection and made with approved solderless connectors brazed (or bolted) to the equipment or structure to be grounded. The main grounding electrode conductor shall be exothermically welded to ground rods and water pipe.

C. All contact surfaces shall be thoroughly cleaned before connections are made to insure good metal-to-metal contact.

D. All exterior grade mounted equipment shall have their enclosures grounded directly to a separate driven ground at the equipment in addition to the building ground connection.

3.02 BONDING

A. Where available on the premises, bond the following items together:

1. Metal water pipe.
2. Building metal frame.

B. A main ground, bare copper conductor, NEC sized but in no case less than #2/0, shall be run in conduit from the Main Switchgear of each building to the building steel in respective building. This ground conductor shall also be run individually and be bonded to the main water service ahead of any union in pipe and must be metal pipe of length as acceptable by authorities having jurisdiction. Provide properly sized bonding shunt around water meter and/or dielectric unions in the water pipe. Also required is the same size ground wire to minimum 5/8" x 20 ft. copperweld driven ground rod.

C. Install ground bushings on all conduits entering enclosures where the continuity of grounding is broken between the conduit and enclosure (i.e. conduit stub-up into a motor control center enclosure). Provide an appropriately sized bond jumper from the ground bushing to the equipment ground bus.

3.03 INSTALLATION AND METHODS - 120 THROUGH 480 VOLT SYSTEMS

A. Except as otherwise indicated, each feeder raceway on the load side of the service entrance shall contain a ground conductor sized as indicated and where not shown shall be sized in accordance with Table 250-95 of the NEC. Conductor shall be connected to the equipment grounding bus in switchboards and panelboards, to lighting fixtures, motors and other types of equipment and outlets. The ground shall be in addition to the metallic raceway and shall be properly connected thereto, using a lug device located within each item enclosure at the point of electric power connections to permit convenient inspection.

B. Each feeder metallic conduit shall be bonded at all discontinuities, including at switchboards and all sub-distribution and branch circuit panels with conductors in accordance with Table 250-95 of NEC for parallel return with respective interior grounding conductor.

C. Provide green insulated ground wire for all grounding type receptacles and for equipment of all voltages. In addition to grounding strap connection to metallic outlet boxes, a supplemental grounding wire and screw equal to Raco No. 983 shall be provided to connect receptacle ground terminal to the box.

D. All plug strips and metallic surface raceway shall contain a green insulation ground conductor from supply panel ground bus connected to grounding screw on each receptacle in strip and to strip channel. Conductor shall be continuous.

3.04 MISCELLANEOUS GROUNDING CONNECTIONS

A. Required connections to building steel shall be with approved terminals and bolted in accessible locations.

B. Where reinforced concrete is utilized for building grounding system (UFER ground), proper reinforced bonding shall be provided to secure low resistance to earth with "thermite" type devices, and #10AWG wire ties shall be provided to not less than ten (10) full length rebars which contact the connected rebar (by Division 16 contractor).

C. All surfaces to which grounding connections are made shall be thoroughly cleaned to maximum conductive condition immediately before connections are made thereto. Exposed bare metal at the termination point shall be painted.

D. Welded or Brazed Connections: Joints in ground conductors shall be welded or brazed. The welding or brazing processes shall be an exothermic type.

3.05 MAIN ELECTRICAL SERVICE GROUNDING AND BONDING (AS APPLICABLE)

A. Ground in accordance with Article 250 of the NEC. Artificial grounding electrodes shall be provided for the main service grounding in sufficient number and configuration to secure grounding resistance specified. Grounding system shall also be extended to the cold water entrance pipe and be grounded to the line side of any metering.

B. Provide counterpoise at service entrance of minimum of three driven ground rods of adequate length spaced 20 feet apart in a triangle, or as detailed. Conductor size between ground rods shall be in compliance with N.E.C. Connections to ground rods shall be thermowelded. Top of ground rods and conductors shall be minimum 24 inches below grade. Connect to building lightning protective counterpoise with #2/0 cable.

3.06 TESTING AND REPORTS

A. Raceway Continuity: Metallic raceway system as a component of the facilities ground system shall be tested for electrical continuity. Resistance to ground throughout the system shall not exceed NEC specified limits.

B. Ground resistance measurements shall be made on each grounding system utilized in the project. The ground resistance measurements shall include building structural steel, driven grounding system, and other approved systems as may be applicable. Ground resistance measurements shall be made in normally dry weather, not less than 24 hours after rainfall, and with the ground under test isolated from other grounds. Resistances measured shall not exceed specified limits.

C. Upon completion of testing, the testing conditions and results shall be certified by the Contractor and submitted in writing on Contractor's letterhead to the Engineer/Engineer.

3.07 GROUND RESISTANCE

A. Grounding resistance measure at main service shall not exceed 10 ohms.

B. Resistance to ground of all non-current carrying metal parts shall not exceed 25 ohms, measured at motors, panels, grounding busses, cabinets, etc.

END OF SECTION

SECTION 16721FA

FIRE ALARM SYSTEM

PART 1 GENERAL

1.01 GENERAL REQUIREMENTS:

A. Applicable provisions of "General Conditions", "Supplementary General Conditions" and "General Requirements", Division One, govern work under this Section.

1.02 DESCRIPTION:

A. Work Included: The Contractor shall furnish and install a complete 24 VDC, closed circuit, fully addressable, electrically supervised zone annunciated fire alarm system as specified herein and indicated on drawings. The system shall include but not be limited to all control panels, power supplies, signal initiating devices, audible and visual alarm devices, wire fittings and all accessories required to provide a complete operating system. The system shall operate as a:

1. Non-coded, continuous ringing system which will sound all audible devices until it is manually silenced.
2. The system shall be wired as a Class B system for all circuits.
3. The installing company shall furnish the Owner with a second year maintenance agreement.
4. The fire alarm system components shall be labeled with the same manufacturer's name and logo to insure the integrity of the complete system.

B. Conduit and boxes to be installed by electrical contractor.

1.03 QUALITY ASSURANCE AND SUBMITTALS:

A. The system shall be provided by a firm regularly engaged in this type of work and shall submit proof that said firm has similar installations that are operating to the satisfaction of the systems owners. The said firm shall submit evidence that it has maintained personnel who will be available for repair and maintenance within 24 hours after notification of service requirement by Owner.

1.04 ACCEPTABLE MANUFACTURERS:

A. Silent Knight
B. Gamewell
C. Notifier

PART 2 PRODUCTS

2.01 CONTROL PANEL

A. The fire alarm control panel shall be of dead front construction and be modular in design. The control panel shall be capable of future expansion and shall provide a minimum of zones indicated on drawings.

B. The control panel shall use state-of-the-art electronics and shall use light emitting diodes (LED) throughout. Each signal initiating circuit shall be represented with a yellow LED and a red LED to indicate trouble and alarm. Each circuit shall include individual supervisory and alarm relays and/or circuitry so that a fault condition in any circuit will not prevent the proper operation of any other circuit. These circuits shall be identified by a lettered nameplate showing the zone designation or function. The nameplate shall be a standard product of the manufacturer designed to enhance the appearance of the face-plate. It shall not be lettered with embossed tape. All signal initiating circuits will automatically lock in until the detection device has been restored to normal and the control panel has been manually reset.

C. The following common equipment shall operate in the described manner. A green pilot LED shall indicate that the system is operating from main power. The common trouble LED shall light for any trouble condition in any part of the system and shall remain on until the trouble condition has been corrected. A common alarm LED shall flash to indicate an unacknowledged alarm in the system and the individual zone LED shall indicate the particular zone. The common alarm LED shall revert to a steady condition upon silencing of the alarm condition. The control panel will provide resound for subsequent alarms and the common alarm LED shall commence to flash with each new alarm if the previous alarm has been silenced. Individual supervisory LEDs will be mounted to the common board as a standard feature. They shall consist of the following:

Voltage Monitor	To supervise external auxiliary power source.
Charger	Supervision of charge voltage being supplied to the battery.
Battery	Low battery/no battery.
Ground Fault	Both positive and negative.
Alarm Loop 1	Common audible output #1.
Alarm Loop 2	Common audible output #2.
Automatic Dialer	Central Station Supervision

D. Individual fuses shall be used on the following common points, and shall cause individual trouble conditions should any of the fuses become subjected to an overload condition.

Alarm Loop 1	Common audible output #1.
Alarm Loop 2	Common audible output #2.
Battery	Overload protection.
Smoke Detector	Used on (4) wire detectors Power
Auxiliary System	Constant output Voltage

E. The common control shall include five switches which shall test all LEDs, reset the system after an alarm condition, shall silence the trouble buzzer and/or the audible devices, shall not disconnect the central station from the control panel, and a fire drill switch to test the audible devices without tripping the central station alarm. A reverse polarity transmitter and a local energy circuit shall be available.

F. An internal diagnostic test plug shall be provided for field testing of system power checks to assist in trouble shooting by maintenance personnel. This diagnostic feature allows for reading actual power to the following points: common positive, common alarm, lamp test, reset, common trouble pulsed alarm, power supply common, silence bus, card supervision sensing and logic supply voltage.

G. Plug-in connectors shall be used to inter-connect mother boards. All mother boards shall be identical and shall be capable of accepting all modules introduced to its assembly.

H. All modules shall be supervised for placement and removal of any module shall cause a trouble condition in the panel. The control panel shall have a power supply with sufficient power output to operate the system. Auxiliary power packs shall be supervised.

I. The battery pack shall provide operating and supervisory power for:

1. 24 hrs. as per ANSI/NFPA Standard 72.
2. Provide low-maintenance gel cell type batteries with sufficient ampere-hour rating to meet the above NFPA Standard and to operate all alarm signals for a duration of 5 minutes at the end of the required period of time.

2.02 MANUAL STATION:

A. Manual Fire Alarm Stations shall be non-coded, non-break glass type equipment with a key operated test-reset lock in order that they may be tested, and so designed that after actual Emergency Operation, they cannot be restored to normal except by use of a key. An operated station shall automatically condition itself so as to be visually detected, as operated, at a minimum distance of one hundred feet, front or side. Manual Stations shall be constructed of die-formed satin-finished aluminum, with operating directions provided on the cover in depressed red letters. The word FIRE shall appear on each side of the stations in depressed letters, one-half inch in size or larger. Manual Stations shall be Underwriters' Laboratories Listed.

2.03 PHOTOELECTRIC SMOKE DETECTOR:

A. The contractor shall furnish and install where indicated on the plans, photoelectric smoke detectors. The combination detector head and twist-lock base shall be UL Listed compatible with a UL Listed fire alarm panel.

B. The base shall be directly interchangeable with an ionization detector.

C. The smoke detector shall have a flashing, status indicated LED for visual supervision. When the detector is actuated, the flashing LED will latch on steady and at full brilliance. The detector may be reset by actuating the control panel reset switch.

D. It shall be possible to perform functional test of the detector without the need of generating smoke. The test method must simulate effects of products of combustion in the chamber to ensure testing of all detector circuits.

E. To facilitate installation, the detector shall be non-polarized. By using a furnished wire jumper, it shall be possible to check circuit loop continuity prior to installing the detector head.

F. Voltage and RF transient suppression techniques shall be employed to minimize false alarm potential. A gated alarm output shall be used for additional detector stability.

G. Auxiliary SPDT relays and/or remote LED alarm indicators shall be installed where indicated.

2.04 PHOTOELECTRIC DUCT SMOKE DETECTORS

A. The duct detector shall be furnished and wired by this contractor and installed on duct by the mechanical contractor. The detector and housing shall be UL listed.

B. Air sampling shall be accomplished via sampling tubes which extend into air ducts.

C. The housing shall have a transparent inspection port allowing viewing of the smoke detector status.

D. Each detector shall have a remote test station with an alarm LED and test switch.

2.05 WATERFLOW DETECTOR

A. Waterflow switch to be supplied and installed by the mechanical contractor and wired in to Fire Alarm System by this contractor.

2.06 SPRINKLER SUPERVISORY SWITCHES

A. Supervisory switch to be supplied and installed by mechanical contractor and wired in to fire alarm system by this contractor.

2.07 AUDIO/VISUAL ALARM DEVICES:

A. Visual Fire Alarms shall be installed at each location designated on the drawings and/or as specified herein. Visual alarms shall be of the flashing type using a Xenon Flashtube designed for operation on 24 VDC. Visual alarms shall be semi-flush mounted. Series SL and shall incorporate an alarm horn operating at 24 VDC.

B. Horns shall be UL Listed and shall be Standard finish fire alarm gloss red enamel with the word FIRE imprinted on the white translucent lens.

2.08 REMOTE ANNUNCIATOR:

A. A remote annunciator shall be furnished and installed as shown on the drawings. The annunciator shall be of the lamp type and duplicate all zone alarm lamps of Main Fire Alarm Control Panel. It shall also include Main Power Lamp, Common Trouble Buzzer and Buzzer Silence features. Annunciator shall have a stainless steel face plate and be arranged for flush mounting.

Zone Identification shall be by:

1. Full English lettering per area.
2. Lamp test shall be activated by a pushbutton switch which electrically tests all visual and audible annunciation.
3. Supervision: Wiring and lamps shall be electrically supervised from control panel. Burned out lamps and open wiring shall cause an audible and visual trouble signal to occur.
4. Audible trouble indication shall be contained within annunciator.

2.09 AIR HANDLING SHUTDOWN: Relay

A. Fire alarm system installer shall provide and install a relay at each air handling unit for shutdown on any alarm from system. The unit shall be normally closed with a coil to match voltage of Fire Alarm Control Panel. This unit shall open on alarm from Fire Alarm Control Panel and interrupt starting circuit of air handler unit fan.

2.10 SYSTEM MONITORING

A. Per NFPA 101-9.6.4.4, emergency forces notification shall be via the plant SCADA (Supervisory Control and Data Acquisition) system where this facility is constantly attended by qualified personnel (Florida DEP licensed class A operator).

PART 3 EXECUTION

3.01 INSTALLATION:

A. Shall be done in a neat workmanlike fashion by a firm regularly engaged in fire alarm installation and service.

3.02 WIRING:

A. Shall be No.14 THWN or THHN.

3.03 INSTRUCTIONS:

A. Shall be given in all phases of the operation to operating persons selected by the Engineer.

3.04 DRAWINGS:

A. As built drawings shall be given to operating persons at time of instructions, in addition to those to be supplied as general requirements of the job.

END OF SECTION

SECTION 02 25 29
EXISTING CONDITION ASSESSMENT

PART 1 GENERAL

1.01 SUMMARY

A. The information included within and attached to this section has been provided as information to the Bidder to assist with their understanding of the existing project conditions, the design intent of the documents, and their minimum responsibilities as a contractor to confirm the existing conditions.

B. None of the information or recommendations contained within any of the documents attached to this section may be referenced in an effort to determine the design intent of the bidding documents.

C. Section Includes:
   a. Test Cut Data from September 01, 2017.
   b. Thermal Calculations at Roof Area 1/A & 1/C
   c. Thermal Calculations at Roof Areas 1/B" and 1/C.
   d. Link to website with field investigation photographs.

D. Related Sections:
   1. Section 01010 – Summary of Work

1.02 EXISTING PROJECT / SITE CONDITIONS

E. Field Investigation: A field investigation at the Administration, Maintenance and West Electrical building was conducted by A/R/C Associates, Incorporated on September 1, 2017. During which times the exposed conditions were observed and the under-roof conditions were determined to the best extent observable without destructive methods. Limited existing construction record drawings and specifications were available for A/R/C to verify. The details of the project indicated and existing conditions are based off typical construction practice. A/R/C offers no assurance that all varying conditions have been discovered, or that any Owner-furnished information is completely accurate. It shall be the responsibility of each bidder to make additional inspections as they may judge to be a necessity.

F. Verification of Dimensions: The approximate dimensions shown for each roof area are the result of reconstruction of the building design from record drawings provided by the Owner and field measurements taken by A/R/C Associates. This information is given to assist prospective Bidders in establishing the approximate scope of the project. As a prerequisite for bidding the project, however, all dimensions shall be field verified by each Bidder so that the dimensions and areas utilized in bidding the project will be confirmed or corrected by the Bidder.

G. Additional Information Available: Various testing and investigative reports may have been performed by the Owner previously and/or in conjunction with the performance of other work which may be available for review through the Owner. We believe most pertinent information available from these sources has already been integrated into these bidding and construction documents.

H. Roof System Test Cuts: As part of those site investigations, ten (10) test cuts were performed at various locations on the three buildings included per scope. Data from those test cuts are attached at the end of this section, and included only for informational purposes.

I. Field Photographs: As part of that site investigation, our office also took numerous photographs of the various conditions for reference during our design process, those are also being made accessible through a website, the link for which is:

https://www.dropbox.com/sh/vqjd4t2v48k7x2z/AAA16TKqqDJKi6SSsw45tQida?dl=0

J. Condition of Structure:
   1. The Owner assumes no responsibility for actual condition of the structure.
   2. Conditions existing at time of inspection for bidding purposes will be maintained by Owner in so far as practicable. However, variations may occur by Owner's operations.
   3. Prior to bidding, inspect and verify visible existing conditions of Project, including elements subject to damage or to movement during reroofing.
      a. Conflicts and problems shall be reported to Procurement for resolution prior to bidding.
      b. Failure to report these conflicts places the responsibility on the Prime Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.
   4. During construction, inspect conditions affecting installation of Products, or performance of work.
      a. Report unsatisfactory or questionable conditions to Architect in writing; do not proceed with work until Architect has provided further instructions.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION - (NOT USED)

END OF SECTION

SECTION 02 41 19
SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Demolition of designated roofing and removal of materials from site.

1.02 RELATED SECTIONS

A. Division 1 - General Requirements

1.03 QUALIFICATIONS

A. Demolition Firm: Company specializing in performing the Work of this Section with minimum five years documented experience.

1.04 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition of roofing, safety of adjacent structures, dust control and disposal.

B. Notify affected utility companies before starting work and comply with their requirements.

C. Do not close or obstruct roadways, sidewalks, and hydrants without permits.

D. Conform to applicable regulatory procedures when hazardous or contaminated materials are present.

1.05 SCHEDULING

A. Schedule work under the provisions of Division 1.

B. Schedule Work to coincide with new reroofing work.

C. Describe demolition removal procedures and schedule.

1.06 PROJECT CONDITIONS

A. Existing Conditions
   1. Report conflicts or problems to the Architect for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.

PART 2 PRODUCTS - (NOT USED)

PART 3 EXECUTION – (NOT USED)

3.01 PREPARATION

A. Provide, erect, and maintain temporary barriers and security devices.

B. Protect existing landscaping materials, appurtenances, structures and adjacent roofs which are not to be demolished.

3.02 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures and occupants.

B. Maintain protected egress from and access to adjacent existing buildings at all times.

C. Cease operations immediately if adjacent structures appear to be in danger. Notify Architect. Do not resume operations until directed.

D. Conduct operations with minimum interference to public or private accesses. Maintain egress and access at all times.

3.03 DEMOLITION

A. Remove demolished materials from site.

B. Do not burn or bury materials on site. Leave site in clean condition.

C. Remove temporary work.

D. Remove materials to be re-installed or retained in manner to prevent damage. Store and protect in accordance with requirements of Division 1.

END OF SECTION

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Nailers and blocking,
2. Field fabricated expansion joint curbs and curb extensions,
3. Preservative treatment of wood where indicated.

B. Related Sections:
1. Section 07 51 00 – Preparation for Re-roofing
2. Section 07 52 00 – Modified Bitumen Roofing – Torched Applications
3. Section 07 62 00 – Sheet Metal Flashing and Trim
4. Section 09 90 00 – Minor Painting

1.02 REFERENCES

A. American Wood-Preservers' Association:
1. AWPA Standard U1, UC 1-4 - All Timber Products - Preservative Treatment by Pressure Process.
2. AWPA Standard U1, UCF A and B - Structural Lumber - Fire-Retardant Treatment by Pressure Process.

B. ASTM International:
1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Southern Pine Inspection Bureau:
1. SPIB - Standard Grading Rules for Southern Pine Lumber.

E. Underwriters Laboratories Inc.:
1. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

F. U. S Department of Commerce National Institute of Standards and Technology:
1. DOC PS 1 - Construction and Industrial Plywood.
2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
3. DOC PS 20 - American Softwood Lumber Standard.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures

B. Product Data: Submit technical data on
   1. Wood /Plywood
   2. Fasteners and Anchors
   3. Wood preservative and fire retardant treatment materials and application instructions.
   4. MSDS of treatment materials.

C. Samples:
   1. Fastener types : Two (2) of each type
   2. Material Samples, if requested by the Architect.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with the following:
   1. Lumber Grading Agency: Certified by DOC PS 20.
   2. Lumber: DOC PS 20.

B. Surface Burning Characteristics:
   1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated and fire retardant treated material.

D. Perform Work in accordance with 2017 6th edition Florida Building Code requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Lumber Grading Rules: SPIB.

B. Miscellaneous Framing/Blocking: Stress Group D 1x and 2x No. 2 Grade Southern Yellow Pine species, 19 percent maximum moisture content, pressure preservative treated where indicated or required by the building code.

C. Plywood Sheathing/Decking: (If required) APA/EWA Structural I, 5/8" thickness (unless otherwise noted), Grade: CDX; pressure treated with preservative and/or fire retardant (FRT) where indicated or required by the building code. Exposure Durability: Exposure 1.

2.02 ACCESSORIES

A. Fasteners and Anchors:
   1. All fasteners: Stainless steel for high humidity and treated wood locations, hot dipped galvanized steel elsewhere.
   2. Nails: ASTM F1667; ring-shanked, except as otherwise directed.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.03 FACTORY WOOD TREATMENT

A. Wood Preservative (Pressure Treatment) for wood (exterior, above ground): AWPA U1, use category 3 (UC3) using water borne preservative with 0.25 pounds per cubic foot of wood product.

B. Wood Preservative (Pressure Treatment) for wood (exterior, in contact with ground): AWPA U1, use category 4 (UC4) using water borne preservative with 0.40 pounds per cubic foot of wood product.

C. Fire Retardant Treatment for plywood: FRT plywood shall be impregnated with chemicals by a pressure process and shall have a flamespread index of 25 or less when tested in accordance with ASTM E-84. "Standard Test Method for Surface Burning Characteristics of Building Materials (ASTM 1988).

PART 3 EXECUTION

3.01 EXAMINATION

A. Division 01 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify substrate conditions are ready to receive blocking, curbing and framing.

3.02 PREPARATION

A. Coordinate placement of blocking, curbing and framing items.

3.03 INSTALLATION

A. General:
   1. Discard material with defects which might impair quality of work and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
   2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.
   3. Securely attach carpentry work to substrate by anchoring and fastening as shown or as required by recognized standards. Countersink fastener heads on exposed carpentry work.
   4. Use fasteners and anchorages as indicated. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required. Holes drilled oversized or wallered out, shall be re-drilled.
   5. Place horizontal members, crown side up.
   6. Construct curb members of solid wood sections.
   7. Do not install wood nailers or sheathing more than one day in advance from installation of roofing. Install dry-in felt over any wood nailers and sheathing.

B. Nailers, Blocking and Curb Extensions:
   1. Coordinate curb extensions and installation of wood nailers with roof construction work.

2. Provide blocking and edging wherever shown and where required for screeding or attachment of other work.
3. Set members level and plumb, in correct position.
4. Construct curb members of single pieces.
5. Curb roof openings [except where prefabricated curbs are provided]. Form corners by alternating lapping side members.
6. Attach to substrates as required to support applied loading. Countersink bolts and nuts with washers flush with surfaces, unless otherwise shown.
7. Where new members are doubled, ends shall be lapped and thoroughly spiked to each other and to bearing members.
8. Where new members bear on concrete, securely fasten to same by bolts or lag screws on centers as called for on drawings, staggered. Provide heads of all bolts or lag screws with large-head washers.
9. Round edges and corners of wood plates where flashing occurs.

C. Plywood Sheathing (wall and roof if applicable):
1. Install sheathing properly framed to required lines, level and rigidly secured in place.
2. Cut sheathing sections to fit. Leave 1/8" clearance between panels at side laps. Cover sheathing with dry-in felt and seal top horizontal edge.

3.04 SCHEDULES

A. Roof Perimeter Nailers, Curbs and Curb Extensions: See project manual details and plans for sizes and locations.

B. General Framing Lumber (as applicable): See project manual details and plans for sizes.

C. Plywood Sheathing (as applicable): See project manual details and plans for locations.

END OF SECTION

SECTION 07 51 00

PREPARATION FOR RE-ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Removal of existing roofing system in preparation for a new roof membrane system.

B. Related Sections
1. Section 02 41 19 - Selective Demolition
2. Section 06 10 00 - Rough Carpentry
3. Section 07 52 00 - Modified Bitumen Roofing Torched Application

1.02 DESCRIPTION OF WORK

A. All Roof Areas where indicated: Remove existing roof membrane system or B.U.R. w/ gravel, perimeter flashings, base flashing, counter flashings, goosenecks, edge metal, vent stack flashing down to the existing lightweight insulating concrete deck.

B. Remove and replace any damaged or deteriorated light weight insulating concrete and metal decking.

C. Remove and replace any damaged or deteriorated blocking, nailers and sheathing.

1.03 QUALIFICATIONS

A. Materials Removal Firm: Company specializing in performing the work of this Section with minimum 3 years documented experience.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide product description and specification information of roof materials and accessories as may be specified elsewhere.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.05 PRE-INSTALLATION CONFERENCE

A. Attend conference specified in Section 01 30 00.

1.06 PROJECT CONDITIONS

A. Existing Conditions

1. The preliminary roof applicator shall verify existing conditions, such as soundness of perimeter conditions, varying deck and other visible conditions prior to bidding.
2. Report conflicts and problems to the Architect for resolution prior to bidding. Failure to report these conflicts and problems places the responsibility on the Prime Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.
3. Replace or restore to original condition any materials or work damaged during construction.
4. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.
5. Failure to install the work in strict accordance with provisions of this Section, is subject to total rejection of work specified herein.

1.07 ENVIRONMENTAL REQUIERMENTS

A. Do not remove existing roofing membrane when weather conditions threaten the integrity of the building contents or intended continued occupancy.

B. Maintain continuous protection prior to and during installation of new roofing system.

1.08 SCHEDULING AND COORDINATION

A. Schedule and coordinated work under the provisions of Division 01.

B. Schedule work to coincide with commencement of installation of new roofing system.

C. Coordinate the work with other affected mechanical and electrical work associated with roof penetrations.

D. Remove only existing roofing materials that can be replaced with new materials the same day or as the weather will permit.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary Protection: Sheet polyethylene; provide weights to retain sheeting in position.

B. Protection Board (as may be required): ASTM C208, Roof Insulating Board type, cellulose fiber board, with the following characteristics:

1.	Board Size	48x96 inches.
2.	Board Thickness	1/2 inch
3.	Board Edges	square

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing site conditions under provisions of Division 01.

B. Verify that existing roof surface is clear and ready for work of this section.

3.02 PREPARATION

A. Sweep roof surface clean of loose matter. Remove loose refuse and dispose off site.

3.03 MATERIAL REMOVAL

A. Remove metal counter flashings

B. Remove roofing membrane, perimeter base flashings, flashings around roof protrusions, pitch pans and pockets

C. Remove damaged insulation and fasteners, cant strips and blocking.

D. Repair existing wood and lightweight insulating concrete deck surface to provide smooth working surface for new roof system.

3.04 TEMPORARY PROTECTION

A. Protect finished Work under provisions of Division 01.

B. Provide temporary protective sheeting over uncovered deck surfaces.

C. Turn sheeting up and over parapets and curbing. Retain sheeting in position with temporary fasteners.

D. Provide for surface drainage from sheeting to existing drainage facilities.

E. Do not permit traffic over unprotected or repaired deck surfaces.

3.05 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Inspection will identify the exact limits of material removal.

C. Testing will identify the exact condition of existing materials and their reuse, repair or removal.

END OF SECTION

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SECTION 07 52 00

MODIFIED BITUMEN ROOFING – TORCHED APPLICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Three ply SBS modified bitumen membrane system torch applied to the new supplemental rigid insulation with gypsum coverboard, over a vented base sheet, mechanically attached over an existing lightweight insulating concrete insulation system on an underlying structural steel deck.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry
2. Section 07 51 00 – Preparation for Re-Roofing
3. Section 07 62 00 - Sheet Metal Flashing and Trim

1.02 REFERENCES

C. American Society for Testing and Materials (ASTM), 100 Bar Harbor Drive, West Conshocken, PA 19428-2959; (610) 832-9585, fax (610) 832-9555
1. ASTM C 177 - Test Method for Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate.
2. ASTM C 1002 - Steel Drill Screws for the Application of Gypsum Board.
3. ASTM C1013 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Roof Insulation.
4. ASTM C 1177 - Glass Mat Gypsum Substrate for Use as Sheathing.
5. ASTM C 1396 - Standard Specification for Water-Resistant Gypsum Backing Board
6. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
7. ASTM D 41 - Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
8. ASTM D312 - Standard Specification for Asphalt used in Roofing
9. ASTM D 2178 - Asphalt Impregnated Glass (Felt) Mat Used in Roofing and Waterproofing.
10. ASTM D6162 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
11. ASTM D6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.
12. ASTM D6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
13. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
14. ASTM E108 - Standard Test Methods for Fire Tests of Roof Coverings.

D. FM Global
   1. FM 4450 - Approval Standard for Class 1 Insulated Steel Deck Roofs.

E. National Fire Protection Association (NFPA)
   1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials

F. National Roofing Contractors Association (NRCA)
   1. NRCA - The NRCA Roofing and Waterproofing Manual.

G. Underwriters Laboratories Inc
   1. UL - Fire Resistance Directory.
   2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
   3. UL 790 - Tests for Fire Resistance of Roof Covering Materials.
   4. UL 1256 - Fire Test of Roof Deck Construction
   5. UL 1897 - Uplift Tests for Roof Covering Systems
   6. UL 2218 – Impact Resistance of Prepared Roof Covering Materials

1.03 SYSTEM DESCRIPTION

A. Administration Bldg. & Maintenance Bldg. -Roof Area 1/A, 1/B & 3/B:
   1. Vented Base Sheet: Mechanically fasten to the existing lightweight insulating concrete (LWIC).
   2. Insulation: Solidly adhere a 2” non-tapered polyisocyanurate rigid insulation board over the vented base sheet, (provide tapered rigid insulation as required to create a 4-way 1/2" per foot slope for drainage as indicated per plan), then fully adhere a 1/4" thick gypsum roof coverboard applied to the rigid insulation.
   3. Multi-ply Roofing System: Torched application of two (2) SBS modified bitumen smooth surfaced polyester reinforced interply membranes to the gypsum roof cover board. Followed by the torched application of an SBS modified bitumen, mineral surfaced cap sheet.

B. Maintenance Bldg. -Roof Area 2/B:
   1. Vented Base Sheet: Mechanically fasten to the existing lightweight insulating concrete (LWIC).
   2. Multi-ply Roofing System: Torched application of two (2) SBS modified bitumen smooth surfaced polyester reinforced interply membranes to the vented base sheet. Followed by the torched application of an SBS modified bitumen, mineral surfaced cap sheet.

C. Electrical Room -Roof Area 1/C:
   1. Vented Base Sheet: Mechanically fasten to the existing lightweight insulating concrete (LWIC).
   2. Insulation: Solidly adhere a 3” non-tapered polyisocyanurate rigid insulation board over the vented base sheet, then fully adhere a 1/4" thick gypsum roof coverboard to the rigid insulation.
   3. Multi-ply Roofing System: Torched application of two (2) SBS modified bitumen smooth surfaced polyester reinforced interply membranes to the gypsum roof cover board. Followed by the torched application of an SBS modified bitumen, mineral surfaced cap sheet.

1.04 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Provide membrane materials, base flashing materials, insulation, fasteners and accessories.

C. Shop Drawings: (as applicable) 1/8" Scale; indicate setting plan for tapered insulation, layout of seams, direction of laps, base flashing details.

D. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane.

E. Samples: Manufacturer to provide upon request; sized to represent material adequately.

F. Manufacturer's Field Reports: Submit under provisions of this section.
   1. Reports: Indicate procedures followed, ambient temperatures and wind velocity during application.
   2. Results of the fastener "pull-out" resistance testing and calculations performed prior to roof system application per Florida Building Code TAS 105.

G. Due to the use of an "EnergyStar" finished roof surface, the Owner will be applying for any available FP&L energy conservation rebate directly, the contractor is to submit all documentation necessary for this application process to the Owner upon request. Any rebate will be received directly by the Owner, the contractor shall not include the value of this rebate within their cost calculations while bidding this project

H. Contract Closeout: Manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

I. All products used shall be asbestos free.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Contract Documents and NRCA Roofing and Waterproofing Manual except where NRCA details differ from the project manual details.

B. Work closely associated with flexible sheet roofing, including vapor barriers, insulation, flashing and counterflashing, and joint sealers, to be performed by the installing applicator of the primary roofing system.

C. Manufacturer of the roofing materials shall provide qualified technical representatives to observe field conditions of surfaces and installation, quality of workmanship as applicable, and to make appropriate recommendations.

D. Manufacturer's Certificate of Compliance: Roof membrane manufacturer's certification that materials are chemically and physically compatible with each other and suitable for inclusion in the roof system and are acceptable for the warranty specified. Materials will not be approved without the manufacturer's written certification.

E. Manufacturer's representative shall visit the project throughout progress of the Work as follows:
   1. Pre-construction meeting.
   2. Once every two weeks, coordinated with the weekly scheduled meetings.
   3. Final "zero punch list" inspection.
   4. Called meetings by the Architect.
   5. 11th month inspection prior to Owner's 12 month inspection.
   6. 23rd Month inspection prior to Owner's 24 month inspection.
   7. Manufacturer's Representative shall make a written report of his observations and recommendations, if any within three (3) days of the visit, however, significant discrepancies between the quantity or quality of the installation and the requirements of the Contract Documents shall be brought to the Architect's attention immediately
   8. The Architect shall be entitled to rely upon such observations and recommendations to establish the materials and systems will meet the requirements of the Contract Documents.

F. Manufacturer's Field Reports: Submit under provisions of Section 01 40 00.
   1. Reports: Indicate procedures followed, ambient temperatures and wind velocity during application.

G. A manufacturer's letter shall be required certifying that the Contractor is an approved and recommended applicator in good standing.

H. The Contractor shall not deliver to site or install a material system that has not been approved.

I. The Contractor shall be required to remove materials installed without prior approval upon Owner's request.

J. The Contractor shall be required to participate in any post-installation testing programs of the installed roof and insulation system as required to demonstrate compliance with the project requirements performed by the Owner upon substantial completion, and prior to acceptance. This will include observation of all testing and any repairs necessary due to these testing activities to return the roof system to new "pre-test" conditions.
   1. Post-installation testing will be performed in compliance with the quantity and procedures defined by FM Global Property Loss Prevention Data Sheet 1-52, "Field Uplift Tests" using the test pressures defined within the project documents.
   2. Any failure of the tested roof assembly not attributable to system design will require the Contractor to perform remedial repairs and/or replacement, as well as additional testing to demonstrate system compliance with the project requirements at the Contractor's expense, without any additional cost to the Owner.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with five (5) years current documented experience.

B. Applicator: A single installer specializing in performing the work of this section with ten (10) years current documented experience and approved by system manufacturer.
   1. Applicator shall have completed a minimum of five (5) projects of a similar nature and size within the last five (5) years.
   2. The Owner reserves the right to request submission of appropriate documentation of the above define qualifications within five (5) business days after the bid. Failure to submit documentation within five (5) calendar days after requested, or to meet the above defined experience qualifications may be grounds for disqualification of the bid.

C. Supervisor: Maintain a full-time non-working supervisor, on the job site during roofing work in progress. Supervisor shall have five current years minimum documented experience of roofing work similar in scope to specified roofing.

D. Manufacturer's Field Inspection and Services:
   1. Manufacturer of the roofing materials shall provide qualified personnel to observe field conditions of surfaces and installation, quality of workmanship as applicable, and to make appropriate recommendations.
   2. Representative shall visit the Project throughout progress of the work, per Article 1.5, E of this section.
   3. Representative shall submit written reports, within three days of each visit to Architect listing observations, recommendations and related comments.

1.07 REGULATORY REQUIREMENTS

A. Conform to applicable code for roof assembly fire hazard requirements.

B. Pull Testing: The Contractor shall have pull tests conducted on the job site in compliance with the Florida Building Code TAS 105 with the specified fasteners to determine the pull-out resistance of the existing deck. Submit the data to the Building Department as required for permitting, and submit copies to the Architect for review and approval prior to installation of any roofing materials.

C. Moisture Testing: The Contractor shall have moisture tests of the existing lightweight concrete conducted on the job site in compliance with the Florida Building Code TAS 126 to determine the moisture content of the existing deck. Submit the data to the Building Department as required for permitting, and submit copies to the Architect for review and approval prior to installation of any roofing materials.

D. Underwriters Laboratories (UL): Class A Fire Hazard Classification required.

E. Underwriters Laboratories (UL): Hail resistance Class 3 or 4 required.

F. Wind Uplift Resistance: Provide wind load calculations and submit engineering calculations and substantiating data to validate wind resistance of any non-rated roof system. Wind uplift calculations shall be based on a design wind speed of 186 mph (ultimate) / 144 mph (nominal) as defined and calculated in accordance with ASCE 7 and the 2017 (6^{th} edition) Florida Building Code requirements. Calculations shall be certified by a professional engineer registered in the State of Florida

G. Material Safety Data Sheets: Submit for all roofing products.

H. There shall be no component substitutions or deviations from the proposed and approved assembly selected for this project. Use of individually approved components, not approved for use together does not constitute an approved assembly.

I. The contractor will be responsible for obtaining a Building Permit from the Building Department of the governing jurisdiction, and any required submittals and inspections thereafter. Signed and sealed copies of the construction documents will be provided by the Owner, all other required documentation is to be provided by the contractor.
   1. The Contractor is to complete and submit all required forms, license and insurance documentation prior to obtaining the building permit.
   2. The Contractor is to provide any required Product Approval information to the governing Building Department based on the specific project conditions and actual manufacturers and products to be used for this work.
   3. The Contractor is to verify the inspection requirements with the governing Building Department and obtain those inspections as required without impacting the progress of the work.

1.08 CERTIFICATION

A. Materials: For each material specified with a standard or reference material designation, certification labels shall appear on each package of bulk-shipments to project with certificate of compliance.
   1. The contractor shall provide all required product approval documentation and engineering data on products and systems being installed on this project.

B. Installer: Provide two copies of all certifications to Architect prior to beginning roofing work.

1.09 MOCK-UP

A. Provide mockup of roof membrane system and associated components and accessories under provisions of Section 01 40 00.

B. Mockup Size: 10 x 10 feet, including insulation, and typical base and counterflashing specified; at location designated.

C. Mockup may remain as part of the Work.

1.10 PRE-INSTALLATION CONFERENCE

A. Convene one week prior to commencing work of this section at project site with Contractor, Roofer, and Subcontractors, governing authorities, product manufacturers, Architect and Owner.

B. Review requirements, Contract Documents, submittals, sequencing, availability of materials and installation facilities, proposed installation schedule, requirements for inspections and testing or certifications, forecasted weather conditions, governing regulations, insurance requirements, and proposed installation procedures.

C. Record discussion on matters of significance; furnish copy of recorded discussions to each participant. Discuss roofing system protection requirements for construction period extending beyond roofing installation.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store, protect, and handle products under provisions of Contract Documents (Division 01).

B. Deliver material in manufacturer's original, unopened containers with manufacturer's labels intact and legible.

C. Deliver material requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

D. Store rolls, cans and drums of cements, primers, and coatings, on end and over clean raised platforms.

E. Store and handle materials to protect them from:
1. Moisture, whether due to precipitation, or condensation.
2. Damage by construction traffic.
3. Temperatures over 110 degrees or below 40 degrees F.
4. Direct sunlight.
5. Mud, dust, sand, oil and grease.

F. Select and operate material handling equipment and store materials to keep from damaging existing construction or applied roofing. Immediately remove and dispose of wet materials.

G. Comply with fire, safety, and environmental protection regulations.

H. Do not store materials on roof decks, nor position roofing installation equipment on roof decks, in concentrations exceeding design live loads

I. Deliver enough material to allow continuous work.

1.12 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather ambient temperatures below 40 degrees F.

B. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

C. Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with requirements of this section and warranty compliance requirements.

1.13 SAFETY REQUIREMENTS

A. All work shall be in compliance with OSHA safety standards and regulations with emphasis on Section 29 CFR 1910, including but not limited to the following requirements:
   1. Provide facility administrator one day prior notice before commencing with work or moving to new areas.
   2. Contractor employees shall wear proper identification and clothing to work at all times.
   3. The Contractor shall provide sufficient temporary barricades in order to contain passage ways around tankers, trash chutes, hoisting areas and areas below roof edges where work is conducted.
   4. Fire extinguishers are required, one on the ground and one on the roof deck.
   5. Seal all possible seepage areas, before using bituminous materials.
   6. Power driven shot fasteners are not permitted.
   7. All pumps shall use rigid pipes.
   8. No flammable or explosive substance or equipment for repairs or alterations shall be introduced in a building of normally low or ordinary hazard classification while the building is occupied unless the condition of use and safeguards provided are such as not to create any additional hazard or handicap to egress beyond the normally permissible conditions in the building.
   9. Protect building and adjacent surfaces from bitumen spillage and repair or replace damaged materials at no cost to Owner.
   10. All toxic substances enumerated in the Florida Substance List established pursuant to S.442.103 that are to be used in the construction, repair or maintenance of facilities are restricted to usage according to the following provisions:
      a. Before any such substance may be used, the Contractor shall notify the Owner in writing at least three working days prior to using the substance. The notification shall contain:
         1) The name of the substance to be used;
         2) Where the substance is to be used; and
         3) When the substance is to be used.
      b. The Owner shall take all reasonable actions to ensure that the Contractor complied with the safety precautions and handling instructions set forth in the material safety data sheet for each substance used by the Contractor so that usage of the substance poses no threat to the health and safety of building occupants and the general public.
   11. Contractor shall maintain a daily "fire watch" for a minimum of two (2) hours after torch down shift has been completed.

12. All “hot work” in conjunction with this project shall be performed in compliance with the precautions defined within the “FM Global Safeguarding Torch Application Roof Installation, Data Sheet 1-33”.

1.14 COORDINATION

A. Coordinate work under provisions of Section 01 11 00 – Summary of Work.

B. Coordinate the work with installing associated wood blocking and nailers, roofing, expansion joints and area dividers, roof drains and metal flashing as the work of this section proceeds.

1.15 SEQUENCING

A. The Owner has defined that the Main Building roof area is to be completed first, a specific substantial completion date has been defined within Section 01 11 00 – Summary of Work.

B. Organize operations so work can simultaneously proceed on the various aspects including roofing, cants and flashing so at the end of each day the work done that day will be substantially complete.

C. Each roof area shall be substantially complete prior to beginning another roof area; utilize multiple crews for multiple roof area construction. Phasing of roof construction by area is not permitted.

D. Sequence equipment removal with covering of deck openings with plywood strong enough to prevent injuries from falling through. Contractor shall install waterproof covering over plywood and tie-in to existing membrane to achieve complete watertightness.

1.16 SUBSTITUTIONS

A. Proposals for substitution products shall be accepted only from bidding contractors and not less than (10) working days before bid due date. Contractor guarantees that proposed substitution shall meet the performance and quality standards of this specification.

1.17 PROJECT CONDITIONS

A. Existing Conditions:
1. The roofing applicator and sheet metal installer shall verify existing conditions, such as soundness of perimeter conditions, and varying deck and wall thickness for length of anchoring services required and other visible conditions prior to Bidding.
2. Report conflicts and problems to the Architect for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Prime Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.

B. Replace or restore to original condition any materials or work damaged during construction.

C. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.

D. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.

E. Observe all appropriate OSHA safety guidelines for this work.

1.18 WARRANTIES

A. Applicators Warranty: A **Three Year** applicator guarantee is to include a 24 hour maximum response time requirement, to cover entire roof assembly, not just the membrane, (Furnish on executed form included at the end of this section).

B. Manufacturer's Warranty: **20 year "No Dollar Limit"** total roof system warranty inclusive of roofing materials, included all products and accessories from deck to finish membrane provided by or approved for use by the roofing manufacturer, (Refer to "Manufacturer's Notice of Intent to Issue Roof Warranty" form at end of this Section).

C. A Manufacturer's Notice of Intent to Issue Roof Warranty Form shall be executed by the Manufacturer that acknowledges project design, warranty requirements, lists primary/secondary material approvals, and the initial manufacturer approval (or certification) for the named roofing contractor as an application. **Attach to Bid Form**.

D. A non-prorated, non-penal sum manufacturer's roof warranty is required.

E. Manufacturer's roof warranty will cover the cost of removal and replacement of damaged or wet insulation that is the result of leaks from poor workmanship or failed material.

F. The Contractor is responsible to submit and provide components required by the roofing system manufacturer for the specific warranty.

G. Warranty will not exclude from coverage damage to the roof system for wind gusts as defined in the Manufacturer's Notice of Intent to Issue Roof Warranty at end of this Section. Warranty may exclude damage for wind launched debris or projectiles which are not part of this system.

H. A Contractor's Final Statement of Compliance shall be issued by the roofing contractor as part of the "close-out" documentation required at the end of the project.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Insurance and Code Requirements: Provide materials complying with governing regulations, installed to comply with Underwriters Laboratories Class A; ASCE 7 and the 2017 (6th edition) Florida Building Code, as calculated for a 145 mph (ultimate) / 112 mph (nominal) wind speed.

B. Obtain primary modified bitumen sheet roofing from a single manufacturer. Provide secondary materials only as recommended by the manufacturer of the primary material, and additionally as specified.

2.02 MODIFIED BITUMEN ROOFING AND FLASHING MEMBRANE MATERIALS

A. Modified Bitumen (Roofing and Flashing) Cap Sheet: Granular surfaced SBS modified bitumen membrane sheet intended for heat welded (torched) application, membrane shall be a minimum of 155 mils, and weight not less than 100 lbs. per 100 square feet. SBS membrane ply shall be reinforced with a 170 gram/square meter minimum non-woven polyester mat(s), shall conform to the requirements of ASTM D 6164, Type I, Grade G, and be a Class A material as tested in compliance with ASTM E 108. Acceptable manufacturer's and products are as follows **(Substitutions are not permitted):**

1.	Soprema	Sopralene Flam 180FR Granules
2.	GAF	Ruberoid SBS Heat-Weld FR
3.	MB Technology	Fastorch SBS FT 160 PWH
4.	Firestone	SBS FR Torch
5.	Polyglass	Elastoshield TS
6.	Johns Manville	DynaWeld 180 FR
7.	XtraFlex (Polyglass)	XtraFlex SBS Poly G

B. Modified Bitumen Interply (Field) Sheet: Smooth surfaced SBS modified bitumen membrane “interply” sheet intended for heat welded (torched) application, membrane shall be a minimum of 90 mils, and weight not less than 70 lbs. per 100 square feet. SBS membrane ply shall be reinforced with a 170 gram/square meter minimum non-woven polyester mat(s), shall conform to the requirements of ASTM D 6164, Type I, Grade S, and be a component within a Class A roofing system as tested in compliance with ASTM E 108. Acceptable manufacturer's and products are as follows **(Substitutions are not permitted):**

1.	Soprema	Sopralene Flam 180
2.	GAF	Ruberoid SBS Heat-weld Smooth
3.	MB Technology	FT 120 PSA
4.	Firestone	SBS Poly Torch Base
5.	Polyglass	Elastoflex S6
6.	Johns Manville	DynaWeld Cap 180 Smooth
7.	XtraFlex (Polyglass)	XtraFlex SBS Poly Base

C. CAP SHEET GRANULES: Manufacturer's standard white or gray cap sheet granules.

2.03 SHEET MATERIALS

A. Strip-In Flashing: Smooth surfaced SBS modified bitumen flashing sheet for torch or cold process application.

B. Venting Base Sheet: ASTM D-4897, Type G-2 coated base sheet with course granular surfacing for cross-ventilation, nominal weight of 70 pounds per roofing square. Acceptable manufactures and products are as listed below.

1. Johns Manville Ventsulation
2. Firestone Venting Base
3. Soprema 4897 Sheet

C. Architects approved (prior to bidding) equivalent.Modified Bitumen "Dry-in" Membrane material: 40 mil (1 mm) minimum total thickness, polyester reinforced, SBS modified asphalt waterproofing and underlayment membrane sheet , single-sided, self-adhesive, with a strippable treated release paper. Factory or field cut if necessary to the size required by the details.

1. Approved Products:
   a. Boral TileSeal HT.
   b. InterWrap Titanium PSU.
   c. Protecto-Wrap Rainproof-40.
   d. Soprema Sopralene Stick.
   e. Tamko TW Metal and Tile.
   f. Architect approved (prior to bidding) equivalent product.

2.04 BITUMINOUS MATERIALS

A. Asphalt Primer: ASTM D41.

B. Plastic Cement: ASTM D4586, Type II, cutback asphalt type (non-asbestos).

C. Modified Bitumen Adhesive: SBS modified asphalt adhesive; such as; "Matrix SB" by US Intec, or manufacturer-approved equivalent.

2.05 RIGID INSULATION

A. Polyisocyanurate Insulation: Closed cell glass fiber reinforced type (tapered and non-tapered), conforming to the following:

1. Board Density: 2.0 lb/cu ft.
2. Board Size: 4x4 feet.
3. Board thickness and slope varies per roof area:
   a. Roof area 1/A, 1/B & 3/B; non-tapered 2" minimum thickness.
   b. Roof areas 1/C; non-tapered 3" minimum thickness
4. Tapered Board: 1/4" and 1/2" per foot are to be used as indicated for "crickets" between drains and counter-slopes at perimeter walls.
5. Compressive Strength: 25 psi per ASTM D 1621
6. Facing: Factory applied skin of glass fiber facing on both faces.
7. Board Edges: Square.
8. Water Absorption: In accordance with ASTM C209, 1 percent by volume maximum.

9. Foam Core Flame Spread: 25 Max. - ASTM E-84 (Tunnel Test).
10. ULI Fire Rating: Conform to the current ULI, Class A, Roof/Ceiling fire rated assemblies (see current ULI "Fire Resistance Directory").

2.06 GYPSUM ROOF BOARD

A. Gypsum Roof Board (Glass fiber reinforced/faced gypsum): as approved for use within a 20 year warranted roof system by the roofing manufacturer, with the following characteristics:
1. Board Type: manufacturer standard product for use over polyisocyanurate insulation and over metal decks.
2. Manufacturer and Product: Georgia-Pacific Corporation, Gypsum Division, or Dens-Deck Prime Roof Board.
3. Board Size: 4 feet x 4 feet (for adhered application) x 1/4" min. thickness. 4 feet x 8 feet (for mechanically attached) x 1/4" min. thickness.
4. Compressive Strength: Minimum 900 psi.
5. Water Absorption: In accordance with ASTM C 1177-91
6. Board Edges: Square.
7. UL Fire Rating: Conform to the current UL, Class A, Roof/Ceiling fire rated assemblies (see current UL "Fire Resistance Directory").

B. Contractor's Option: Gypsum Roof Board (Glass fiber reinforced with no face layer) : as approved for use within a 20 year warranted roof system by the roofing manufacturer, with the following characteristics:
1. Board Type: manufacturer standard product for use over polyisocyanurate insulation and over metal decks.
2. Manufacturer and Product: United States Gypsum Company or Securock Roof Board.
3. Board Size: 4 feet x 4 feet (for adhered application) x 1/4" min. thickness. 4 feet x 8 feet (for mechanically attached) x 1/4" min. thickness.
4. Compressive Strength: Minimum 1,250 psi
5. Water Absorption: 10 In accordance with ASTM C 473
6. Board Edges: Square.
7. UL Fire Rating: Conform to the current UL, Class A, Roof/Ceiling fire rated assemblies (see current UL "Fire Resistance Directory").

C. Contractor's Option: Multi-ply, semi-rigid asphaltic roof substrate board composed of a mineral fortified asphaltic core formed between two asphaltic saturated fiberglass liners.
1. Board Type: manufacturer standard product for use over polyisocyanurate insulation only.
2. Manufacturer and Product: Soprema, Sopraboard
3. Board Size: 4 feet x 4 feet (for adhered application) x 1/8" thick (minimum as required by manufacturer.
4. Compressive Strength: 440 psi.
5. Water Absorption: <1% in accordance with ASTM C 209
6. Board Edges: Square.

2.07 MECNANICAL FASTENERS

A. Refer to Details 8.01 thru 8.04 for Fastener Schedule and requirements.

B. For Fastening Base Flashing to Wood Nailers: Roofing nails: galvanized, hot dipped or non- ferrous type, size as required to suit application.

C. Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and system manufacturer; length required for thickness of material with plastic washers.

D. For All Locations not provided for in the above Schedule: Provide size, type, material and finish as required, matching material being fastened.

2.08 INSULATION ADHESIVES

A. Provide insulation adhesive type and product approved by the roofing manufacturer as a component within the tested roof system selected for this project. Manufacturers and products include the following.
   1. OLY BOND Adhesive Fastener, Olympic Manufacturing Group, Inc. 153 Bowels Road, Agawam, MA 01001, 800-633-3800 and (FAX: 413-821-0417).
   2. INSTA-STIK Professional Roofing Adhesive, Insta-Foam Products, Inc., 1500 Cedarwood Drive, Joliet, IL 60435-3187, 800-800-3626, (FAX: 815-741-6822).
   3. TITE-SET Commercial Roofing Adhesive, Polyfoam Products, Inc., 10798 NW 53rd Street, Sunrise, FL 33351, 888-774-1099, (FAX: 954-578-1042).
   4. ROOF ASSEMBLY ADHESIVE, CHEM-LINK Advanced Architectural Products, Inc., 416 Ransom Street, Kalamazoo, MI 49007, 800-826-1681. May be obtained through ASR Associates, Inc., 800-683-0221.

B. Other acceptable adhesives: Any Adhesives approved and tested by the roofing system manufacturers may be submitted for review and acceptance by the Architect no later than ten (10) calendar days prior to bidding.

C. Contractor to submit certification based on pull tests showing adhesive meets ASCE 7 uplift requirements.

2.09 FIBRATED ALUMINUM COATING

A. Fibrated reflective coating with asphalt cut-back base, fiberglass fibers, and leafing-type aluminum pigment; complying with ASTM D-2824, Type III.

2.10 ACCESSORIES

A. Metal Cant Strip (and Contractors Options): Basis of design is a continuous strip of 16 gage, G90 galvanized steel, with the material formed to a 140 degree angle top and bottom, with a 3 inch minimum face width. Due to combustibility concerns, the contractor has the following options:
   1. Perlite, treated by the manufacturer for torch application
   2. Mineral fiber.
   3. Formed sheet metal cant.
   4. Adhering a self-adhesive modified bitumen membrane to the face of a fiber cant.
   5. Laminating gypsum roof board to the face of the cant strip.

6. Modified bitumen cant (Derbicant by Performance Roof Systems, Inc.)

B. Vent Pipe Flashing: Prefabricated pipe flashing of 4 lb. per square foot common pig lead having a 4 inch deck flange.

C. Modified Bitumen, Self Adhesive Flashing Tape: Utilize ProtectoFlash Building Tape - 20 mil thick by 4 inch wide as manufactured by Protecto Wrap Company of Denver, Colorado (800-759-9727), Grace Vycor Plus or Eternabond at joints of gypsum roof board.

D. Cementitious Filler Compound: Utilize an acrylic modified, site mixed, cement based compound intended for the correction of minor roof slope issues, such as that produced by RoofSlope of Murrieta, CA 92562, (888) 255-1888), www.roofslope.com

E. Flashing Tape: Double sided, grey extruded or preformed, 99% solids, crosslinked polyisobutylene compound, non-sag, non-toxic, non-staining, permanently elastic self adhesive tape. 1/8" minimum thickness, 3/4" minimum width unless noted otherwise on the drawings.
1. Pecora Corporation Extru-Seal Glazing Tape
2. Tremco Construction Products 440 II Tape
3. Equivalent products as approved by the Owner and Architect.

F. Insulation Joint Tape: Asphalt treated glass fiber reinforced; 6 inches wide; self adhering.

G. Traffic Pads: Provide either the manufacturer's standard factory fabricated walkway pad system, or field fabricate as follows:
1. Provide a contrasting color, granule surfaced cap sheet membrane as specified above, cut into four foot lengths, remove selvage edge.
2. Heat weld a single layer of this cap sheet to a similarly prepared single layer of smooth surfaced interply membrane as specified above.
3. Provide and install where indicated by the project drawings, and as required by the roof membrane manufacturer as determined in the field.

2.11 PREFABRICATED METAL CURBS

A. Approved Products Include:
1. The Pate Company
2. Custom Curb, Inc
3. Equivalent products as approved by the Owner and Architect.

2.12 PREFABRICATED EUIPMENT SUPPORTS

A. Approved Products Include:
1. The Pate Company
2. Custom Curb, Inc
3. PHP Systems/Design
4. Equivalent products as approved by the Owner and Architect.

2.13 SEALANTS

A. As specified in Section 07 90 00 – Joint Protection

B. Sealant Primer: Recommended by sealant manufacturer to suit application

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

D. Backer Rod: Extruded polyolefin foam made of a nonabsorbing outer skin and a highly resilient interior network of open and closed cells which will not out-gas when ruptured.

2.14 TAPERED DRAIN SUMPS

A. 3000 psi structural grout; 3/4" per foot slope.

B. Tapered rigid insulation: Uniform 3/4" per foot slope per project details

2.15 LEAD DRAIN FLASHING

A. 36 inch square flashing of 4 lb. common desilvered pig lead sheet.

2.16 MISCELLANEOUS MATERIALS

A. All other material and accessories, not specifically described, but required for a complete and proper installation of roofing, shall be products of, or recommend by the manufacturer of the primary material and subject to the approval of the Architect.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Total Installation Concept:
1. The specified system is a total roofing system, not a patched up, chopped up, spliced or added to or on roofing system. Therefore, this type of application will not be acceptable.
2. If a section of roof requires reworking and/or patching, the entire area or section of roofing shall be replaced. This shall mean from vertical surface to vertical surface, or roof perimeter to roof perimeter in all directions.

B. Watertightness Imperative:
1. The work specified herein will not preclude the use of procedures that will maintain the buildings watertight. Therefore, the Contractor, while conforming to these Contract Documents, must utilize necessary procedures to keep water out of the buildings while construction is in progress.
2. At end of each day's roofing installation and prior to the onset of all inclement weather, new section of roofing shall be temporarily sealed with cut-offs to the unfinished substrates. Seal projections through the roof and

to the surrounding intersections so that no moisture may enter roofing or into structure before work resumes. Remove cut-offs before work resumes.

3. Cut-offs: 1 plies of roofing, fully adhered by torching, or set in full bed of modified bitumen adhesive/mastic; remove at beginning of next days' work.

C. In areas where there is a chance of debris falling into the occupied space, work will be performed after hours, on weekends or on holidays.

D. Environmental Impact: Ensure that fresh air intakes in the area of new roofing construction are properly sealed or filtered. Coordinate user requirements for temporary equipment shutdown as needed. Also, take care to prevent lightweight concrete or asphalt from entering through voids in the deck.

E. Interior Work: Coordinate installation of associated ceiling repairs with user schedules and peak-use times.

F. Off Hour Work: The following roof construction activities must be coordinated and scheduled to occur while those spaces immediately below the required work are not occupied.

1. Asbestos abatement (if applicable)
2. Roof tear-off.
3. Removal or installation of heavy roof top equipment.
4. Structural and/or deck repairs.
5. Application of hot asphalt to structural deck.
6. Loading or unloading of materials.
7. Any interior (below structural roof deck) work

G. Building Safety: **Contractor shall maintain a daily "fire watch" for a minimum of two (2) hours after torch down shift has been completed.**

3.02 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secured.

C. Verify deck is clean and smooth, free of depressions, waves, or projections, properly sloped to drains, valleys, or eaves.

D. Confirm deck is dry by moisture meter with 12 percent moisture maximum in compliance with Florida Building Code TAS 126 prior to or upon removal of the existing roof membrane system.

E. Verify roof openings, curbs, pipes, conduit, sleeves, ducts, roof drains and vents through roof are solidly set, and cant strips and reglets are in place.

F. Roof membrane manufacturer's technical representative is to inspect the roof deck / substrate conditions prior to application of roofing materials to verify the substrate is acceptable to receive the proposed roofing system in compliance with the appropriate Florida Product Approval Installation Instructions. A

written report stating such is to be submitted to the Owner and Architect for their review and records

3.03 INSTALLATION REQUIREMENTS

A. Protect other work from spillage of modified bitumen roofing materials and prevent liquid materials from entering or clogging drains and conductors. Replace/restore other work damaged by installation of roofing system work.

B. Insurance/Code Compliance: Install system for (and test where required to show) compliance with governing regulations and with the following requirements:
   1. Underwriters Laboratories "Fire Classified" and "Class A", the Florida Building Code and ASCE 7 for wind up-lift resistance for wind speed of 145 mph (ultimate) / 112 mph (nominal).

3.04 PREPARATION – EXISTING DECK

A. Test fastener to verify that pull out strength is at least 60 lbs. per fastener. A documented pull test report from the fastener manufacturer is to be provided indicating a minimum number of pull tests per roof area and per square feet as required by the roofing material manufacturer.

B. Replace any damaged or deteriorated decking per the unit price allowances and as authorized by the Owner. Smooth rough spots and sweep all surfaces clean. Fill surface honeycomb and variations with manufacturer's approved filler material.

C. "Divot" repair at the existing LWIC as a result of existing roof tear-off is to be considered part of the base bid services, and not part of the unit price cost allowance.

3.05 APPLICATION OF BASE SHEET

A. Venting Base Sheet:
   1. Start with 18" width at the low edge, followed by full width sheets.
   2. Lap the venting base sheet 4 inches at edges and ends.
   3. Mechanically fasten base sheet in accordance with the prescribed attachment requirements as detailed within the project documents, or as determined by the roof system manufacturer due to the project wind uplift criteria (most stringent to govern).
   4. At parapet walls, extend the venting base sheet up and over the wall covering and wood blocking where necessary for venting.
      a. Nail venting base sheet to the wall at 8" on center in each direction.
      b. Apply flashing adhesive at side laps (or end laps) and over nail heads to keep wall flashing watertight until the multiple ply flashing and modified bitumen flashing is installed.

3.06 PREPARATION FOR INSULATION APPLICATION

A. The Contractor shall verify field dimensions for determining a positive drainage slope.

B. Install only as much insulation board in any one day as can be covered by the completed membrane in the same day.

C. Prior to insulation board application, remove excess dust, loose granules and foreign materials from surface of the substrate by brooming and powered blowers or vacuums.

D. Contractor shall insure that slopes indicated on the drawings are "finish" slopes, regardless of irregularities and deviations in the roof deck or substrate.

3.07 ADHERED INSULATION AND ROOF BOARD APPLICATION

A. Solidly adhere (at the manufacturer's recommended rate and spacing) using an insulation board adhesive, a precut polyisocyanurate insulation board system to the existing roof system.

B. Adhere 1/2” per foot tapered rigid insulation crickets at “high” side of mechanical equipment and curbs, and as indicated by the project drawings.

C. Butt board edges tightly. Smooth surfaces irregularities and unevenness between boards in top layer and apply joint tape to gypsum roof boards before priming. Fully prime finished surface of gypsum roof board.

D. Cant Strips/Tapered Edge Strips: Except as otherwise shown, install preformed 45 degrees metal cant strips at junctures of membrane with vertical surface after installation of the gypsum roof board.

E. Tapered Edge Strips: Install taper edge strips as necessary to provide a smooth transition between slight elevation changes prior to installation of the gypsum roof board.

3.08 MEMBRANE APPLICATION

A. Interply Sheet Application:
   1. Install a SBS modified bitumen interply sheet, lapped, shingled in proper direction to drain water to roof drain locations, using torch-adhered application.
      a. Apply flame to bottom side of interply as it is being rolled out to achieve adhesion to gypsum cover board, vented base sheet and/or preceding interply sheet.
      b. Avoid applying flame directly to gypsum roof board. Excessive flame will damage the roof board.
   2. Overlap ends of connecting plies (end lap) minimum of 10 inches. Remove all factory splices from rolls.
   3. Apply membrane; lap and seal edges and ends permanently waterproof.
   4. Apply membrane smooth, free from air pockets, wrinkles, or tears. Ensure full bond of membrane to substrate.

5. Extend membrane up to top of cant strip.
6. Extend membrane over vapor barrier of wall construction and seal.
7. Seal membrane around roof protrusions and penetrations.
8. Allow sufficient "bleed out" at membrane edges to ensure proper bonding.
9. **Contractor shall maintain a daily "fire watch" for a minimum of two (2) hours after torch down shift has been completed.**

B. Slope Corrections for Proper Drainage:
1. Upon installation of the first interply, use water to test the roof system for proper drainage, mark any areas of standing water for correction.
2. At minor depressions, standing water is to be eliminated by the application of additional plies of the specified modified bitumen interply sheet.
3. At more significant depressions, standing water is to be eliminated by the application either cementitious filler compound and/or tapered rigid insulation with a gypsum coverboard.
4. At crickets between drainage scuppers, enhance the existing roof slope with tapered rigid insulation with gypsum coverboard, or cementitious filler compound to provide a finished slope to the drain / scupper of 1/4" per foot.
5. At drainage basins for scuppers which have been abandoned, fill the existing roof slope with cementitious filler compound to provide a level deck and install 1/4" per foot tapered rigid insulation with gypsum coverboard, or cementitious filler compound to provide a finished slope to the adjacent active scupper of 1/4" per foot as indicated on the roof plans.
6. Upon completion of this remedial work, prime the new substrate as required and install a SBS modified bitumen interply sheet, lapped, (shingled in proper direction to drain water to roof drain locations), with torch-adhered application.

C. Granular Surfaced Cap Sheet
1. Roll out cap sheet and cut each roll in two equal lengths. Allow cap sheet to relax 30 minutes before installation.
2. Laying Cap Sheet: Lay out cap sheet in the direction of the roof slope.
3. Apply flame to bottom side of cap sheet as it is being rolled out to achieve adhesion to interplies. Lap end of sheets 10 inches, and side laps 3 inches. Remove all factory splices from rolls.
4. Apply membrane; lap and seal edges and ends permanently waterproof.
5. Apply membrane smooth, free from air pockets, wrinkles, or tears.
6. Allow sufficient "bleed out" at membrane edges to ensure proper bonding.
   a. Apply granules to "bleed out" areas (matching color of new cap sheet) in a timely manner so as to ensure embedment into asphalt. Apply pressure over granules as may be required.
7. **Contractor shall maintain a daily "fire watch" for a minimum of two (2) hours after torch down shift has been completed**.

D. Membrane Flashing (Torch Applied)
1. Install SBS modified bitumen, polyester reinforced flashing system using a roofing torch on vertical surfaces of wall and curbs over a mechanically fastened base ply felt or solid substrate.

a. Apply flexible sheet base flashing using a “torch” application over initial modified bitumen interply flashing.
b. Hand rub to ensure complete embedment and adhesion of flashing.
c. Three course outside corners and side laps using reinforcing membrane and flashing adhesive. Coat exposed asphalt with fibrated aluminum coating.

2. Secure top of flashing to nailers or solid substrate at 4 inches on center.
3. Coordinate with installation of roof drains, curbs and related flashing.
4. **Contractor shall maintain a daily “fire watch” for a minimum of two (2) hours after torch down shift has been completed.**

E. Membrane Flashing (Cold Process Application)

1. Install SBS modified bitumen, polyester reinforced flashing system in trowelable flashing adhesive on vertical surfaces of wall and curbs over a mechanically fastened base ply felt or solid substrate.
   a. Apply flexible sheet base flashing using cold process application methods over modified bitumen interply flashing.
   b. Hand rub to ensure complete embedment and adhesion of flashing.
   c. Three course outside corners and side laps using reinforcing membrane and flashing adhesive. Coat exposed asphalt with fibrated aluminum coating
2. Secure top of flashing to nailers or solid substrate at 4 inches on center
3. Coordinate with installation of roof drains, curbs and related flashing.

F. Set-on Accessories:

1. Coordinate installation of set-on accessories.
2. Review details for special installation requirements.
3. Where small roof accessories are set on the membrane, set primed metal flanges in a 1/4" thick bed of flashing adhesive, and seal penetration of membrane with bead of flashing adhesive.

G. Metal Flashing:

1. Strip metal flanges using manufacturer's standard white or gray granular-surfaced flashing, set in modified bitumen adhesive, extending minimum 4" beyond flange

H. Vent Pipe Flashing:

1. Set metal flange in a 1/4" thick flashing adhesive.
2. Top of sleeve shall be bent over and extended down into the vent pipe a minimum of 1 inch. Obstruction of opening is not permitted.
3. Strip-in as specified for set-on accessories.
4. Set primed metal flanges of set-on accessories in flashing adhesive.

I. Traffic Pads:

1. Provide walkway protection pads at locations shown, using units of size shown or, if sizes not shown, using units of manufacturer's standard size, 1/2" thick. Set units in roof cement or adhesive compatible with and approved by roof membrane manufacturer. Leave 3" clear between pads.

3.09 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions Division 1 of the Contract Documents.

B. Correct identified defects or irregularities.

C. Require site attendance of roofing and insulation materials manufacturers during installation of the Work.

3.10 CLEANING

A. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

B. Repair or replace defaced or disfigured finishes caused by work of this section.
   1. Trash and scraps are a hazard and shall be collected and disposed of immediately.
   2. The applicator shall remove all masking protection equipment, materials and debris from the work and storage areas and leave those areas in an undamaged and acceptable condition.
   3. Place new sod in an acceptable blending of the edges of new sod to existing surrounding sod in all damaged areas.
      a. Do not place new sod over existing sod. Excavate so that top plane of new sod will conform to adjacent plane of existing sod. Match new sod with existing sod type.

3.11 PROTECTION

A. Protect building surfaces against damage from roofing work.

B. Where traffic must continue over finished roof membrane, protect surfaces.

C. Upon completion of roofing work (including associated work) advise Owner of recommended procedures for surveillance and protection of roofing during remainder of construction period. At the end of the construction period, or at a time when remaining construction work will in no way affect or endanger roofing, make a final inspection of roofing and prepare a written report to Owner and Architect describing nature and extent of deterioration or damage, if any, found in the work.

D. Repair or replace deteriorated or defective work found at time of substantial completion inspection. Repair damages to roofing which occurred subsequent to roofing installation and prior to final completion inspection. Repair or replace the roofing and associated work to a condition free of damage and deterioration at time of final completion.

END OF SECTION

MANUFACTURER'S NOTICE OF INTENT TO ISSUE ROOF WARRANTY

Whereas_____
herein called the "Roofing System Manufacturer" hereby gives notice to:

Owner: _____

Address:_____
of its Notice of Intent to issue its Roof Warranty, to the Owner for the Project,

Project:_____

Address:_____
incorporating the Manufacturer's_____

_____
roofing system or product is installed in accordance with the Contract Documents.

Manufacturers' Notice of Intent to Issue Roof Warranty in conformance with the Contract Documents shall be executed by the manufacturer and attached to the bid form. Each Bidder shall submit a single form, only from the specified manufacturer, and shall include items 1 and 2 as follows:

1. A detailed description of the components of the manufacturer's system proposed and a list of any other component and accessories, proposed for use in the system that is provided by other manufacturers or suppliers.

    a) A statement that the Manufacturer's Representative has thoroughly reviewed the job conditions and project manual, (plans, specifications & details). Having reviewed the above items and project requirements in detail, the Representative will provide a written response to the Design Professional ten days prior to the bid date, if conflicts between the Manufacturer's requirements occur with the above listed documents.

2. A sample of the Manufacturer's Roof Warranty shall be attached to and submitted with this form and the bid package. The manufacturer shall delete all exceptions relative to system failure from high wind uplift pressures due to gale force winds and windstorms below 120 mph and below the following "Unfactored / (Nominal) Wind Uplift Pressures as calculated per the Florida Building Code and ASCE 7:

a)	Interior of Roof (Zone 1):	-30 psf
b)	Perimeter of Roof (Zone 2):	-45 psf
c)	Corners of Roof (Zone 3):	-65 psf

3. **Twenty (20)** year total roof system warranty inclusive of roofing materials, all included products and accessories, including all metal flashings, from roof deck to finish membrane, whether supplied by the membrane manufacturer or by others. Provide a "No Dollar Limit", single source responsibility, non-deductible roofing warranty inclusive of all material and labor in full compliance with all the requirements of the project specifications.

a) The manufacturer shall modify the roof warranty to include total labor coverage for the warranty period and to Cover damage to roof materials and insulation down to the roof deck resulting from water penetration.

b) The manufacturer shall modify the roof warranty to state that the Owner has the right to make emergency repairs without voiding the warranty if the manufacturer or applicator does not respond within 24 hours to notification by the Owner of a defect or leak.

c) The manufacturer shall modify the roof warranty to state that annual inspections with written reports by the Owner, and resulting maintenance, are sufficient to fulfill the periodic inspection requirements of the manufacturer's warranty.

4. The manufacturer's Representative shall conduct a Post-Construction field inspection no earlier than **eleven (11) months**, and no later than **twelve (12) months** after the Date of Substantial Completion. Submit a written report within seven (7) days of this visit to the Owner's Maintenance Dept. listing observations, conditions and any recommended repairs or remedial action.

5. The manufacturer will, during the **second** (2^{nd}), and **fifth** (5^{th}), year of this warranty, inspect the roof system and provide a written Executive Summary of the Roof Condition to the Owner.

Further, the manufacturer acknowledges that the applicator:

Roof Applicator's Name:_____

Address: _____

has been approved to install this roof system since _____, _____ and meets the criteria for an approved applicator listed in the Project Manual.

By signing the above, the Authorized Representative of said Manufacturer certifies and represents the Roofing System Manufacturer with the authority to contract and make the above representations to the Owner.

By: _____ Date: _____
Signature of Authorized Representative

Name:_____ Title: _____

Witness:_____

Date: _____

APPLICATOR'S WARRANTY FOR ROOFING

Whereas _____

of (Address)_____

herein called the "Roofing Contractor", has performed roofing, flashing and sheet metal and associated ("work") on following project:

Owner:_____

Address:_____

Name and Type of Building:_____

Address:_____

Area of Work:_____

Date of Acceptance:_____

Warranty Period: **Three Years** Date of Expiration:

The Roofing Contractor hereby certifies to the Owner as a "Final Statement of Compliance" that the finished roof membrane (and insulation) system was installed in compliance with the approved contract documents.

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks, faulty or defective materials, roofing components deemed faulty or in disrepair, and workmanship for designated the Warranty Period.

NOW THEREFORE Roofing Contractor 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 watertight condition.

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

1. Specifically excluded from this Warranty are damages to roofing work and other parts of the building, and to building contents, caused by: a) lightning, windstorm; b) fire; c) failure of roofing system substrate or structure (including cracking, settlement, excessive deflection, deterioration, and decomposition). When work has been damaged by any of the foregoing causes, Warranty shall be null and void until such damage has been repaired and until cost or repairs has been paid by the Owner or by another responsible party as so designated.

2. The Roofing Contractor is responsible for damage to work covered by this Warranty, and is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

3. The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect, disrepair or deterioration. The Contractor shall guarantee to respond to all notifications within **twenty-four (24) hours** and to make all such repairs as deemed necessary to correct said leaks or defects to a satisfactory condition to the Owner. Repairs shall be made by workman in the current employment of the Contractor. Subcontracting of repair work is not permitted.

4. The definition of faulty roofing components or roofing in disrepair includes, but is not limited to the following:

    A. Blisters in roofing.
    B. Cracks or ridging in roofing membranes.
    C. Delamination, shears or tears in membrane.
    D. Defects in the quality of work or materials.
    E. Leaks of any kind.

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

IN WITNESS THEREOF, this instrument has been duly executed this

_____day of_____, 20____.

_____
Roofing Contractor Firm

_____
Signature of Authorized Person

_____ (SEAL)
Title

_____
Witness

SECTION 07 56 10

FLUID APPLIED FLASHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Furnish and install fluid-applied-flashing system, comprised of a fleece and resins forming flashing base and top coat; as specified in accordance with drawings and manufacturer=s requirements. Application to be applied a large flue extended thru mansard wall.

1.02 REFERENCES

A. ASTM International:

1. ASTM D412 – Standard Test Methods for Rubber Properties in Tension.
2. ASTM D2240 - Test Method for Rubber Property - Duration of Hardness,
3. ASTM G23 - Weatherometer Testing 2000 Hrs.
4. ASTM E96 - Water Vapor Transmission of Materials.
5. ASTM E108/UL 790 - Tests for Fire Resistance of Roof Covering Materials.
6. ASTM D413 - Adhesion Test method.
7. ASTM C297 - Flatwise Tensile Strength, after aging (according to ICBO).

B. ICBO – International Conference of Building Officials

1. ICBO Research Committee=s Acceptance Criteria for Roof Systems - Water Permeability.
2. ICBO Acceptance Criteria for Special Roofing Systems - Physical Capabilities and Permanent Deformation Test.

1.03 SYSTEM DESCRIPTION

A. Fluid-Applied-Flashing System: Primers as required by manufacturer and as specified in the installation manual, elastomeric polyester resin, non-woven polyester reinforcement fabric (fleece), top seal coating and related accessories

104 SUBMITTALS

A. Under provisions of Section 01 33 00 submit the following:

1. Manufacturer=s product data on physical and chemical properties of products, preparation of substrate required, product limitations, and cautionary requirements.
2. Manufacturer=s written approval of installer firm.
3. Manufacturer=s general and specific installation requirements, recommendations and procedures.
4. Manufacturer=s certification that products meet or exceed specified requirements.
5. Material System Sample: Cured membrane sample and fleece sample 2" by 6".

6. Shop Drawings: Indicate joint or termination detail conditions and conditions of interface with other materials.
7. Details: Furnish manufacturer=s standard details, modified standard details and special details as deemed appropriate.
8. Manufacturer=s Safety Data Sheets (MSDS) on all materials, chemicals, products or substances used in the work of this section which may be constructed as hazardous by the governing bodies with jurisdiction, including State Department of Labor and Industries, or Department of Ecology, or OSHA federal and state.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturer: Company specializing in manufacturing the products specified in this section with not less than ten years documented experience. Fluid Applied Flashing system shall have a successful proven field exposure for a minimum of ten years.
2. Installer: Company specializing in performing the work of this section approved in writing by the manufacturer.

B. Work of this section shall comply with manufacturer=s general and specific instructions.

C. Field sample: Provide a 12 inch long x 8 inch wide sample of finished waterproofing membrane for approval and identification by roofing inspector. Clearly identify date and job name on the back of each sample.

1.06 REGULATORY REQUIREMENTS

A. Comply with applicable code for fire resistance ratings of roof systems and as specified.

B. Meet the requirements of the UL Class A Fire Hazard Classification.

C. Maintain at all times on the jobsite a commercial grade, currently certified Fire extinguisher.

1.07 PRE-INSTALLATION CONFERENCE

A. Under provisions of Section 01 30 00, convene on the roof for a roofing conference prior to the beginning of work for this section. Contractor, Applicator, Owner, Architect/Engineer, Roofing Consultant, governing authorities, distributor=s technical services representative and other parties interested in the performance of the roofing system shall be in attendance.

B. Review Contract Documents, submittals, proposed installation schedules, job set-ups, location and storage of materials, requirements for inspection, testing, warranty, governing regulations, installation procedures and coordination with other work.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, and handle products to site under provisions of Section 01 63 00.

B. Protect stored products from extreme temperatures, weather and sunlight in accordance with manufacturer=s written recommendations.

C. All labels shall be readable with UL markings clearly visible.

D. Deliver materials in sufficient quantities to allow a continuity of the work.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Do not apply flashing system materials during inclement weather or under conditions not acceptable to the manufacturer.

B. Do not apply roofing systems materials when moisture from dew is present or if rain or moisture sources are present, forecasted or expected or when weather conditions and ambient temperatures do not permit work to be performed in accordance with manufacture=s recommendations and warranty requirements.

C. Do not expose materials vulnerable to water or sun damage in quantities that can not be weatherproofed during the same day. At the end of each workday and when weather threatens provide tie-offs, approved by manufacturer=s installation procedures that are proven effective in providing weathertight seal and in preventing moisture penetration.

1.10 SCHEDULING

A. Schedule work under the provisions of Division 1.

B. Schedule work to coincide with commencement of installation of new roofing system.

C. Remove only existing roofing materials that can be replaced with new materials the same day.

1.11 COORDINATION

A. Coordinate work under provisions of Division 1.

1.12 PRODUCT WARRANTY

A. Provide manufacturer=s standard written warranty, signed by manufacturer of roofing system and installer, agreeing to repair or replace defective materials and workmanship within the specified warranty period.

B. Warranty Period: 20 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS AND PRODUCTS

A.	Firestone	UltraFlash
B.	GAF	TopCoat Liquid Applied Flashing System
C.	Johns Manville	PermaFlash System
D.	Soprema:	Alsan RS Flashing.
E.	Siplast:	Parapro 123 Flashing System.
F.	Kemper Systems:	Kemperol Membrane BR/200 System.

G. Equivalent systems as approved by, and included within the roofing manufacturer's 20 year weathertightness warranty.

2.02 MATERIALS

A. Membrane: Cold liquid applied polyurethane reinforced waterproofing membrane with a polyester reinforced fleece.

B. Polyester Reinforcement Fleece: Reinforcement fleece shall consist of the manufacturer=s supplied non-woven polyester fleece.

C. Top Coat: Fire retardant single component coating as supplied by the manufacturer.

2.03 ACCESSORIES

A. Filler: Resin type as recommended by manufacturer.

B. Primer-Sealer: Type as recommended by manufacturer and as required by UL-790 Class A testing for substrate.

PART 3 EXECUTION

3.01 GENERAL

A. Install roofing system materials and assemblies in strict accordance with manufacturer=s recommendations.

B. Maintain one current copy of applicable manufacturer=s installation instructions for system components and one copy of Contract Documents including system approvals on the rooftop during installation.

3.02 EXAMINATION

A. Verify that surfaces and project site conditions are ready to receive work as defined in this section.

B. Verify that area to be coated is smooth, dry and free of water, grease, oil, dirt, dust, debris, gravel, paint, asphalt, projections, depressions, loose scale, sand, curing compounds and other foreign deposits in accordance with manufacturer=s recommendations.

C. Do not begin work until unsatisfactory conditions are corrected. Beginning work means installer accepts surfaces and substrates as satisfactory and ready to receive roofing materials.

3.03 PREPARATION – EXISTING METAL SURFACES

A. Remove contaminants such as, coatings and other materials that may interfere with total adhesion. Take extra precautions not to damage existing structure or adjoining surfaces. Protect adjacent materials and finishes from physical damage. Provide protection as required and remove from site at completion of work.

B. Flashings shall be abrasively cleaned or ground as required to provide a sound open abraded surface.

C. Mask off and protect adjacent finished surfaces that are not scheduled to receive the new fluid applied flashing system.

3.04 PREPARATION - EXISTING BUILT-UP ROOFING WITH GRAVEL SURFACING

A. Spud back existing gravel surfacing.

B. Flashings shall be ground for a 4 inch minimum band at all vertical termination points, to wall transitions, and 4 inches onto horizontal roof surfaces.

3.05 PREPARATION - EXISTING GRANULATED MODIFIED BITUMEN ROOFING

A. All loose granules, dust and dirt shall be removed from the surface of the membrane by brooming and power vacuuming.

3.06 PREPARATION - EXISTING CONCRETE

A. Concrete shall be abrasively cleaned to provide a sound substrate free from laitance with an open concrete surface.

B. Areas of minor surface deterioration of 0.50 inch or greater in depth, and/or spalls, voids, bug holes and other deterioration on vertical surfaces or horizontal surfaces shall be repaired in accordance with the requirements of the membrane manufacturer and the Owner or his designated representative.

3.07 PREPARATION - EXISTING MASONRY

A. Masonry walls must be hard kiln dried brick, reinforced concrete block or waterproof concrete block construction.

B. Flashings must not be applied over soft or scaling brick or concrete, faulty mortar joints, or walls with broken, damaged or leaking coping. Walls of ordinary hollow tile, or other materials which in themselves are not

waterproofed, should not be accepted as suitable to receive flashings unless they are properly waterproofed, to prevent moisture infiltration from above or behind the flashing system.

3.08 FLASHINGS AND ACCESSORIES

A. Install manufacturer=s standard membrane flashings and accessories in locations indicated on the plans and in accordance with the manufacturer=s instructions. All flashing shall be tight and of adequate height to assure watertightness. Whenever possible a minimum of 6" of membrane shall be extended into flashing areas, with resin extending past end of fleece.

B. Laps/Seams: Maintain a minimum 2 inch overlap at all side laps of adjacent fleece rows and 4 inch overlaps at butt laps, tie-ins and flashings (reinforcing fleece and resin). For tie-ins onto modified bitumen, asphalt or other approved membranes, provide minimum 12 inch overlaps (reinforcing fleece and resin).

C. Seal flashings and flanges of items penetrating membrane.

3.09 MEMBRANE APPLICATION

A. Apply polyester resin to properly cleaned and primed roof deck in accordance with manufacturer=s written instructions at the rate required by manufacturer.

B. Embed sheet of polyester fleece into resin in a smooth and uniform manner. Roll fleece into resin in accordance with manufacturer=s manual to remove all entrapped air, voids, and abridgements.

C. Lap side and end joints by 2 inches minimum. Allow resin to cure a minimum of one day before top coating is applied.

3.10 FINISH COAT APPLICATION

A. Apply coat of top seal coating in accordance with manufacturer=s written instructions and at a rate recommended by manufacturer. Apply over the cured membrane the day following its inspection and approval by manufacturer=s technical representative. Allow to cure per manufacturer=s instructions.

3.11 FIELD QUALITY CONTROL

A. Field inspection will be performed under provision of Section 01 40 00.

B. Correct indentified defects or irregularities.

C. Require site attendance of Distributor=s technical services representative periodically during the installation of the work for purposes of advising the installer of procedures and precautions for use of roofing materials and to ensure that all work meets the manufacturer=s requirements.

3.12 CLEANING

A. Repair or replace defaced or disfigured finishes caused by work of this Section.

B. Remove trash and debris from project site under provisions of Section 01 50 00.

C. Remove equipment and parts from project site.

3.13 PROTECTION OF FINISHED WORK

A. Protect building surfaces against damage from work of this Section.

B. Protect finished work under the provision of Section 01 50 00.

END OF SECTION

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Parapet caps and edge metal
2. Flashings and Counterflashings
3. Miscellaneous Sheet Metal at all Roof Areas
4. Accessories

B. Related Sections:
1. Section 06 10 00 - Miscellaneous Rough Carpentry: Wood blocking and curb extensions.
2. Section 07 52 00 – Modified Bitumen Membrane Roofing – Torch Application
3. Section 07 90 00 – Joint Sealers
4. Section 09 90 00 – Painting: Prime and finish painting.

C. References:
1. ASTM International:
   a. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   b. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products.
   c. ASTM B32 - Standard Specification for Solder Metal.
   d. ASTM B749 - Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products.
   e. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   f. ASTM D4397 - Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
   g. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
2. National Roofing Contractors' Association:
   a. NRCA – National Roofing Contractors' Association Manual.
3. Sheet Metal and Air Conditioning Contractors:
   a. SMACNA - Architectural Sheet Metal Manual..

1.02 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Submit shop drawings for any condition not shown on plans and details.

C. Product Data: Submit data on manufactured components metal types, finishes, and characteristics.

D. Samples:
   1. Submit two samples 12 x 12 inch in size illustrating a typical external corner, internal corner, material and finish.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA and standard details and requirements.

B. Failure to install work in strict accordance with provisions of this Section, is subject to total rejection of the work specified herein.

C. Maintain copy of document on site.

1.04 QUALIFICATIONS

A. Fabricator and Installer: Company specializing in sheet metal work with minimum three years documented experience.

1.05 PRE-INSTALLATION MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials causing discoloration or staining.

1.07 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate application of flashings with application of roofing, protruding material, and roof accessories to provide a complete weathertight installation according to the specified warranty requirements.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Stainless Steel: ASTM A 167; Type 304, soft temper, 22 ga. or 24 ga. thickness unless otherwise specified; smooth 2B finish.

B. Zinc-Coated Steel: Commercial quality with 0.20% copper, ASTM A 525 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, 24 gage except as otherwise indicated.

C. Aluminum: ASTM B 209, alloy 3003, temper H14, AA-C22A41 mill finish; Sheet and extruded tube for downspouts, 0.125" thick.

D. Sheet Lead: Standard 0.063 inch thick lead sheet weighing 4 pounds per square foot, arsenical-antimonial and pig lead alloy meeting the requirements of ASTM B29. Use sheet lead or tubing for flashing of vent pipes, roof drain sumps and other roof penetrations noted.

2.02 ACCESSORIES

A. Termination Bar: Aluminum ASTM B-209, Alloy 6061, Temper T-6, mill finish; sizes 1/8" thick by 1-1/2" with rounded edges.

B. Sheet Metal Fasteners:
1. Fasteners: Stainless steel
2. Exposed fasteners are prohibited, and may only be used where specifically permitted by the project details or the Architect.
3. Fasteners being on weather side of metal are to be a minimum #10 size "Scots" type screw with metal-backed neoprene washer integral with the head of the screw, or 3/16" diameter minimum steel rivet.
4. Use stainless steel fasteners for exterior application and cadmium plated fasteners for interior applications. Use painted fasteners where fastening into painted panel or trim.
5. Locate and space fastenings for true vertical and horizontal alignment. Use proper type fastening tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

C. Fasteners: Stainless steel: Fastener size and penetrations into various substrates should be as follows:
1. Wood: ¼ inch screw x 2 inch penetration or 1½ inch annular ring stainless steel roofing nail.
2. Concrete: ¼ inch "zamac" nail-in x 1 ½ inch penetration.
3. Concrete Block: ¼ inch "zamac" nail-in x 1 ½ inch penetration.

D. Fastener Schedule: Anchorage for below assumed to be into wood blocking, see details for other specifics.
1. Continuous Cleats: 1½ inch annular ring stainless steel roofing nails at 6 inches on center maximum.
2. See Fastener Schedule sheets included as part of the project documents.

3. For all conditions not covered, refer to fastener specifications above or consult with Architect.

E. Metal Flashing Adhesive: Epoxy Adhesive may be used to assemble flashing fabrications using aluminum or pre-finished metals as noted by the project details Utilize a 2 component methacrylate adhesive system, approved products are:

1. SciGrip SG300 series adhesive as manufactured by SCIGRIP Americas, 600 Ellis Road, Durham, NC 27703. Contact: (887) 477-4583, (www.scigrip.com).
2. Weld-on SS300 series adhesive as manufactured by IPS Structural Adhesives, Inc., 600 Ellis Road, Durham, NC 27703. Contact: (887) 477-4583, (www.ipscorp.com).
3. Partite 7300 or 7400 series adhesive as manufactured by Parson Adhesives, Inc., 3345 Auburn Road, Suite 107, Rochester Hills, MI 48309. Contact: (248) 299-5585, (www.parsonadhesives.com).
4. The above products have been represented locally by North American Composites, 3715 North Frontage Road, Lakeland, FL 33810. Contact: (800) 241-5817. (www.nacomposites.com).
5. Architect approved equal.

F. Dry-in Membrane: Forty (40) mils thick, polyester reinforced, SBS modified asphalt waterproofing and underlayment membrane sheet.

1.	Boral	TileSeal HT
2.	InterWrap	Titanium PSU
3.	Protecto-Wrap	Rainproof 40
4.	Soprema	Sopralene Stick
5.	Tamko	TW Metal and Tile

6. Architect approved (prior to bidding) equivalent product.

G. Primer: Asphaltic based primer for flanges set in adhesive.

H. Protective Backing Paint (bituminous coating): FS-TT-C 494; Cold applied asphalt mastic, SSPC paint 12 compounded for 15 mil dry film thickness per coat.

I. Sealant: Sealant specified in Section 07 90 00.

J. Plastic Cement: ASTM D 4586, Type I.

K. Flashing Tape (concealed application): Double sided, gray extruded or preformed, 99% solids, cross linked polyisobutylene compound, non-sag, non-toxic, non-staining, permanently elastic self adhesive tape. One eighth (1/8) inch minimum thickness, 3/4" minimum width unless otherwise noted on the drawings.

1.	Pecora Corporation	Extru-Seal Glazing Tape
2.	Tremco Construction Products	440 II Tape

3. Equivalent products as approved by the Owner or Architect.

L. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

M. Solder: ASTM B 32; type suitable for application and material being soldered.

2.03 FABRICATION

A. Form sections shape indicated on Drawings, accurate in size, square, and free from distortion or defects.

B. Fabricate cleats of same material as sheet metal, interlocking with sheet.

C. Form pieces in longest possible lengths.

D. Hem exposed edges on underside 1/2 inch; miter and seam corners.

E. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

F. Fabricate corners from one piece with minimum 18 inch long legs; solder for rigidity, seal with sealant.

G. Pretin edges of stainless steel sheet. Solder shop formed metal joints. After soldering, remove flux. Wipe and wash solder joints clean. Weather seal joints. (Heliarc shop formed aluminum joints).

H. Perform soldering work slowly, with properly heated irons to thoroughly heat seam material and sweat solder through full width of seam that shall show not less than 1 inch of evenly flowed solder.
   1. Start soldering immediately after application of flux.
   2. Solder flat locked seams.

I. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.

J. Fabricate flashings to allow toe to extend 1 1/2” over wood nailers. Return and brake edges.

2.04 FINISH

A. Prepare stainless steel surfaces in accordance with Section 09 90 00.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mils when dissimilar metals are in contact.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

C. Verify roofing termination and base flashings are in place, sealed, and secure.

D. Do not proceed with work of this section until conditions detrimental to the proper and timely completion of the work have been corrected in an acceptable manner.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted counterflashing (reglets) to lines and levels indicated on Drawings. Seal top of counterflashing (reglets) with sealant.

C. Paint concealed metal surfaces with protective backing paint to minimum dry film thickness of 15 mils where applicable.

3.03 INSTALLATION

A. Where applicable, insert flashings into reglets to form tight fit. Secure in place with lead wedges. Seal flashings into reglets with sealant.

B. Secure flashing in place using concealed fasteners. Use exposed fasteners only where permitted.

C. Apply plastic cement compound between metal flashings and felt flashings.

D. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

E. Solder / weld per metal type metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

F. Apply modified bitumen cement compound between metal flashing and bituminous underlayment and/or flashing membrane. At other locations utilize self-adhesive butyl flashing tape as specified above.

3.04 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Inspection will involve surveillance of Work during installation to as certain compliance with specified requirements.

3.05 SCHEDULE

	Location	Metal Type	Thickness	Finish
A.	Coping Cap	Stainless Steel	24 gage	Mill
B.	Coping Cap Joint Covers	Stainless Steel	26 gage	Mill
C.	Coping Cap Cleats	Stainless Steel	22 gage	Mill

D.	Edge Metal Transition Fab.	Stainless Steel	24 gage	Mill
E.	Edge Metal	Stainless Steel	24 gage	Mill
F.	Continuous Cleats	Stainless Steel	22 gage	Mill
G.	Hot stack Hood Trans.	Stainless Steel	22 gage	Mill
H.	Adapter Curb Caps	Stainless Steel	20 gage	Mill
I.	Counterflashing & Receiver	Stainless Steel	24 gage	Mill
J.	Blocking/ Cants/ Curbs	Galvanized	16 gage	Mill
K.	Gooseneck Vent Fabrications	Stainless Steel	24 gage	Mill
L.	Weatherhead Fabrications	Stainless Steel	24 gage	Mill
M.	Gutters	Stainless Steel	24 gage	Mill
N.	Gutter/Downspout Brackets	Stainless Steel	1/8” thick	Mill
O.	Downspouts	Aluminum	1/8” thick	Mill

P. Miscellaneous metal flashing and transitions: Stainless steel, mill finish, 24 gage, as required by Architect.

END OF SECTION

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SECTION 07 63 00

ROOF PENETRATION FLASHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Section includes fabrication and installation of flashings for: pipes, conduits and other round items, angle irons, channels and similar penetrations; irregular shapes such as "Uni-strut"; and similar items penetrating, resting on, or anchored to the roof.
   2. Metal roof penetration flashing assemblies are considered an integral part of the roofing system(s) and shall be covered under the roofing membrane manufacturer=s and roofing installer's guarantees and warranties.
   3. All roof penetrations shall be flashed using materials, methods and details appropriate for each condition encountered, as described in this section, or if not described in this section, as recommended by S.B.C. Industries and accepted by the Design Professional.

B. Related Sections:
   1. Section 06 10 00 – Rough Carpentry:
   2. Section 07 52 00 – Modified Bitumen – Torch Application
   3. Section 07 62 00 – Sheet Metal Flashing and Trim
   4. Section 07 90 00 – Joint Protection

1.02 REFERENCES

A. AISI (American Iron and Steel Institute)
   1. AISI American Iron and Steel Institute - Stainless Steel - Uses in Architecture.

B. ASTM International
   1. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet & Strip.
   2. ASTM A 653 - Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process - Commercial Quality/
   3. ASTM B 32 - Solder Metal.
   4. ASTM B 486 - Paste Solder.
   5. ASTM D 226 - Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   6. ASTM D 4586 - Asphalt Roof Cement, Asbestos-Free.

C. FS Federal Specifications
   1. FS O-F-506 - Flux, Soldering, Paste and Liquid

D. NRCA (National Roofing Contractors Association)
   1. NRCA National Roofing Contractors Association - Roofing Manual.

E. SMACNA (Sheet Metal and Air Conditioning Contractors National Association)

1. SMACNA - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide membrane repair materials Product Data, have the Contractor submit material samples only when the Construction Manager requires such.

C. Manufacturer's Installation Instructions: Indicate special precautions required for seaming the membrane.

D. Manufacturer's Field Reports: Submit under provisions of Section 01 63 00.

1.04 QUALITY ASSURANCE

A. General:
1. All flashings shall be designed to comply with or exceed the following:
a. National Roofing Contractors Association (NCRA) - ARoofing and Waterproofing Manual@ (latest edition) except where other editions are specifically referenced.
b. Sheet Metal and Air Conditioning Contractors Association (SMACNA), Architectural Sheet Metal Manual (latest edition).
c. Manufacturer=s standard details as accepted by the Design Professional.
d. Project details as issued for bidding and construction.

B. Manufacturer Qualifications:
1. All set-on penetration flashings shall be shop fabricated by a single manufacturer whose specialty is the fabrication of roof penetration flashings of the type specified in this section and who has been in business for a minimum of 5 years. More than 80% of the business shall be devoted to the fabrication of roof penetration flashing.

C. Installer Qualifications:
1. Installers shall be qualified and approved by the roof penetration flashing manufacturer prior to commencement of the work.

1.05 REGULATORY REQUIREMENTS

A. Provide materials complying with governing regulations and codes installed to comply with the following:
1. UL Listing: Provide roofing system materials and component materials that have been tested for application and slopes indicated and are listed by Underwriters Laboratories, Inc. (UL) for Class A external fire exposure.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver to site, store, protect from potential damage, and handle products under provisions of Section 01 63 00.

B. Deliver material in manufacturer's original, unopened containers with manufacturer's labels intact and legible.

C. Deliver material requiring fire resistance classification to the job with labels attached and packaged as required by labeling service.

D. Store and handle materials to protect them from:
   1. Moisture, whether due to precipitation, or condensation.
   2. Damage by construction traffic.
   3. Temperatures over 110 degrees F or below 40 degrees F.
   4. Direct sunlight.
   5. Mud, dust, sand, oil and grease.

E. Comply with fire, safety, and environmental protection regulations.

F. Take special precautions against traffic on roofing when ambient temperature is above 80 degree F. Avoid heavy traffic on the work during installation.

1.07 PROJECT CONDITIONS

A. Existing Conditions:
   1. The roofing repair applicator shall verify existing conditions prior to Bidding.
   2. Report conflicts and problems to the Design Professional for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Prime Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.
   3. Replace or restore to original condition any materials or work damaged during construction.
   4. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.
   5. Failure to install the work in strict accordance with provisions of this Section, is subject to total rejection of work specified herein.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Do not apply roofing membrane during inclement weather ambient temperatures below 40 degrees F.

B. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

C. Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with requirements of this section and warranty compliance requirements.

1.09 COORDINATION

A. Coordinate work under provisions of this Section.

B. Coordinate application of flashings with application of roofing, protruding material, and roof accessories to provide a complete weathertight installation according to the specified warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements specified in this section, provide metal roof penetration flashing systems from one of the following manufacturers:
   1. S.B.C. Industries - P. O. Box 610397, North Miami, FL 33261, Phone: 1-800-228-2580 or (305) 685-6350 FAX: (305) 686-6360 E-Mail: sbcindust@shadow.com
   2. Thaler Metal USA, 1902 Common Street, Suite 500, New Braunfels, Texas 78130, (866) 583-6001 FAX:(830) 626-6010 E-Mail: rena@thalermetal.com
   3. The Pate Company, 245 Eisenhower Lane South, Lombard, IL 60148, Phone (800) 243-3018 email: sales@patecurbs.com

2.02 COMPONENTS

A. Metal: Stainless steel, type 304, 2B, ASTM A-240.

B. Solder: ASTM B32, 50% tin - 50% lead; if lead-free solder is required, tin-silver, ASTM 96.5TS.

C. Foam Tape: Closed cell foam, PSA on one side, 1/4" or 3/8" x 1" wide, ASTM D-1056.

D. Backer Rod: Open cell polyurethane.

E. Sealant: Single part urethane, ASTM C920-79.

F. Asphalt Primer: As recommended and approved by the roofing membrane manufacturer and conforming to ASTM D-41 requirements.

G. Modified Asphalt Roof Cement: As recommended and approved by the roofing membrane manufacturer.

2.03 FABRICATION

A. General:
   1. All deck flanges shall have full rounded corners
   2. Collar or stack portions of flashing assemblies and sealant covers for square or round pipes larger than 3" in diameter shall be fabricated from 24 gauge stainless steel. Unless noted otherwise, all other metal flashing assemblies shall be fabricated from 26 gauge stainless steel.
   3. Gauges for custom fabrications not specifically described herein shall be as recommended by the roof penetration flashing manufacturer and accepted by the Design Professional.
   4. Pitch pans are not to be used in lieu of any other penetration flashing in these specifications. Exceptions require special written approval by the

Design Professional and will only be granted where, in the judgment of the Design Professional, no other means of positive flashing is feasible. In such cases where pitch pans are specifically approved by the Design Professional, said pitch pans shall conform to the following:

a. Fabricate from 24 gauge stainless steel, using 7-3/4" stock x girth required, forming a hemmed 3" high side with a 1/4" - 3/8" inside return at the top and a 4" deck flashing flange. Provide 2" clearance from protrusion. If pitch pan can be slipped over penetration, shop solder four corners 4-1/2" with radial corners in place. If pitch pan cannot be slipped over penetration, wrap pitch pan around penetration, and solder corners and vertical seam.

B. Fabrication of flashings for pipes, conduits and other round items penetrating, resting on or anchored to roof which allows a tubular flashing to be slipped over.

1. Form tubular flashing sleeve no less than 9" high and of proper diameter to provide 1/8" minimum - 1/4" maximum clearance from pipe or conduit.
2. Fabricate square flashing deck plate to a size 7-1/2" larger than protrusion. Punch hole of appropriate size in center and extrude surrounding material upward 1/4" providing a continuous vertical soldering flange and solder 9" high tubular flashing sleeve. Cut 1" minimum radius on flashing plate corners.
3. Fabricate counterflashing 5" high with a diameter 2" greater than pipe or conduit.
4. Provide a conical sealant cover, sloped outward and downward at 30 degrees to 45 degrees from the horizontal plane with an inside diameter equal to pipe or conduit size and an outside diameter 1" to 2" larger.
5. Shop solder all seams watertight.
6. Provide Model P/S or C/S with standard accessory sealant cover as manufactured by S.B.C. Industries or Design Professional accepted equal product from one of the listed manufacturers.

C. Fabrication of flashings for connected pipes, conduits and other round items not allowing a tubular flashing to be slipped over.

1. Form semi-cylindrical tubular flashing sleeves (180 degrees) not less than 9" high, tightly seam intersecting halves to mate snugly. Provide a split flashing deck plate with radial corners and being formed upward to provide a continuous soldering flange for semi-cylindrical sleeve engagement. Size each unit to allow for vibration and thermal movement of pipe or conduit with 1/8" minimum x 1/4" maximum.
2. Form cylindrical counterflashing 5" high with seamed edge to a diameter 1/4" larger than 9" high sleeve.
3. Provide conical sealant cover, sloped outward and downward at 30 degrees to 45 degrees from a horizontal plane, with an inside diameter equal to pipe or conduit size and an outside diameter 2" larger.
4. Provide Model P/D or C/D with standard sealant cover as manufactured by S.B.C. Industries or Design Professional accepted equal product from one of the listed manufacturers.

D. Fabrication of flashings for angle irons, AH@ beams, channels and square tubing.

1. Form a 6" high two piece angular configuration similar to penetration, but allowing 3/16" minimum to 3/8" maximum clearance in any direction.

Fabricate flashing deck flanges in two pieces and shop solder to 6" angular stacks. Provide an umbrella type counterflashing conforming to protrusion which extends 3/4" at 45 degrees outward from angular stack flashing.

2. Provide Model A/D, H/D, CH/D or SQT/D, with standard sealant cover as manufactured by S.B.C. Industries or Design Professional accepted equal product from one of the listed manufacturers.

E. Fabrication of flashings for ribbon or coaxial cable for lightning protection, T.V. antennas, satellite dishes, telephone wire and similar penetrations:

1. Consult S.B.C Industries for fabrication of gooseneck type cable flashing or provide Design Professional accepted equal product from one of the listed manufacturers.

F. Fabrication of flashings for "Uni-strut" members and other irregular shaped roof membrane penetrations:

1. Consult S.B.C. Industries for fabrication of "Uni-strut" and custom or irregular shaped metal flashing assemblies. Design Professional accepted equal products from one of the listed manufacturers will be acceptable.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. All deck flanges shall be primed, set in a full fresh bed of flashing cement and stripped-in in accordance with membrane manufacturer=s recommendations and related specifications and drawings.
2. All flashings shall be shop fabricated from field measurements.
3. Clearances between penetrations (including flashing sleeves) and between penetrations and the leading edge of cants at wall or equipment base flashings shall be a minimum of 18" in compliance with NRCA Table 4 - Guide for Clearance Between Pipes/Walls/Curbs, as found in the NRCA Roofing and Waterproofing Manual (Fourth Edition).

B. Installation of flashing for pipes, conduits and other round items penetrating, resting on, or anchored to roofing.

1. Slide flashing unit over penetration and firmly embed flashing plate in full bed of mastic.
2. Counterflashing and sealant cover: Using a solvent with a rapid evaporation rate and leaving no residue, clean area of pipe directly above flashing. Wrap a single layer of 1/4" to 3/8" x 1" wide closed cell tape around pipe, 1/4" above top of base sleeve. Wrap cap flashing around allowing top to extend 1/4" above top of tape. Apply sealant into channel at top and tool for positive runoff. Apply conical sealant cover directly above sealant.

C. Installation of flashing for connected pipes, conduits and other round items penetrating roofing or resting on roof not allowing a tubular flashing to be slipped over.

1. Base sleeves: Mate shop fabricated half sections together around pipe and solder vertical and horizontal seams watertight. Embed flashing flange in full bed of mastic.
2. Counterflashing and conical sealant cover: Using a solvent with a rapid evaporation rate and leaving no residue, clean area of pipe directly above flashing. Wrap a single layer of 1/4" to 3/8" x 1" wide closed cell foam tape around pipe 1/4" above top of base sleeve. Install cap flashing. Solder vertical seam. Apply sealant into channel and tool for positive runoff. Apply conical sealant cover directly above sealant.

D. Installation of flashing for angle, AH@ beams, channels and square tubing.
1. Around the protrusion, snap or slide nesting flashing sections together, and embed flashing flange in full bed of mastic. Solder all seams and neutralize flux. At area of clearance between protrusion and top of stack flashing, insert backer rod 3/8" below top of stack flashing. Apply a liberal amount of sealant and tool for positive drainage. Install sealant cover directly above stack flashing in wet sealant.

E. Installation of flashings for ribbon or coaxial cable for lightning protection, T.V. antennas, satellite dishes, telephone and similar penetrations:
1. Follow manufacturer=s instructions for installation of cable flashing.

3.02 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 1.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

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SECTION 07 90 00

JOINT SEALERS

PART 1 GENERAL

1.01 SUMMARY

A. Section includes sealants and joint backing, and accessories.

B. Related Sections:
1. Section 07 52 00 – Modified Bitumen Torch Application.
2. Section 07 62 00 – Sheet Metal Flashing and Trim

1.02 REFERENCES

A. ASTM International:
1. ASTM C 834 - Standard Specification for Latex Sealants.
2. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM C 1193 - Standard Guide for Use of Joint Sealants.
4. ASTM D 1056 - Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
5. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
6. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

1.03 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Products Data: Submit data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, and color availability.

C. Samples: Submit two samples, 1/4 x 6 inch in size illustrating sealant colors for selection.

D. Manufacturer's Installation Instructions: Submit special procedures, surface preparation and perimeter conditions requiring special attention.

E. Warranty: Include coverage for installed sealants and accessories failing to achieve watertight seal, exhibit loss of adhesion or cohesion, and sealants which do not cure.

1.04 QUALITY ASSURANCE

A. Perform work in strict accordance with sealant manufacturer’s requirements for preparation of surfaces and material installations instructions.

B. Maintain one copy of each document covering installation requirements on site.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Applicator: Company specializing in performing Work of this section with minimum three years documented experience, and approved by manufacturer.

1.06 MOCKUP

A. Section 01 40 00 - Quality Requirements: Requirements for mockup.

B. Construct mockup of sealant joints in conjunction with window, wall and roof mockups specified in other sections.

C. Construct mockup with specified sealant types and with other components noted.
   1. Determine preparation and priming requirements based on manufacturers recommendations; take action necessary for correction of failure of sealant tests on mock-up.
   2. Verify sealants, primers, and other components do not stain adjacent materials.

D. Locate where directed by Architect/Engineer.

E. Incorporate accepted mockup as part of Work.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Section 01 63 00 - Product Requirements.

B. Maintain temperature and humidity recommended by sealant manufacturer during and after installation.

1.08 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Coordinate Work with sections referencing this section.

1.09 WARRANTY

A. Provide a five (5) year warranty under provisions of Section 01 70 00 –Execution and Closeout Requirements.

PART 2 PRODUCTS

2.01 JOINT SEALERS

A. Manufacturers:
1. Dow Corning Corp.
2. GE Silicones
3. Pecora Corp.
4. Sika Corp.
5. Tremco
6. Sonneborn
7. ChemLink
8. Substitutions: Section 01 63 00 - Product Requirements

B. Products Description:

1. Silicone Sealant (Type S): ASTM C 920, Grade NS, Class 25. Use single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non sagging type; color as selected or match adjacent finish materials. Acceptable Manufacturers:
   a. Dow Corning Product: 795
   b. GE Product: Silpruf
   c. Pecora Corporation Product: 860 / 863 / 864
   d. Tremco Product: Spectrem II

2. Polyurethane Sealant (Type S): ASTM C 920, Grade NS, Class 25. Use single component, chemical curing, non-staining, non-bleeding, capable of continuous water immersion, non sagging type; color as selected or match adjacent finish materials. Acceptable Manufacturers:
   a. Sika Product: 1A
   b. Sonneborn Product: NP-1

3. Ethicone Sealant (Type S): ASTM C 920, Grade NS, Class 25. Use single component, moisture curing, solvent free, non-staining, non-non bleeding, capable of continuous water immersion, non sagging type; color as selected or match adjacent finish materials. Acceptable Manufacturers:
   a. ChemLink Product: M-1
   b. Architect approved equal

2.02 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: Backer Rod of extruded polyolefin foam made of non-absorbing outer skin and a highly resilient interior network of open and closed cells which will not out-gas when ruptured. Oversize backer rod 30 to 50 percent larger than joint width.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify substrate surfaces and joint openings are ready to receive work.

C. Verify joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

A. Remove loose materials and foreign matter impairing adhesion of sealant.

B. Clean and prime joints.

C. Perform preparation in accordance with ASTM C1193.

D. Protect elements surrounding Work of this section from damage or disfiguration.

3.03 INSTALLATION

A. Perform installation in accordance with ASTM C1193 and manufacturer's instructions.

B. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2 : 1.
   2. Neck dimension no greater than 1/2 of joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

C. Install bond breaker where joint backing is not used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

F. Tool joints concave. channel shaped. as detailed.

3.04 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean adjacent soiled surfaces.

3.05 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 01 70 00 - Execution and Closeout Requirements: Protecting installed construction.

B. Protect sealants until cured.

3.06 SCHEDULE (JOINT TYPES)

A.	Metal to Metal	Type: Silicone	Color to match metal
B.	Metal to CMU/Stucco	Type: Silicone	Color to match metal
C.	Metal to Roof Membrane	Type: Ethicone	Color to match metal
D.	CMU / Stucco joints	Type: Urethane	Color to match paint selected
E.	Roof Membrane to CMU	Type: Ethicone	Color to match Membrane

END OF SECTION

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SECTION 09 90 00
MINOR PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Surface preparation and field application of paints for use in touching up existing surface

1.02 REFERENCES

A. ASTM D 16 - Definitions of Terms Relating to Paint, Varnish, Lacquer, and Related Products

B. PDCA (Painting and Decorating Contractors of America) - Painting - Architectural Specifications Manual

C. SSPC (Steel Structures Painting Council) - Steel Structures Painting Manual

1.03 DEFINITIONS

A. Conform to ASTM D 16 for interpretation of terms used in this Section.

1.04 SUBMITTALS

A. Submit under provisions of Division 01

B. Product Data: Provide data on all finishing products

C. Samples: Submit manufacturer's color chart illustrating range of colors available for each surface finishing product scheduled

D. Manufacturer's Installation Instructions: Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years' experience.

B. Applicator: Company specializing in performing the work of this section with minimum 3 years documented experience.

1.06 REGULATORY REQUIREMENTS

A. Conform to code for flame and smoke rating requirements for finishes.

1.07 MOCK-UP (FIELD SAMPLES)

A. Provide field sample of paint under provisions of Division 01.

B. Provide field sample panel, fascia edge metal, illustrating special coating color, texture, and finish. Locate where directed.

C. Accepted samples may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store, protect and handle products under provisions of Division 01.

B. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

C. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

D. Store paint materials at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.09 PROJECT CONDITIONS

A. Existing Conditions
   1. The Bidder shall verify existing conditions prior to Bidding.
   2. Conflicts and problems shall be reported to the Architect for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Prime Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.
   3. Replace or restore to original condition any materials or work damaged during construction.
   4. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.
   5. Failure to install the work in strict accordance with provisions of this Section, is subject to total rejection of work specified herein.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 45 degrees F (7 degrees C) for interiors; 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

1.11 EXTRA MATERIALS

A. Provide 1 gallon of each color and type to Owner.

B. Label each container with color, type, texture, locations, in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 PAINTING PRODUCTS

A. Manufacturers:
1. Benjamin Moore
2. Devoe and Reynold
3. PPG Industries
4. Porter Paint
5. Pratt & Lambert
6. Sherwin-Williams

B. Manufacturers - Primer: Manufacturer's specified primer for use with metals, stucco, wood and other building materials

C. Substitutions: Under provisions of Division 01

2.02 MATERIAL REQUIREMENTS

A. Coatings: Ready mixed, lead free, except field catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.

2.03 FINISHES

A. Refer to schedule at end of section for surface finish schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions under provisions of Division 01

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

A. Correct defects and clean surfaces which affect work of this section.

B. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

C. Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints are cleaned. Prime and paint after repairs.

D. Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

3.03 APPLICATION

A. Apply products in accordance with manufacturer's instructions.

B. Do not apply finishes to surfaces that are not dry.

C. Apply each coat to uniform finish. Apply each coat slightly darker than preceding coat unless otherwise approved.

D. Allow each coat to dry before applying next coat. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

3.04 FIELD QUALITY CONTROL

A. Field inspection will be performed under provisions of Division 01.

3.05 CLEANING

A. Clean work under provisions of Division 01.

B. Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.06 SCHEDULES

A. Exterior Plaster (Stucco touch up):
   1. One Coat of masonry primer.
   2. Two coats of acrylic masonry paint. Color to match existing wall.

END OF SECTION

SECTION 22 07 19
PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation, jackets and accessories.

B. Thermal insulation of roof drains to minimize condensation within interior of building.

C. Where applicable, non combustible pipe insulation to fully wrap all PVC plastic pipe and fittings within a return air ceiling plenum to comply with surface burning characteristics of ASTM E 84 and the Florida Mechanical Code, Section M602.2.2.1.

1.02 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Section 22 14 13 - Plumbing Piping: Placement of hangers and hanger inserts.

B. Section 22 14 26 – Roof Drains

1.03 REFERENCES

A. ASTM C 585 - Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System).

B. ASTM C 921 - Properties of Jacketing Materials for Thermal Insulation.

C. ASTM E 84 - Surface Burning Characteristics of Building Materials

D. NFPA - Surface Burning Characteristics of Building Materials

E. UL 723 - Surface Burning Characteristics of Building Materials

1.04 SUBMITTALS

A. Submit under provisions of Division 01.

B. Product Data: Provide product description, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Installation Instructions: Indicate procedures which ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Materials: Flame spread/smoke developed rating of 25/50 or less in accordance with ASTM E 84.

B. Existing Conditions

1. This project involves the installation of insulation on new and/or existing roof drainage piping located below the roof deck within the building envelope. Contractor to verify existing and other visible conditions prior to Bidding.
2. Report conflicts and problems to the Architect for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.
3. Replace or restore to original condition any materials or work damaged during construction.
4. Surfaces not designated to receive the system shall be properly masked or otherwise protected against accidental spillage or application of the material to those areas.
5. Failure to install the work in strict accordance with provisions of this Section is subject to total rejection of work specified herein.

1.06 APPLICATOR QUALIFICATIONS: Company specializing in performing the work of this section with minimum of three years' experience

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store, protect, and handle products under provisions of Division 1.

B. Deliver materials to site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

C. Store insulation in original wrapping and protect from weather and construction traffic.

D. Protect insulation against dirt, water, chemical, and mechanical damage.

PART 2 PRODUCTS

2.01 GLASS FIBER INSULATION

A. Manufacturers:

1. Knauf.
2. CertainTeed
3. Johns Manville
4. Owens Corning

B. Insulation: ASTM C 547; 1 inch thick, rigid molded, noncombustible.
   1. 'K' ('ksi') value: ASTM C 335-89, 0.23 at 75 degrees F.
   2. Maximum Moisture Absorption: 0.2 percent by volume.
   3. Surface Burning Characteristics: Flame Spread less than 25; smoke developed less than 50 per ASTM E 84.

C. Vapor Barrier Jacket
   1. White kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
   2. Moisture Vapor Transmission: ASTM E 96-90; 0.02 perm inches.
   3. Secure with self sealing longitudinal laps and butt strips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. On exposed piping, locate insulation and cover seams in least visible locations.

C. Insulate pipes conveying fluids:
   1. Provide vapor barrier jackets, factory applied or field applied.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe.
   3. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations.
   4. Insulate entire system including fittings and bottom of roof drains (around deck).

D. Inserts and Shields:
   1. Insert Location: Between support shield and piping and under the finish jacket.
   2. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
   3. Shields: Galvanized steel between pipe hangers and inserts.

E. Finish insulation at supports, protrusions, and interruptions.

3.03 TOLERANCE

A. Substituted insulation materials shall provide thermal resistance within 10 percent at normal conditions, as materials indicated and comply with surface burning characteristics of ASTM E 84.

3.04 INSULATION SCHEDULE

A. Plumbing Systems
B. Primary Roof Drainage within Building
C. Roof Drain Bodies

END OF SECTION

SECTION 22 14 13
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Installation of roof drain piping and pipe fittings.

B. Installation of new primary & overflow drains.

C. Installation of new HVAC condensate pipes.

1.02 PRODUCTS INSTALLED BUT NOT FURNISHED IN THIS SECTION

A. Section 22 07 19 – Piping Insulation.

B. Section 22 14 26 - Plumbing Specialties: Roof drains.

1.03 REFERENCES

A. ASTM D-1785 - PVC Plastic Pipe, Schedule 40.

B. ASTM D-2466 - PVC Plastic Pipe Fittings, Schedule 40.

C. ASTM D-2855 - Making Solvent-Cemented Joints with PVC Pipe and Fittings.

1.04 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Provide data on pipe materials, pipe fittings, and accessories. Provide manufacturers catalog information.

1.05 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Record actual locations of installed piping runs.

1.06 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the Products specified in this section shall have a minimum five years experience.

B. Installer: Company specializing in performing the work of this section shall have a minimum three years documented experience

1.07 REGULATORY REQUIREMENTS

A. Perform Work in accordance with Florida Department of Education and current National Plumbing code requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store, protect and handle products under provisions of Section: 01 66 00.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 PIPING AND ACCESSORIES

A. PVC Pipe: ASTM D-2729, Schedule 40 DWV; Type I, four, six and eight (4, 6 & 8) inch pvc pipe:
   1. Fittings: Schedule 40 PVC.
   2. Joints: ASTM D-2855-96(2002), solvent weld with ASTM D-2564 solvent cement.

B. Clevis Hangars: Carbon steel; plain finish; size to accommodate four, six and eight (4, 6 & 8) inch pvc pipe and one and one-half (1 2”) inch pipe insulation:

C. C Clamps: Low carbon steel with hardened steel cup point set screw; plain finish;

D. Continuous Threaded Rod: Low carbon steel; plain finish; rod diameter sized for clevis hangars and beam clamps; length to accommodate pipe slope and ceiling space.

E. HVAC Unit Condensate Pipe:
   1. Pipes and AP@ Traps: Schedule 40 PVC.

F. No-Hub Couplings; Used with vent pipe extensions
   1. Cast Iron, Steel and PVC Pipe Extension Couplings: Anaco SD Series 4000 Husky, or Clamp-All Torque 125 No-Hub Coupling.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions under provisions of Division 01.

B. Verify locations of new roof drains and drain piping. Coordinate with roofing applicator to interface roof drains with roof work. Locate and mark locations of new roof drains on roof surface and confirm acceptability of locations with architect before installations.

3.02 PREPARATION

A. Cut pipe to required length and remove burrs.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment.

3.03 CUTTING AND PATCHING

A. All labor required for cutting and patching of roof decks, walls, ceilings, floors and sidewalks shall be furnished by the plumbing installer.

3.04 INSTALLATION OF NEW ROOF DRAINAGE SYSTEM

A. Install replacement roof drains and emergency overflow drains in accordance with the manufacturer's instructions at locations indicated on drawings.

B. Support each roof drain using two 2 inch by 2 inch by 3/16 inch support angle. Angles shall be installed when drains fall between or a maximum of one (1) foot away from structural members. Install between structural support members and clamp angles to support members.

C. Installation of Piping and Accessories :

1. Install drain piping in accordance with applicable plumbing code and recognized industry practices. Provide a permanent leakproof piping system.
2. Install each pipe run with minimum joints and couplings. Align piping accurately at connections, within 1/16 inch misalignment tolerance.
3. Locate interior conductor piping runs, vertically and horizontally. Avoid diagonal runs where possible. Orient runs parallel with walls and column lines. Locate using diagrams, details and notations if not otherwise indicated. Run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosures elements of building; limits clearance to 1 inch outside insulation. Piping shall be concealed from view unless noted.

4. Where required, remove existing piping and install new sized piping along existing run.

D. Installation of Hangars, Supports, Anchors and Shields :
   1. Install pipe hangars, support rods, clamps and attachments to support piping properly from building structure: Install supports at each structural member (steel joist or beam) and not to exceed **4 feet** on center, install hanger at each change in direction of piping.
   2. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories.

3.05 HVAC CONDENSATE DRAIN PIPE

A. Install PVC condensate lines and 'p' traps on every unit requiring such. Run condensate lines to closest roof drain.

3.06 ERECTION TOLERANCES

A. Slope piping to drain at minimum slope of 1/4 inch per foot (2%) for piping 3 inch and smaller, and 1/8 inch per foot (1%) for piping 4 inches and larger. Piping may require a specific positive drainage slope for ceiling space limited in height which has been noted on the drawings. Contact architect if conflicts occur due to ceiling cavity height.

B. Provide pipe support per details.

3.07 TESTING

A. Test existing and new roof drains. Rod out existing drains before reroofing and every drain after reroofing work is completed. Plug and fill the complete drainage system with water to level of highest drain or opening above roof. System shall hold test water 30 minutes without leaks.

3.08 ROOF DRAIN PIPING INSULATION

A. After successful testing of roof drainage system, insulate piping and existing system as specified in Section 22 07 19.

END OF SECTION

SECTION 22 14 26
ROOF DRAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof Drains: Installation of new primary & secondary drains

1.02 RELATED SECTIONS

A. Section: 07 52 16 - Modified Bitumen Roofing – Torched Application.

B. Section: 22 14 13 - Plumbing Piping.

1.03 REFERENCES

A. ANSI A112.21.2 - Roof Drains.

1.04 DESCRIPTION OF WORK

A. Remove and re-install the existing roof drain assembly and piping at existing location at roof area C/1, northeast corner with 6" roof drain and piping capacity. Provide and install a secondary roof drain at this same location as indicated by the plans and details.

B. Refurbish existing roof drains and cast iron overflows at all remaining locations. (sandblast, apply epoxy paint, replace clamping ring, strainer, studs and all hardware with new).

1.05 SUBMITTALS

A. Submit under provisions of Section: 01 33 00.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.06 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 1.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 1.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver to site, store, protect and handle products under provisions of Section: 01 60 00.

B. Accept specialties on site in original factory packaging. Inspect for damage.

1.09 PROJECT/SITE CONDITIONS

A. Existing Conditions

1. Verify existing conditions, such as soundness of perimeter conditions, and varying deck and wall thickness for length of anchoring services required and other visible conditions prior to Bidding.
2. Report conflicts and problems to the Architect for resolution prior to Bidding. Failure to report these conflicts and problems places the responsibility on the Contractor to complete the work in accordance with the Documents at no additional cost to the Owner.

PART 2 PRODUCTS

2.01 ROOF DRAINS (Replacement)

A. Manufacturers:
1. J.R. Smith Model 1010 (Basis of Design)
2. Zurn
3. Josam
4. Wade

B. Roof Drains: (Sizes as indicated on plans)
1. Body: Lacquered cast iron with sump. Threaded bottom or optional side discharge outlet suitable for application.
2. Strainer: Removable aluminum with vandal proof screws.
3. Accessories: Membrane flange and membrane clamp with integral gravel stop, with adjustable under deck clamp and roof sump receiver.
4. Nipple: Single end threaded Cast iron or steel nipple of sufficient length (min. 8") for use with no-hub connection to existing cast iron piping. With Zurn drain use Z1040 nipple.

C. Overflow drain:
1. Zurn Model ZC100-C-R-W2-ST or equivalent product from above listed manufacturer

PART 3 EXECUTION

3.01 PREPARATION

A. Verify that all existing roof leader piping has been cleaned and tested for proper operation prior to proceeding with the installation of roof drains

B. Coordinate cutting and forming of roof construction to receive drains.

3.02 INSTALLATION

A. New Roof Drains:
   1. Install roof drains and connecting piping in accordance with description in Section: 22 14 13 and with roof drain manufacturer's instructions

3.03 TESTING

A. Test existing and new roof drains. Rod out existing drains before reroofing and every drain after reroofing work is completed. Plug and fill the complete drainage system with water to level of highest drain or opening above roof. System shall hold test water 30 minutes without leaks.

3.04 ROOF DRAIN INSULATION

A. After successful testing of roof drainage system, insulate piping and existing piping system as specified in Section: 22 07 19.

END OF SECTION

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ATTACHMENT A

LABORATORY ANALYSIS REPORT

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EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
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http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341500758
CustomerID:	AMECH25
CustomerPO:	C012307452
ProjectID:	

Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	01/27/15 12:41 PM
Analysis Date:	1/27/2015
Collected:	1/26/2015

Project: **6380-14-1260.*** SWRF (3 Roofs)**

The samples in this report were submitted to EMSL for analysis by Fiber Count by Phase Contrast Microscopy (PCM), NIOSH 7400 Method, Revision 3, Issue 2, 8/15/94*. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date::	1/27/2015	Sample Receipt Time:	12:41 PM
Analysis Completed Date:	1/27/2015	Analysis Completed Time:	2:51 PM

Analyst(s):

Jonathan Teda PCM (10)

Samples reviewed and approved by:

Jonathan Teda, Asbestos Lab Manager
or other approved signatory

Limit of detection is 7 fibers/mm². Intra-laboratory Sr values: 5-20 fibers = 0.40, 21-50 fibers = 0.28, 51-100 fibers = 0.44. Inter-laboratory Sr values (Average of EMSL round robin data) = 0.29. The laboratory is not responsible for data reported in fibers/cc, which is dependent on volume collected by non-laboratory personnel. This report relates only to the samples reported above. This report may not be reproduced, except in full, without written approval by EMSL. Results have been blank corrected as applicable. Samples received in good condition unless otherwise noted.

Samples analyzed by EMSL Analytical, Inc. Orlando, FL

Initial report from 01/28/2015 08:11:23

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EMSL Analytical, Inc.
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Phone/Fax: (407) 599-5887 / (407) 599-9063
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EMSL Order:	341500796
CustomerID:	AMECH25
CustomerPO:	C012307452
ProjectID:	

Attn: **Ron Trapane**
AMEC E&I, Inc.
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Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	01/28/15 12:05 PM
Analysis Date:	1/30/2015
Collected:	1/22/2015

Project: **6380.14.1260.020; SWRF Roofing And NESHAP**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**% Non-Fibrous**	**% Type**
AB-1B *341500796-0010*	RC-4, N End, Admin Bldg Roof - Roofing Membrane	White/Yellow Fibrous Heterogeneous	20%	Synthetic	80% Non-fibrous (other)	**None Detected**
AB-2A-Felt *341500796-0011*	RC-3, S End, Admin Bldg Roof - Felt/Paper	Black Fibrous Homogeneous	95%	Synthetic	5% Non-fibrous (other)	**None Detected**
AB-2A-Paper *341500796-0011A*	RC-3, S End, Admin Bldg Roof - Felt/Paper	Brown/White Fibrous Homogeneous	90% 8%	Cellulose Glass	2% Non-fibrous (other)	**None Detected**
AB-2B-Felt *341500796-0012*	RC-4, N End, Admin Bldg Roof - Felt/Paper	Black Fibrous Homogeneous	98%	Synthetic	2% Non-fibrous (other)	**None Detected**
AB-2B-Paper *341500796-0012A*	RC-4, N End, Admin Bldg Roof - Felt/Paper	Brown Fibrous Homogeneous	85% 10%	Cellulose Glass	5% Non-fibrous (other)	**None Detected**
AB-3A *341500796-0013*	RC-3, S End, Admin Bldg Roof - Lightweight	Gray Non-Fibrous Homogeneous			15% Ca Carbonate 85% Non-fibrous (other)	**None Detected**
AB-3B *341500796-0014*	RC-4, N End, Admin Bldg Roof - Lightweight	Gray Non-Fibrous Homogeneous			5% Ca Carbonate 95% Non-fibrous (other)	**None Detected**
AB-4A-Flashing *341500796-0015*	On Vent, N End, Admin Bldg Roof - Curb Flashing Adhesive	White Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
AB-4A-Adhesive *341500796-0015A*	On Vent, N End, Admin Bldg Roof - Curb Flashing Adhesive	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**

Initial report from 02/02/2015 09:51:03

EMSL Analytical, Inc.
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EMSL Order:	341500796
CustomerID:	AMECH25
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ProjectID:	

Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	01/28/15 12:05 PM
Analysis Date:	1/30/2015
Collected:	1/22/2015

Project: **6380.14.1260.020; SWRF Roofing And NESHAP**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**		**% Non-Fibrous**	**% Type**
AB-7A-Flashing *341500796-0021*	E End Of Unit On AHU, Around Edges Of Bldg - Curb Flashing Adhesive	White Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
AB-7A-Adhesive *341500796-0021A*	E End Of Unit On AHU, Around Edges Of Bldg - Curb Flashing Adhesive	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**
AB-7B-Flashing *341500796-0022*	W End Of Unit On AHU, Around Edges Of Bldg - Curb Flashing Adhesive	White Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
AB-7B-Adhesive *341500796-0022A*	W End Of Unit On AHU, Around Edges Of Bldg - Curb Flashing Adhesive	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**
OB-1A *341500796-0023*	RC-5, E Lower Roof, O+M Bldg Roof (Lower Level) - Roof Membrane	White/Yellow Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
OB-1B *341500796-0024*	RC-6, W Lower Level, O+M Bldg Roof (Lower Level) - Roof Membrane	Various Fibrous Heterogeneous	10% 5%	Synthetic Cellulose	85% Non-fibrous (other)	**None Detected**
			Result includes a small amount of inseparable attached material			
OB-2A-Felt *341500796-0025*	RC-5, E Lower Roof, O+M Bldg Roof (Lower Level) - Felt/Paper	Black Fibrous Homogeneous	95%	Synthetic	5% Non-fibrous (other)	**None Detected**

Initial report from 02/02/2015 09:51:03

EMSL Analytical, Inc.
5125 Adanson Street, Suite 900, Orlando, FL 32804
Phone/Fax: (407) 599-5887 / (407) 599-9063
http://www.EMSL.com orlandolab@emsl.com

EMSL Order:	341500796
CustomerID:	AMECH25
CustomerPO:	C012307452
ProjectID:	

Attn: **Ron Trapane**
AMEC E&I, Inc.
75 E. Amelia Street Suite 200
Orlando, FL 32801

Phone:	(407) 522-7570
Fax:	
Received:	01/28/15 12:05 PM
Analysis Date:	1/30/2015
Collected:	1/22/2015

Project: **6380.14.1260.020; SWRF Roofing And NESHAP**

Test Report: Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy

			Non-Asbestos			Asbestos
Sample	**Description**	**Appearance**	**% Fibrous**		**% Non-Fibrous**	**% Type**
OB-4B-Beige Flashing *341500796-0030B*	W Side Lower Level, Exhaust Vents - Curb Flashing Adhesive	Beige Fibrous Homogeneous	15%	Synthetic	85% Non-fibrous (other)	**None Detected**
OB-4B-Adhesive *341500796-0030C*	W Side Lower Level, Exhaust Vents - Curb Flashing Adhesive	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**
OB-4B-Tan Flashing *341500796-0030D*	W Side Lower Level, Exhaust Vents - Curb Flashing Adhesive	Tan Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**
OB-5A *341500796-0031*	E Side Lower Level, AHU - Curb Flashing Adhesive	Various Fibrous Heterogeneous	5%	Synthetic	95% Non-fibrous (other)	**None Detected**
OB-5B-White Flashing *341500796-0032*	W Side Lower Level, AHU - Curb Flashing Adhesive	White Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
OB-5B-Adhesive *341500796-0032A*	W Side Lower Level, AHU - Curb Flashing Adhesive	Yellow Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**
OB-5B-White/Green Flashing *341500796-0032B*	W Side Lower Level, AHU - Curb Flashing Adhesive	White/Green Fibrous Homogeneous	10%	Synthetic	90% Non-fibrous (other)	**None Detected**
OB-5B-Membrane *341500796-0032C*	W Side Lower Level, AHU - Curb Flashing Adhesive	White Non-Fibrous Homogeneous			100% Non-fibrous (other)	**None Detected**

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			Non-Asbestos				Asbestos
Sample	**Description**	**Appearance**	**%**	**Fibrous**	**%**	**Non-Fibrous**	**% Type**
OB-8B-Pink Flashing *341500796-0038*	On E Wall, Lower Level, On Walls To Upper Roof - Curb Flashing & Adhesive	White/Pink Fibrous Homogeneous	10%	Synthetic	90%	Non-fibrous (other)	**None Detected**
OB-8B-Adhesive *341500796-0038A*	On E Wall, Lower Level, On Walls To Upper Roof - Curb Flashing & Adhesive	Yellow Non-Fibrous Homogeneous			100%	Non-fibrous (other)	**None Detected**
OB-8B-White Flashing *341500796-0038B*	On E Wall, Lower Level, On Walls To Upper Roof - Curb Flashing & Adhesive	White Fibrous Homogeneous	10%	Synthetic	90%	Non-fibrous (other)	**None Detected**
OBU-1A *341500796-0039*	RC-7, N End, Middle Upper Roof - Roofing Membrane	Brown/White/Silver Fibrous Heterogeneous	3% 8%	Cellulose Synthetic	89%	Non-fibrous (other)	**None Detected**
OBU-1B *341500796-0040*	RC-8, S End, Middle Upper Roof - Roofing Membrane	Various Fibrous Heterogeneous	5% 15%	Cellulose Synthetic	80%	Non-fibrous (other)	**None Detected**
			Result includes a small amount of inseparable attached material				
OBU-2A *341500796-0041*	RC-7, N End, Middle Upper Roof - Felt/Paper	Brown/White Fibrous Homogeneous	85% 10%	Cellulose Glass	5%	Non-fibrous (other)	**None Detected**
			No felt present				
OBU-2B *341500796-0042*	RC-8, S End, Middle Upper Roof - Felt/Paper	Brown Fibrous Homogeneous	80% 10%	Cellulose Glass	10%	Non-fibrous (other)	**None Detected**
			No felt present.				

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Project: **6380.14.1260.020; SWRF Roofing And NESHAP**

The samples in this report were submitted to EMSL for analysis by Asbestos Analysis of Bulk Materials via EPA 600/R-93/116 Method using Polarized Light Microscopy. The reference number for these samples is the EMSL Order ID above. Please use this reference number when calling about these samples.

Report Comments:

Sample Receipt Date::	1/28/2015	Sample Receipt Time:	12:05 PM
Analysis Completed Date:	1/30/2015	Analysis Completed Time:	11:29 AM

Analyst(s):

Jonathan Teda PLM (30)

Manolo Hernandez PLM (36)

Samples reviewed and approved by:

Jonathan Teda, Asbestos Lab Manager
or other approved signatory

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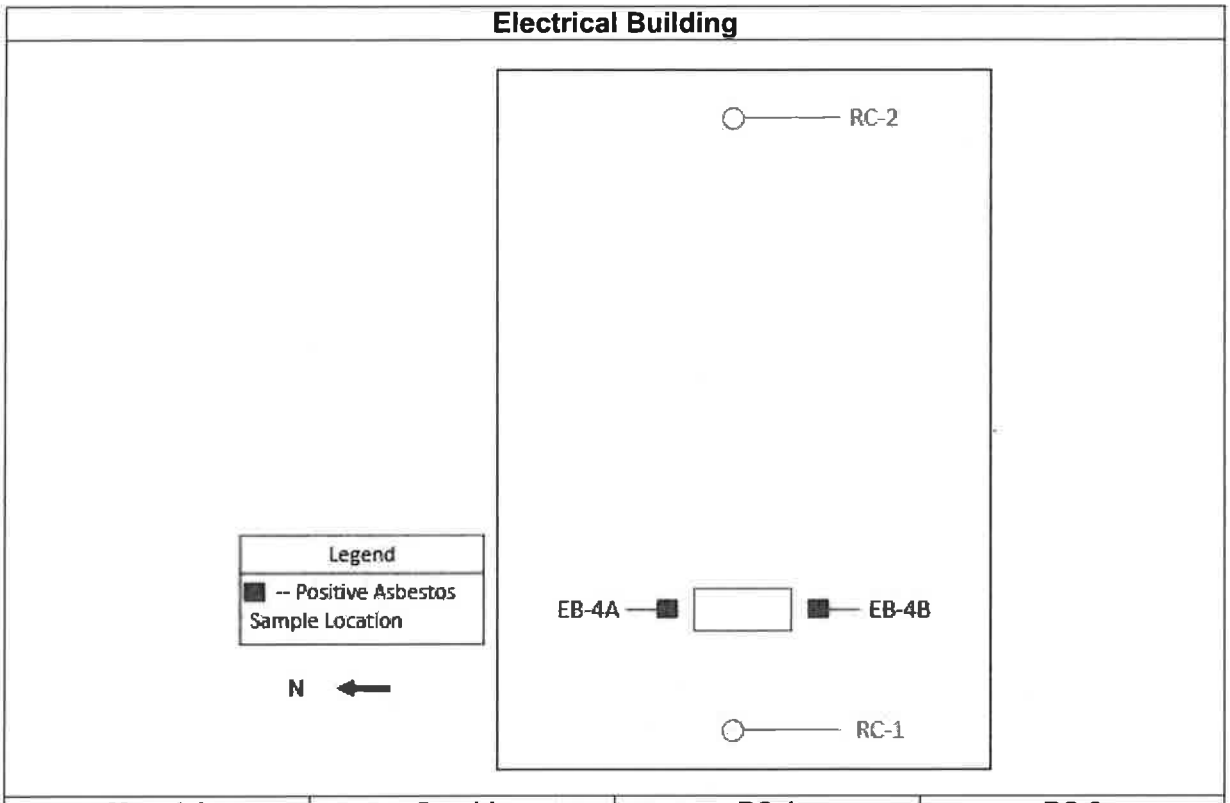
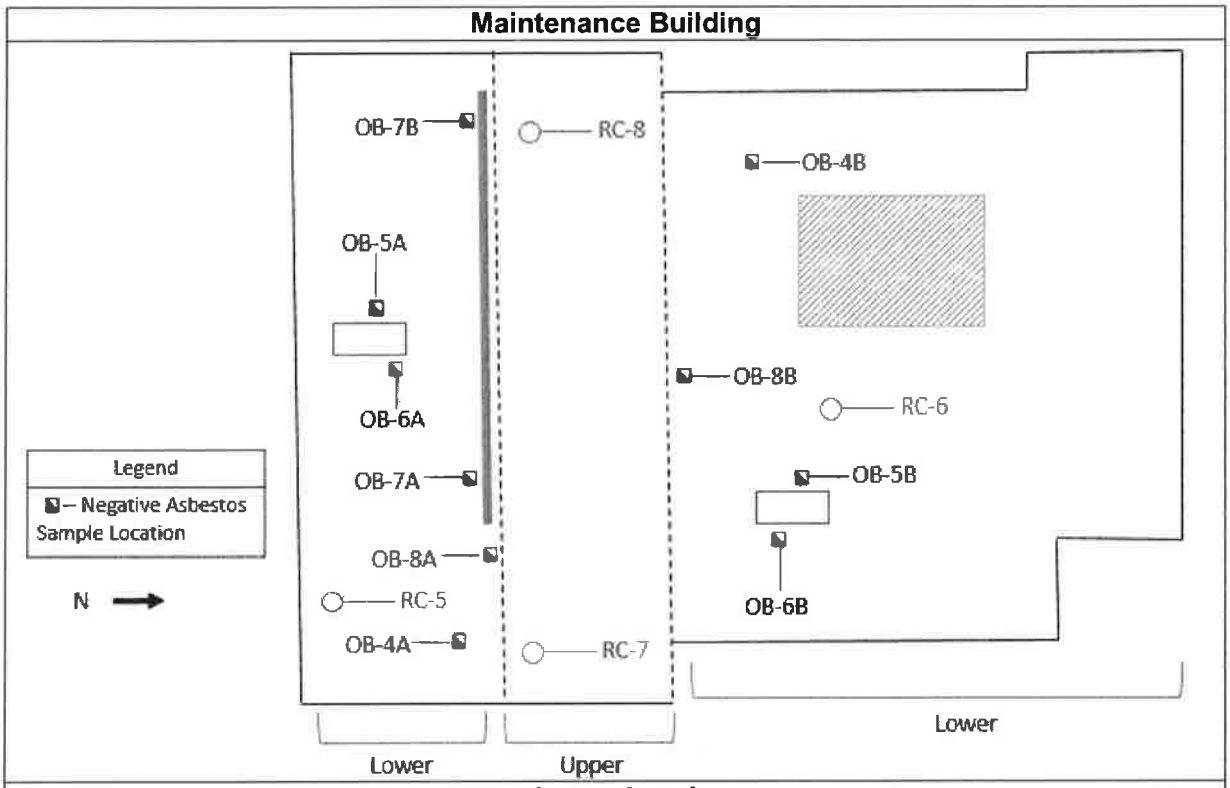


Material	Graphic	RC-1	RC-2
Cap Sheet		¼"	¼"
Perlite		¼"	¼"
Lightweight Concrete		3 ¼"	3 ¼"
Total Depth		3 ¾"	3 ¾"

Figure 1: Roof Plan and Sample Locations on Electrical Building Roof



Lower Level			
Material	**Graphic**	**RC-5**	**RC-6**
Roofing Membrane			
Felt/Paper			
Lightweight Concrete		4"	4 ½"
Isocyanurate Insulation		1"	2"
Lightweight Concrete		1 ½"	½"
Total Depth		6 ½"	7"

Upper Level			
Material	**Graphic**	**RC-7**	**RC-8**
Roofing Membrane			
Felt/Paper			
Lightweight Concrete		4"	4"
Isocyanurate Insulation		2"	2"
Lightweight Concrete		1"	¼"
Total Depth		7"	6 ¼"

Figure 3: Roof Plan and Sample Locations on Maintenance Building Roof

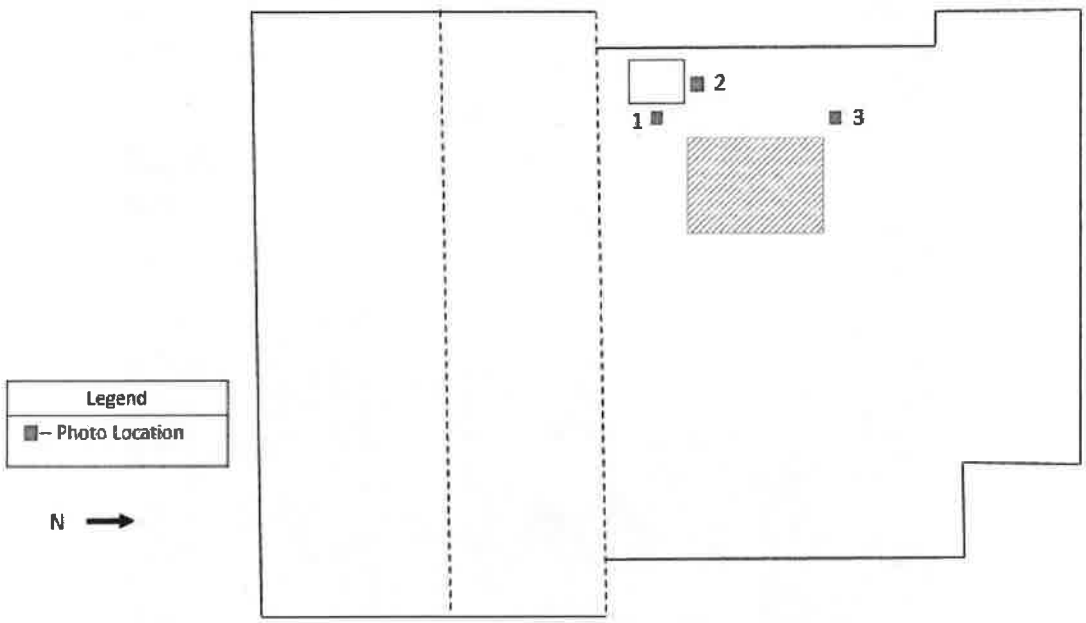


Figure 4: Drawing of Photo Locations at Maintenance Building

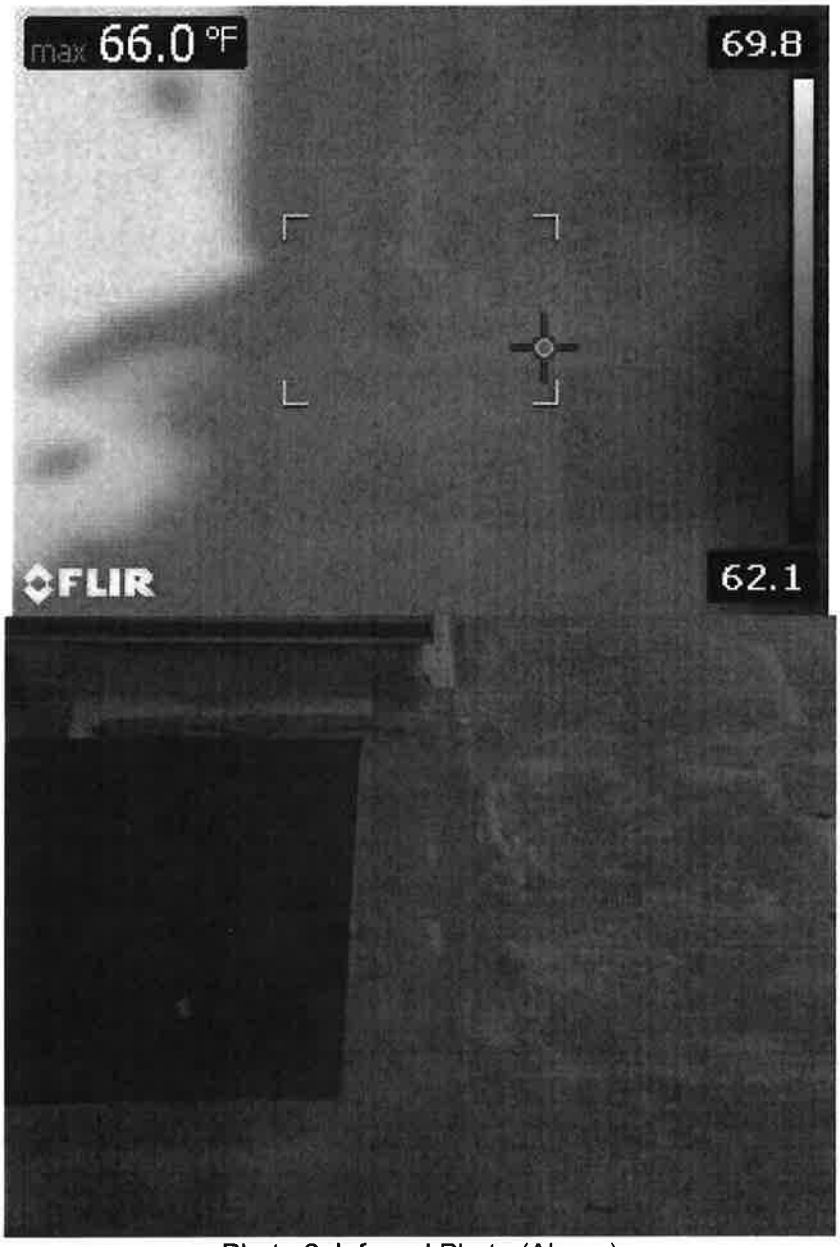


Photo 2: Infrared Photo (Above)
Associated Non-Infrared Photo (Below)
Location- To the Right of Walk Pad Directly Outside Entry Hatch

APPENDIX B

ORANGE COUNTY UTILITIES

PERMITS OBTAINED BY COUNTY

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